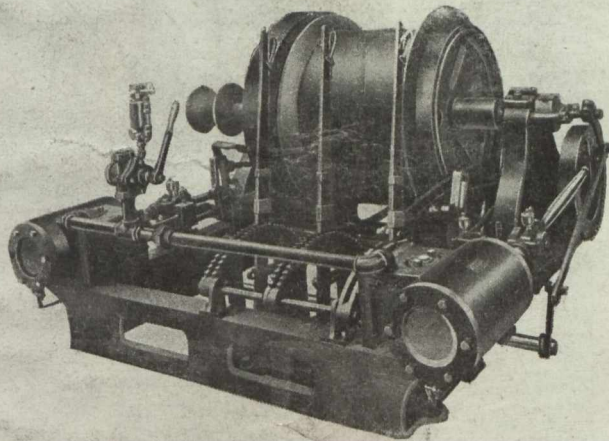


# CANADIAN MINING JOURNAL

VOL. XLI.

GARDEN CITY PRESS, Ste. Anne de Bellevue. JANUARY 23, 1920.

No. 3.



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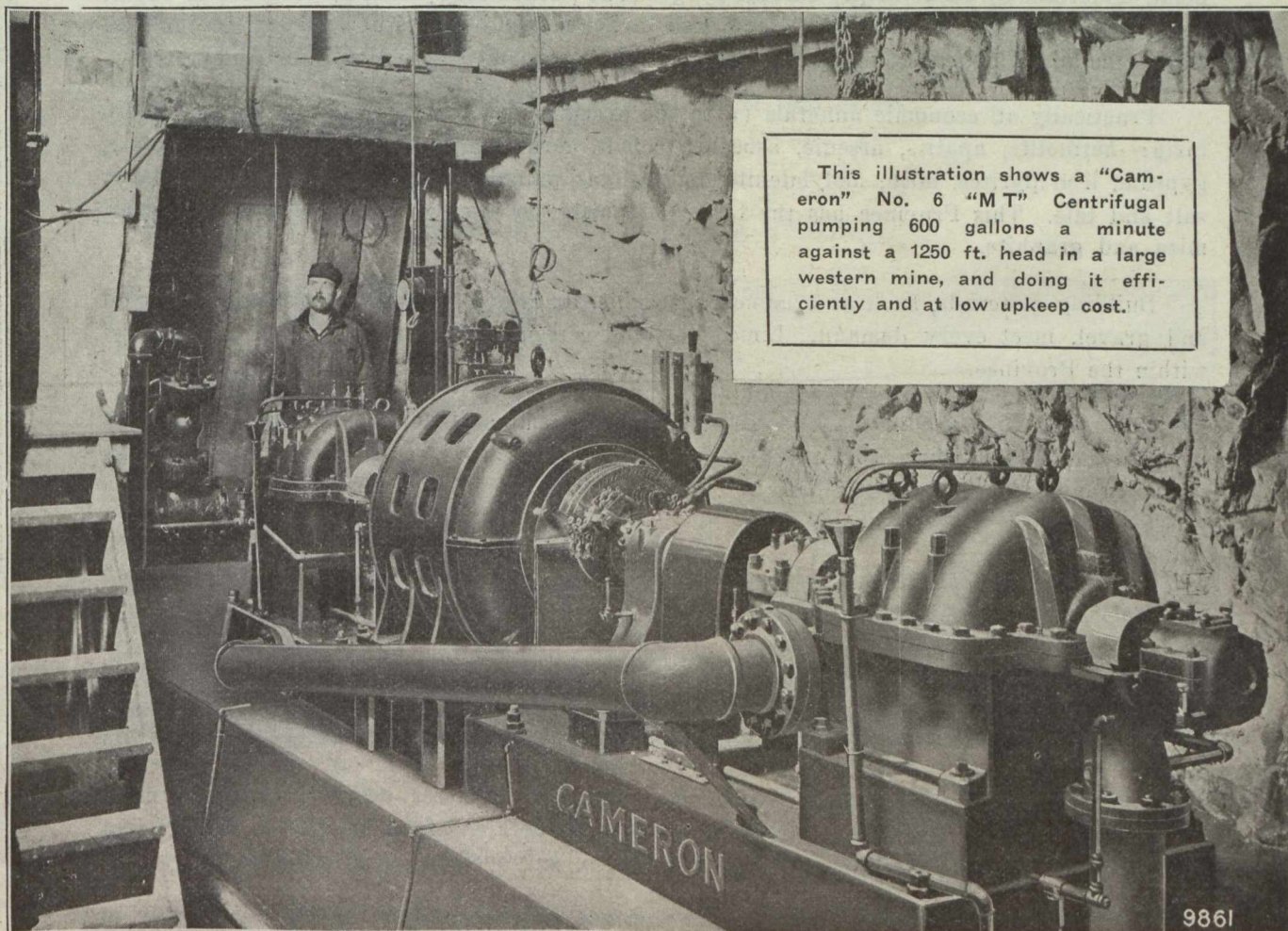
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PROVINCE OF ONTARIO



BUREAU OF MINES

HON. H. MILLS, Minister of Mines.

# Ontario's Mining Lands

Ontario, with its 407,262 square miles, contains many millions of acres in which the geological formations are favorable for the occurrence of minerals, 70 per cent of the area being underlain by rocks of pre-Cambrian age. The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Magpie and Moose Mountain Mines.

Practically all economic minerals (with the exception of coal and tin) are found in Ontario:—actinolite, apatite, arsenic, asbestos, cobalt, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, mica, molybdenite, natural gas, palladium, petroleum, platinum, quartz, salt and tale. This Province has the largest deposits on the continent of tale, feldspar, mica and graphite.

Building materials, such as ornamental marble, limestone sandstone, granite, trap, sand and gravel, meet every demand. Lime, Portland cement, brick and tile are manufactured within the Province.

Ontario in 1918 produced 45 per cent. of the total mineral output of Canada. Returns made to the Ontario Bureau of Mines show the output of the mines and metallurgical works of the Province for the year 1918 to be worth \$80,308,972 of which the metallic production was \$66,178,059.

Dividends and bonuses paid to the end of 1918 amounted to \$13,359,210 for gold mining companies, and \$74,810,521 for silver mining companies, or a total of \$88,169,733.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water. Hydro-electric power is available in many parts of the Province, and many undeveloped water-powers remain to be harnessed. A miner's license costs \$5.00 per annum, and entitles the holder to stake out in any or every mining division three claims of 40 acres each. After performing 240 day's assessment work on a claim, patent may be obtained from the Crown on payment of \$2.50 or \$3.00 per acre, depending on location in surveyed or unsurveyed territory.

For list of publications, illustrated reports, geological maps and mining laws, apply to

**Thos. W. Gibson,**

Deputy Minister of Mines,

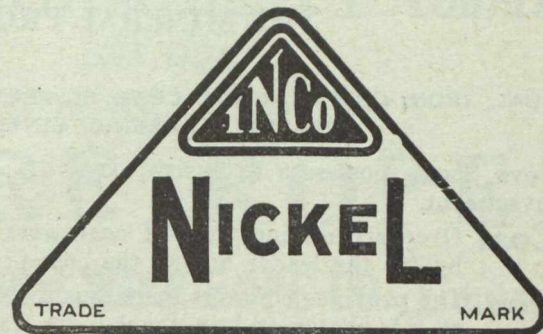
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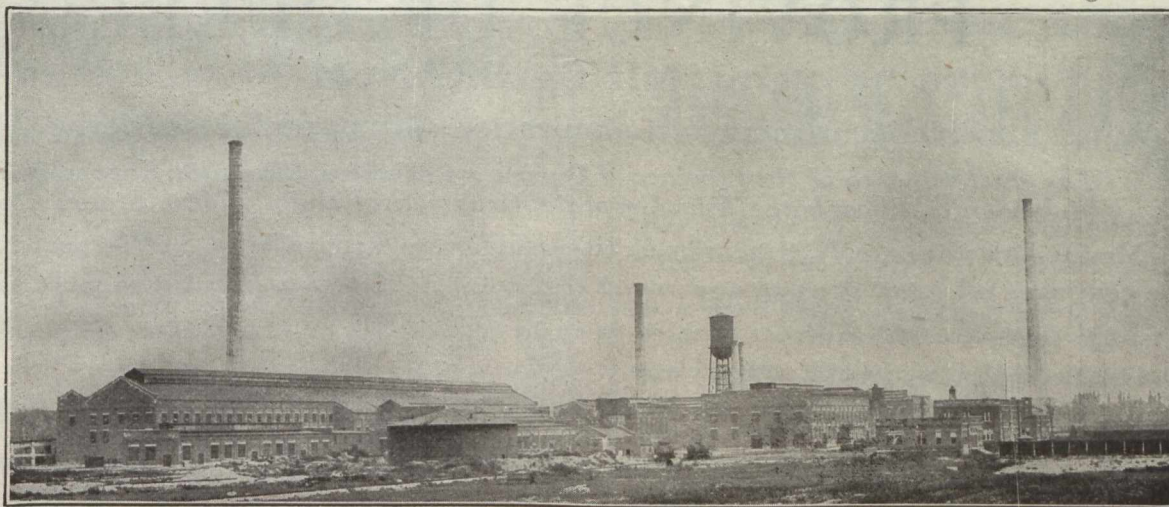
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# The Minerals of Nova Scotia

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Nova Scotia possesses extensive areas of mineral lands and offers a great field for those desirous of investment.

**Coal** Over six million tons of coal were produced in the province during 1916, making Nova Scotia by far the leader among the coal producing provinces of the Dominion.

**Iron** The province contains numerous districts in which occur various varieties of iron ore, practically at tide water and in touch with vast bodies of fluxes. Deposits of particularly high grade manganese ore occur at a number of different locations.

**Gold** Marked development has taken place in this industry the past several years. The gold fields of the province cover an area approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

**Gypsum** Enormous beds of gypsum of a very pure quality and frequently 100 feet thickness, are situated at the water's edge.

High grade cement making materials have been discovered in favorable situations for shipping.

Government core-drills can be had from the department for boring operations.

The available streams of Nova Scotia can supply at least 500,000 h.p. for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and other Literature may be had free on application to

HON. E. H. ARMSTRONG, - HALIFAX, N.S.

*Commissioner of Public Works and Mines*



## 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.

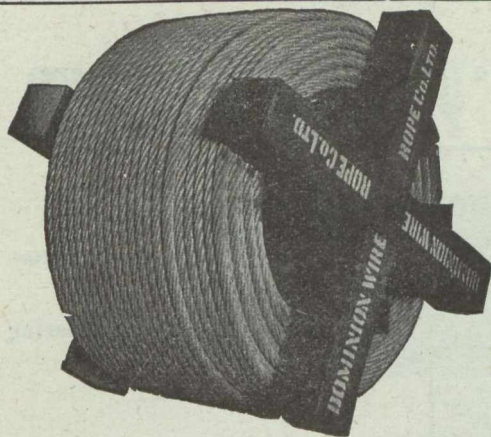
**MINING CONCESSION.** Notwithstanding the above, a mining concession may be acquired at any time at the rate of \$5 an acre for SUPERIOR METALS, and \$3 an acre for INFERIOR MINERALS

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

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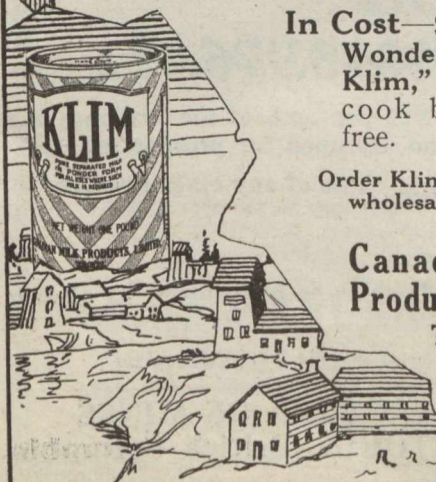
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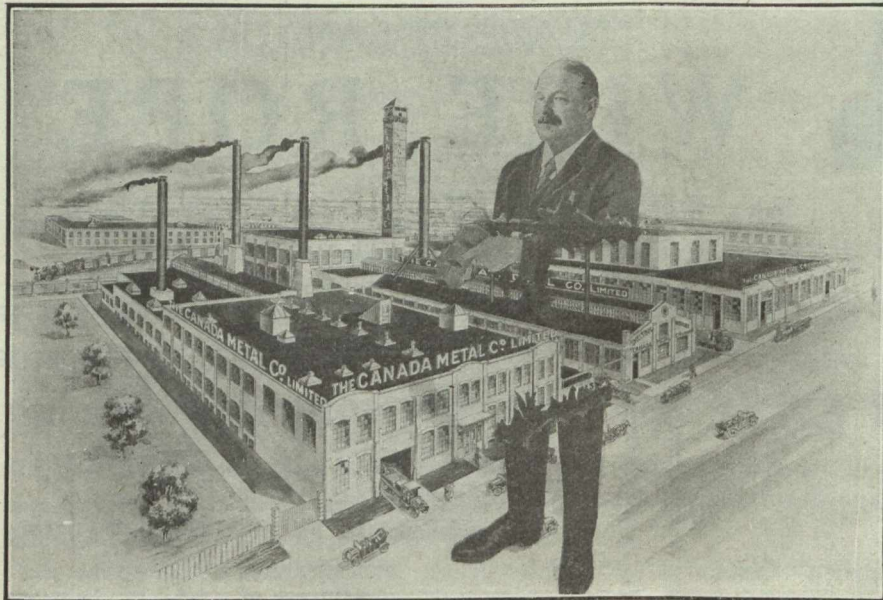
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**Aggregate Value of \$637,353,581**

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.

**Production During last ten years, \$313,976,022**

Lode-mining has only been in progress for about twenty 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

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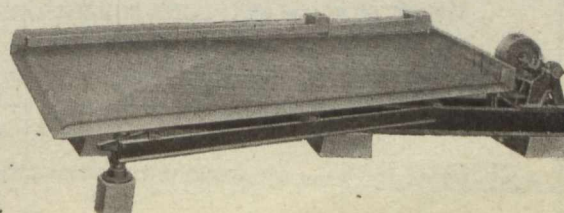
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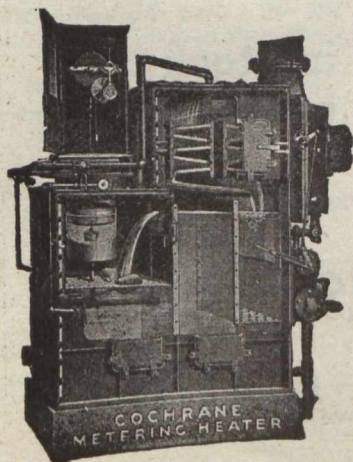
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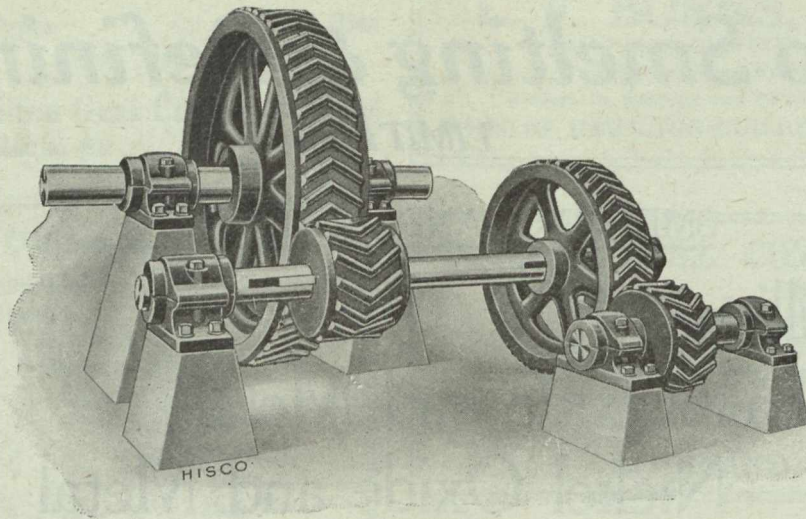
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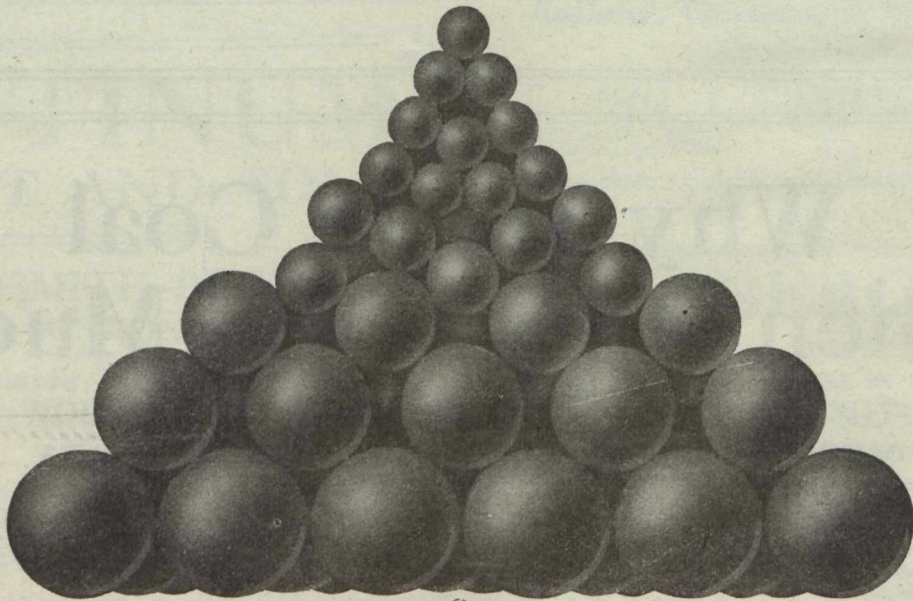
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# Canadian Mining Journal

A Weekly Journal devoted to the Science and Practice of the Mining, Metallurgical and Allied Industries, with an Up-to-date Review of existing conditions.

VOL. XLI.

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## CONTENTS

Pages 53 to 74.

<b>Editorial—</b>		
Misplaced Parsimony.....	53	The Tantalus Colliery, Yukon..... 65
The Permanency of High Prices of Commodities .....	53	Metal Quotations..... 65
En Passant.....	54	Where Common Sense Fails..... 65
Obituary .....	55	Engineering Institute of Canada..... 66
Vancouver Branch of the Canadian Mining Institute .....	55	New Inspector of Mines..... 66
Primary Considerations In Hydraulic Stowing, by C. A. John Henry, F.R.S., A.M.I.M.E.....	56	Commission on Coal Mining in Alberta..... 66
Imprisoned Underground, by George Huston....	61	British Columbia Letter..... 67
Civil Service Commissioners' Statement regarding Geological Survey Resignations.....	62	Nova Scotia Notes..... 69
Resignations from U. S. Geological Survey.....	62	Port Arthur Notes..... 70
Our Northern Ontario Letter.....	63	Ontario and Coal..... 70
		General Mineral Production in Nova Scotia During Mines Year 1919..... 70
		Alcohol from Coal..... 72
		Canadian Coal Men..... 74
		The Standard Stock and Mining Exchange..... 74

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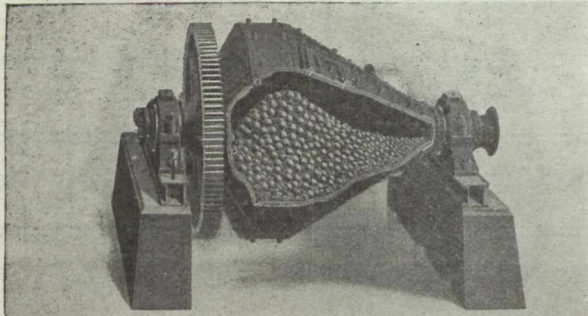
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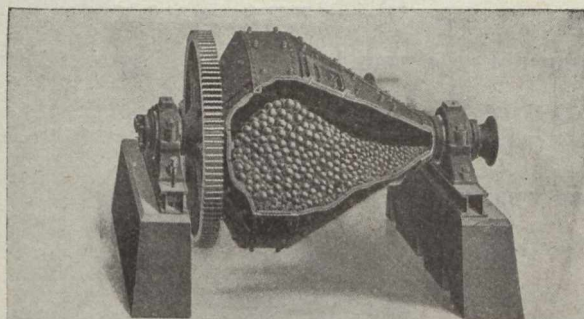
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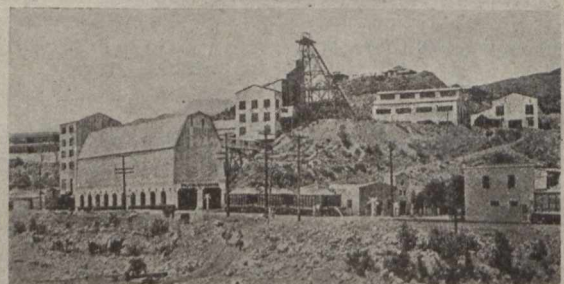
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# EDITORIAL

## Misplaced Parsimony

Further bearing on the opinions expressed under the above caption in the last "Journal" we reproduce a Canadian Press dispatch which has appeared in the newspapers, making excerpts from a Statement by the Civil Service Commission which takes exception to the widespread condemnation by Canadian newspapers and the technical press of the circumstances which have compelled a number of the members of the Geological Survey to resign their positions in order to take up more remunerative employment offered to them by wealthy oil corporations. We do not believe the explanation of the Commission requires much comment. It is self-revealing enough. The crux of the statement is in the following sentence, which we excerpt:

"This powerful and tremendously wealthy corporation (The British Petroleum Company) approaches an officer on the staff of the Geological Survey who has been receiving \$2,600, but who under the classification will at once increase to \$3,300, and offers him \$6,200 to start with. The Government cannot compete with such an offer, and the country would not sanction it."

What justification was there at any time, let alone the unusual times through which we are passing, for paying a competent geologist \$2,600 a year? What ground is there for considering \$3,300 to be an adequate annual salary for a competent professional man to-day?

The Commission asks that equally wide publicity should be given to the actual conditions under which the defections from the Geological Survey are taking place as has been given to the defections and their ne-

cessary consequence. It may be surmised that the daily and technical press will gladly give the requested publicity, for the facts disclosed by the Commission's statement of explanation and defence emphasize the point we have previously endeavoured to make clear, namely, that there is a fundamental and absolute misconception in the official mind, and in the mind of our provincial and federal legislatures, of the status of the scientific man, and the remuneration that he should receive.

The Commission states that two of the members of the Survey who are going away admit that the revised scale of salaries "is as liberal as the Government is justified in offering." Judging by the salaries for which Government geologists have worked in the past, we hardly think they can be admitted as competent judges of what is the extent of the remuneration the Government is justified in offering. The Ottawa Journal more-accurately sums up the relative issues at stake when it remarks:

"The loss within a few weeks of one-third of its staff is the worst blow ever received by the Geological Survey—the most powerful single instrument in the past development of the natural resources of Canada. Coming at the present crisis in the progress of that nation this is nothing short of a calamity."

It is assumed—and it is nothing but an assumption—that the people of Canada will not sanction adequate remuneration of the Geological Survey and other departments of the Civil Service detailed to deal with scientific matters, but why should the people of Canada play second fiddle to a private corporation?

## The Permanency of High Prices of Commodities

Has the peak of commodity prices been reached? The reasons for such a belief, when examined, are found to consist largely of faith in things not seen, and they are insubstantial, conjectural, and above all, the expression of a very natural hope.

Conversely, what are the reasons to expect a continuance of the decreased purchasing value of money, or possibly a further decrease in that value? These reasons, if looked into in detail, will be discovered to be substantial and matters of fact, and not admitting hopefulness for decreased prices.

Overshadowing all other questions affecting production is the loss in world population occasioned by war, famine and pestilence, three miseries that even to-day affect a large part of Europe and Asia. Added to these things is the political instability of Central Europe, and the whole Mohammedan and Mongolian world. The outcome of this unrest none can foresee, but it is an unmistakable and certain deterrent to production. The world is not at peace.

There is a definite shortage in the basic raw materials of civilization. The wheat production in Can-

ada, Australia, the United States and Argentina, both that now being harvested and that which will be harvested and that which will be harvested next Summer, promises very poorly. There is no visible reason why either the supply or the price of wheat should favour the consumer in the near future.

The same outlook applied to the production and cost of coal. With the notable exception of the United States, and possibly Japan, there is every reason to look for lessened production of coal and increased cost of mining and transportation.

In the matter of transportation, it has recently been pointed out in the United States that when the railways are returned to their owners in that country an increase in rates will be required that will cost each family in the United States, no less than \$215. The likelihood of an increase in the rates of the Canadian National Railways has been announced by the Chairman of the Board, and, whether he had announced it or not, an increase in miners' wages and the increase in railwaymen's wages provide a self-evident and compelling reason to expect an increase in transportation rates. Some decrease in ocean-freights may take place as new vessels are completed, but this is a slow process, and, in any case, the cost of commodities in Canada is but slightly affected by ocean freights, except in the case of some luxuries and such articles as tea and sugar.

The general adoption of the shorter working day will inevitably decrease production, and no increased efficiency during the actual working hours can possibly make up for the shorter use of machinery during each twenty-four hours which accompanies the shorter working day of the machine attendants. By increased efficiency during working hours, by greater use of machinery, and by cutting out unnecessary or duplicate motions, possibly production may be helped, but the natural outcome of the shorter day is the adoption of multiple shifts, something to which labour is oppos-

ed, and a system moreover that is only possible where a complete sufficiency of workmen and housing accommodation exists. Neither of these requirements are found in North America to-day.

**Increased** wages mean very little in these days of considerable uncertainty as to what monetary value really consists of, but decreased working hours, smaller production, and actual shortage of basic raw materials, do mean a great deal, and, apart from all questions of currency inflation, functioning of themselves, they mean increased costs of commodities.

Summarizing the foregoing, the influences which tend to decrease production, and to cause scarcity of essential raw materials are, amongst others, chiefly the following—improvement of the world by actual material destruction during the war, and in the wars now in progress; loss of life by war, famine and pestilence, in the past four years and at the present time; shortage of the products of the field, the forest and the mine, cumulative over the war period, and still continuing; restriction of production by shorter working hours; lessening of efficiency by apparently high wages and easily gained wealth; diminishing stores of natural resources, particularly coal and timber; and above all, and entering into all, the lassitude and disillusionment that has followed upon a peace that is not peace, and the non-fulfilment of promises given under the urgency of national peril. promises that are impossible of fulfilment.

The resultant of all these forces, it seems to us, will be to further increase the apparent price of all commodities, and it may well be that we have entered upon a permanently higher level of prices, irrespective altogether of considerations of currency, and arising from a general desire to work less, to eat more, and to engage more frequently in life's little diversions.

As to reasons why commodity prices should decline there do not appear to be any.

## En Passant

**A**N interesting statement was recently made in London by Dr. H. Forbes Leslie, managing director of English Oilfields, Ltd., at the annual meeting. "In several of our borings," said he, "at a considerable depth from surface we have encountered a mineral formation quite unknown in England. It is impossible at present to estimate what commercial value, if any, this discovery may represent, but, so far, we have been able to determine the presence of several valuable metals and mineral substances. One thing appears certain, however, that below the Mesozoic formations in East Anglia there probably exist great thicknesses of metamorphic rocks, in character and mineral wealth resembling those outcropping on the west of these Islands in Wales and elsewhere, but, by

the appearance of the sediments which have been derived from them, they would appear to be far richer in minerals and metals than their Welsh counterparts, and to more nearly approximate to the South African metamorphic series." The analogy strikes us as rather strained, but the discovery of a hitherto unsuspected formation, with mineral-bearing possibilities, in so long-settled a country as East Anglia, would indicate how little can really be known of the vast and but meagrely prospected stretches of Canada, and is another proof of the folly of allowing Canada to lose the services of the men who are able to piece together with some coherence the fragmentary knowledge that is as yet possessed of the geological history and structure of this Dominion.

NO more romantic tale was ever told in mining annals than that entitled "Imprisoned Underground" reproduced in this issue from "Mining and Scientific Press," and best of all, the tale has a happy ending. The combination of the diamond drill, the geophone and the electric-light to rescue men entombed for fourteen days is literally a fairy tale of science.

OF much interest to Canada is the announcement that the experiments which have for some years been carried on at Duluth, Minn., by Heyden Stone & Co., for the commercialization of the lean magnetites of the Eastern Mesaba Range, have proved conclusively the commercial practicability of the enterprise. A new plant is expected to be completed towards the end of 1920 which will have a treating capacity of up to 4,000 tons daily. The product, which is understood to be a magnetically concentrated one, following sintering, will contain upwards of 60 per cent iron, low in phosphorous and with practically no moisture. Mr. Chase Osborn has described the great bodies of lean iron ore that exist on the North Shore of Lake Superior, and these will, if the Duluth enterprise proves successful, assume new and greater importance. It is also interesting to note, from our Port Arthur's correspondent's letters, that drilling in Northern Ontario has proved the presence of iron ores of considerable iron content at depth, where only lean ores were present in the surface exposures.

OUR readers will note a letter in this issue subscribed collectively by Sheffield manufacturers of molybdenum steels, which has reference to Dr. Arnold's new formula, reported to be a substitution of molybdenum for tungsten in high-speed steels, combined with vanadium as a stabiliser. The steel manufacturers who are licensees of "Como" steel believe that they have demonstrated the superior stabilizing value of cobalt mineral, a fact that should be of significant interest in Canada. We have both molybdenum, cobalt and tungsten, and, indeed, Canada appears to possess all the necessary factors to enable this country to take high rank as a producer of alloy steels.

THE confident forecasts which are so liberally distributed through our daily press, ostensibly originating in Holland, as to what Holland will do with regard to the Allied demand for the person of the ex-King of Prussia and the former German Emperor, evidence that the machine of German propaganda is working with undiminished efficiency. Some Canadian newspapers can even beat the Dutch at knowing the Dutchman's mind and intentions.

WHY should it be assumed that the Allies wish to put the ex-Kaiser on trial out of a spirit of revenge? What the British people want; what they

elected Lloyd George as Premier to do, is to find out who, or what, started the war. If this is uncovered, so that all the world can see it, then perchance, we can prevent a second, and an infinitely more horrible war.

#### OBITUARY.

John Casey, Manager of the Caledonia Colliery of the Dominion Coal Company at Glace Bay died of pneumonia on the 14th January, after a very brief illness.

Mr. Casey was 44 years of age, and had all his life been employed at the Caledonia Colliery, where by personal merit he had risen from trapper boy to manager, and had he lived was likely to have gained further preferment.

After the Caledonia Mine fire, which occurred in 1899, and following the death of the Underground Manager who, with a number of other men was killed in the mine at the time of the fire, Mr. Casey was appointed overman. He continued in this position until his father, who was Underground Manager, retired from that position, and his son took his place. In 1910, Mr. Casey was appointed manager, and remained in that position until his death.

John Casey was regarded by his fellows and those who worked under his direction as a man among men, and, as the Glace Bay "Gazette" remarks, they would have followed his lead anywhere.

Mr. Casey always took a lively interest in the "Safety First" Movement, and his management of the mine that came under his charge was competent, conscientious, and consistent. At the same time Mr. Casey was always on the look-out for new methods, and kept himself up-to-date by technical reading.

The Editor would beg permission to record his own grief at John Casey's sudden taking-off, and his appreciation of many kindnesses received from a man who in his time befriended many and was never sparing of his time or purse to serve others. The sympathy of Mr. Casey's many friends and admirers will be extended to his relatives.

#### VANCOUVER BRANCH OF THE CANADIAN MINING INSTITUTE.

Dr. E. T. Hodge was presented with a pair of gold cuff-links, engraved with his monogram, by the Vancouver Branch, in recognition of the competent manner in which he organized the First Annual General Meeting of the Institute in Toronto at the close of last November. Dr. P. W. Brock made the presentation on behalf of the Vancouver Branch, and that the recognition was well-deserved will be unanimously agreed in by every person who attended this meeting.

Dr. Brock reported on the recent conference held in Vancouver to consider the draft of the bill which Parliament is to be asked to enact regulating the engineering profession in Canada. The draft bill has been considered in British Columbia by a Committee comprising representatives of the civil engineers, architects, chemists assayers, and members of the Canadian Mining Institute, and amendments have been considered by this local body, known as the Joint Mainland Legislative Committee. The Institute members propose amendments to protect geologists and mining engineers specifically. A similar local committee is considering the draft bill in the interests of the Vancouver Island engineers.

# Primary Considerations In Hydraulic Stowing\*

By C. A. John Hendry F. R. S., A. M. I. M. E.,

The flushing of anthracite coal mines with slit and fine rock or slate has been carried on in the United States for many years with great success. In fact the idea originated in the United States, and the method has been adopted with certain modifications by various other countries. British engineers term the process "hydraulic stowing," and the following article notes conditions prevailing at various mines in India where stowing is practiced. Certain factors should be taken into consideration before a definite plant is decided upon in introducing hydraulic stowing in a mine and suggestions are here made as to the lines along which such preliminary investigations should be conducted.

Looking at the matter from a purely hydraulic standpoint, the delivery of stowing hydraulically through a pipe is subject to the following elementary rules: (1) The loss by friction is proportional to the length of the pipe; (2) it varies roughly as the square of the velocity; (3) it varies inversely with the diameter of the pipe; (4) it increases with the roughness of the pipe surface; (5) it is dependent of the pressure. The introduction of some lubricating element in the stowing material, such as nodules of clay, is possibly well worth consideration for it would reduce wear on the pipes carrying the stowing material.

The coefficient of friction naturally varies with the velocity of flow and the diameter of the pipe. With a comparatively short pipe it may be necessary to consider losses due to elbows or bends in the pipe line. Where (as is usually the case) the length of the pipe is greater than 1000 times the diameter, the velocity head and the loss of heat at the entrance need not be considered, for it is so small in comparison to the frictional loss as to be quite negligible.

## Loss of Efficiency in Pipe Lines.

Generally speaking, in long pipes we may ignore losses due to entrance, bends and variations in the pipe sections. The effect due to bends is of small importance compared with other frictional losses, and it is with these other frictional losses that we are chiefly concerned. If sand stowing, or packing, is to be carried out on definite lines, it will be necessary to find out the relation of head to length of pipe line, the ratio of sand to water and the velocity to the size of the pipe.

All these things will have a definite relation one to the other, and if the system is to be carried out on a larger scale than is desirable to collect information and to experiment so that a basis may be established for common use. It may be an exhaustive matter to derive suitable coefficients for all conditions, still there is no reason why the behavior of certain mixtures, such as one part of sand to three of water, should not have certain coefficients of friction worked out for them. Then the velocity (and therefore the rate of supply) can be determined; or the maximum length to a certain head can be derived and the cost of an installation and its capabilities can be worked out with some exactness prior to the commencement of the work.

\*From a paper read before the Geological and Mining Society of India.

Rough experiments have shown that the ratio of sand to water varies in direct proportion to the head and the length of the pipe, while the frictional coefficient is doubled when the sand is introduced to the maximum carrying capacity of the water. Such results should be checked with pipes of a greater head and length; then we will find that the effect of a bend at the entrance will be less evident and the flow steadier. Roughly speaking, where the proportion of the head to the length is 1 to 5, then the proportion of sand to water will be about 1 to 3; or where the proportion of the head to the length is 1 to 3, then the sand to the water will be about 1 to 15. However, the capacity of an installation will depend upon the size of the pipes and the velocity of flow in them; it would be an advantage of experiments as previously suggested could be carried out in instances where systems were in actual use so as to determine the proportionate results with some degree of accuracy.

## Planning a Stowing System.

To determine the size of a pipe for use under certain conditions it will be necessary first to decide upon the rate at which stowing (flushing) is to be done. Furthermore, the velocity of discharge will bear a definite relation to the diameter of the pipe and its length. Hence, the first problem will be to determine the most economical proportion of the head to the length of pipe underground. The problem is to determine whether it would be more economical to put down a series of boreholes direct to the various portions of the workings to be flushed, or whether it would be better to establish one or two main points of flushing supply pipes from the surface to the mines and use long lines of pipe underground.

This problem will be influenced by the following considerations: (1) The rate at which the flushing must be done; (2) nature of the strata to be bored; (3) quantity of water available; (4) grade of the underground pipes; and (5) the velocity of flow of the flushing mixture. It should be remembered that there is a limit or the minimum velocity at which the mixture will flow; at velocities below this minimum the sand held in suspension will gradually increase frictional losses until movement of solids practically ceases. On the other hand, high velocities of mixtures result in abnormal and costly wear of pipes.

The wear on the pipe due to friction would vary with the proportion of sand to water—the more water used the less friction. However, it should be considered that the more water used the greater will be the expense for pumping out the water after it had been used for flushing. It would be a nice balance of costs to determine which would be the most economical mixtures.

Having determined upon the output and velocity, it will be a simple matter to gage the head required, to work out the most convenient flushing or feeding point at the surface to calculate the dimensions of pipe required. Where the head is considerable it would possibly be an advantage either to put down two or more boreholes, or to supplement the head by the introduction of a pumping unit.

The disposal of the flush water and its clarification are important. In certain mines where the pitch of the

seam is steep enough, it may be cheaper to flush the sand to the workings through a flume or trough. This method can be used when the pitch is 15 deg.; or even at a less pitch if the proportion of sand to water is high. It may be necessary to bring the flushing water from a distance; this might be offset by the greater availability of river sand in a dry season. If the distance to move the mixture on the surface is considerable, and the grades favorable, then an open flume may be more economical than a pipe-line.

Regarding the character of the pipes to be employed we may consider: (1) Cast iron; (2) wrought iron; (3) wood; (4) terra cotta; and (5) porcelain lined. The shape in comparatively small installations would be circular, but avoid pipes may be considered in special cases. In general it will prove economical to employ thicker cast iron pipes for flushing lines than is usual in the case of pipes used for water only; in no case is it advisable to employ them under  $\frac{1}{2}$  in. in thickness as the tensile strength is low and uncertain.

If, for economic reasons, cast-iron pipes must be employed, it is advisable to have them as thick as practicable. For instance, assume the outer diameter of a pipe is 7 in. and the inner 6 in., then the cross-section area of pipe metal would be 10.21 sq.in. If we increase the outer diameter of the pipe to  $7\frac{1}{2}$  in., and keep the inside diameter 6 in., then the section area would be 15.904 sq.in.; there would be an increase of 5.694 sq.in. in section. Thus, for scarcely more than half as much more metal, the life of the thicker pipe will be double as long as in the first case; this is true provided we assume the pipe will give trouble and have to be discarded when its thickness get below, say,  $\frac{1}{4}$  inch.

#### Materials Used in Stowing Pipes.

Wrought-iron pipes are not particularly suitable for use on longitudinal lines, as their cross-section is comparatively small; they have, however, the advantage of considerable length, resulting in fewer joints, and their fibrous structure (if unriveted) offers less resistance than granular sections.

For underground pipe lines wood might be profitably employed in special cases; the pipes consist of a number of staves, their edges bevelled at an angle radiating to the centre of the pipe and bound around at intervals with steel ties arranged with a take-up block to insure efficient tightening. The staves would be 1 to 3 in. thick, depending upon the size of the pipe. The pipe would be bulky and not generally adaptable. Pressures up to 200 lb. per sq.in. are possible, though 150 lb. would be a satisfactory maximum. With higher pressures it is likely that water would be forced through the pores of the wood.

The porcelain-line pipe is possibly debarred by its high cost from adoption in cases where coal is mined and sold at a particularly low figure. It is possible that vitrified terra cotta may be suitable for underground use, as when vitrified it is coated with an impervious vitreous lining on which acids and alkalis make no impression. This is an important point. As in some cases a good proportion of the wear of pipes is due to the acidity of the water. It may be possible for interested concerns in India to devise means of materially increasing the vitreous lining to suit the peculiar conditions of use. The average pipe can be made to stand a reasonable pressure, say, 100 lb. per sq.in. The joint will, of course, be somewhat difficult and tedious to

make. In Pennsylvania half-section glazed-tile pipe has been used on the surface for carrying silt and water to great advantage; this transportation line constituted an open trough.

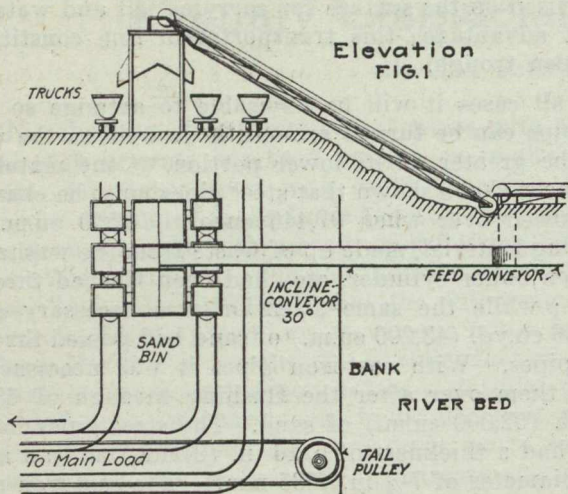
It all cases it will be advisable to arrange so that the pipe can be turned around, if desired, as the wear will be greater on its lower portion. Continental experiments have shown that steel pipes must be changed or turned over when 97,446 cu.yd. (74,500 cu.m.) of stowing material, made up of waste from the washeries, broken boiler cylinder, etc., had been flushed through them; while the same attention was necessary after 56,506 cu.yd. (43,200 cu.m.) of sand had passed through the pipes. With cast-iron pipes it was necessary to turn them over after the flushing through of 68,016 cu.yd. (52,000 cu.m.) of sand. The steel pipes in this case had a thickness of  $\frac{5}{16}$  in. (8 mm.) and an internal diameter of  $7\frac{1}{4}$  in. (185 mm.) The cast-iron pipes had a thickness of  $\frac{3}{8}$  in. (10 mm.) and an internal diameter of  $5\frac{7}{8}$  in. (150 mm.).

#### Considerations Influencing Materials Used.

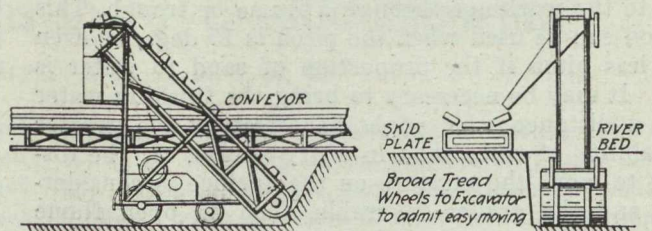
In the Jharia, India, coal field the proximity to sand areas renders one apt to overlook other sources of packing nearer at hand. It might, for instance, be more economical to remove the overburden (surface) covering coal on the outcrop and utilize this if suitable; or even put it through crushers in the case of hard or lumpy material in order to reduce it to its requisite fineness, before using in the mine. There might be cases where local material which required crushing may prove more economical than obtaining something from a distance; at the Rand mines in Africa the whole of the tailings is often utilized for this purpose.

The following points require attention when considering the question of transporting sand from its source of supply to the mines: (1) Accessibility of the sand; (2) cost of transportation to the mines; (3) method of packing. In the case of India, whether the sand is required for the Dishergarh of Jharia field, the accessibility of supply is practically the same; but in the case of transport there are two entirely different problems to be dealt with—one in which mines are near enough to the river to draw their supply of sand, and the other where mines are at such a distance as to render the capital outlay prohibitive without co-operation between adjacent mines.

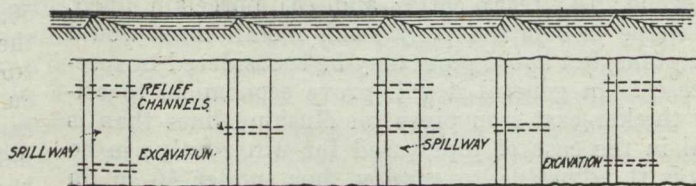
The packing may be deposited in a bin or reservoir adjacent to the mine or above the workings, and be washed down a pipe, the head being sufficient to drive the sand up to the required position. There will also be cases where it is possible to sink a borehole in the river bed and feed with sand direct; in this case the pipe should be fitted with valves at the surface and also (as an additional safeguard) at the foot, in order that they may be closed down during flood periods. Otherwise the loading from the river bed will, in a measure, depend upon the method of transportation adapted to the mine. In any case it is safe to assume a severe gradient will have to be negotiated from the river bed to the bank. The work on the bed will in a majority of cases have to be of a temporary nature suitable for rapid removal and therefore a separate unit to the main pipe line. For this, light belt conveyors may be suggested, one of more horizontal ones on the bed and the other running up the bank (see Figs. 1 and 2).



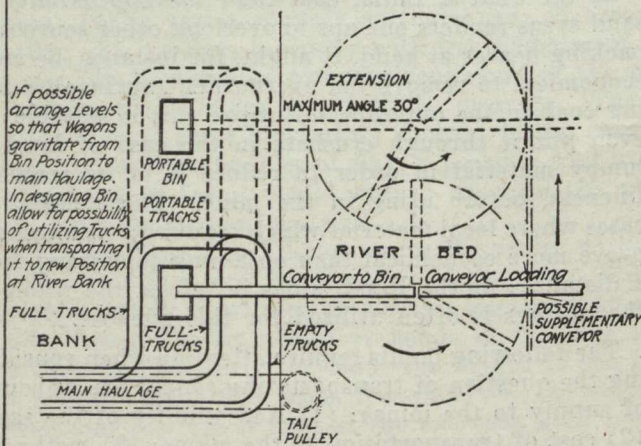
**Plan FIG. 2**  
**METHOD OF RAISING SAND FROM RIVER**



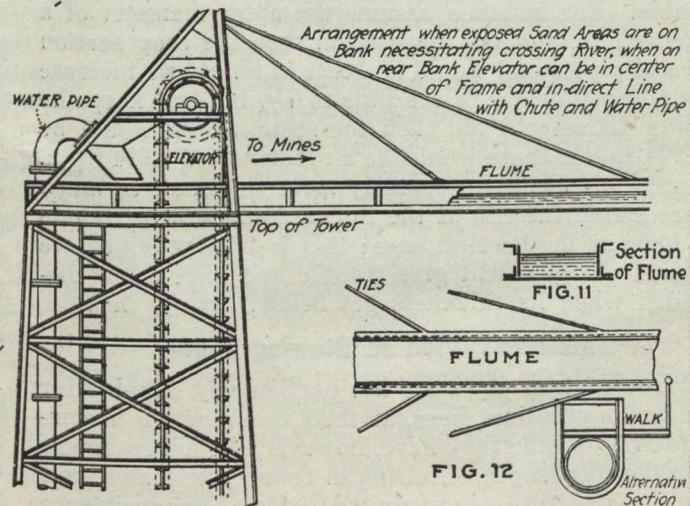
**Side Elevation FIG. 6**      **Cross Elevation FIG. 7**  
**EXCAVATOR FOR LOADING CONVEYORS**



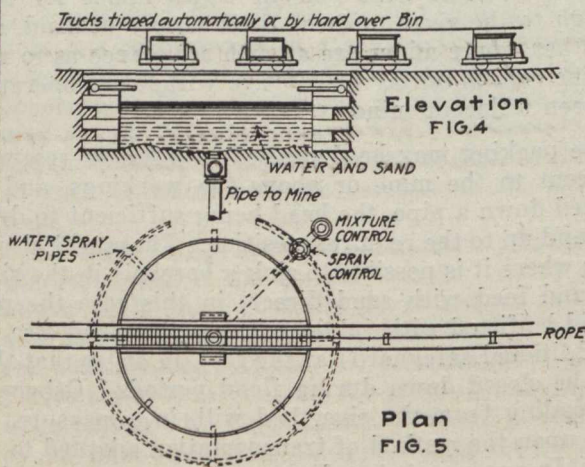
**Plan FIG. 9**  
**LONGITUDINAL SECTION OF RIVER WITH SUGGESTED EXCAVATION LEAVING SPILLWAYS TO ADMIT OF MAXIMUM PRECIPITATION AND MINIMUM OF SCOUR**



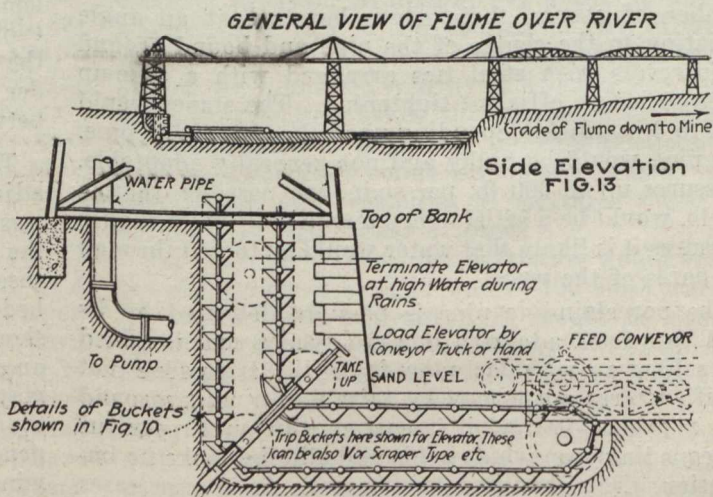
**Plan FIG. 3**  
**ARRANGEMENT OF SUPPLEMENTARY CONVEYOR**



**Elevation FIG. 10**      **Section of Flume FIG. 11**  
**BANK TOWER FOR FLUME**



**Plan FIG. 5**  
**SAND RECEIVING BIN OVER MINE**



**General View FIG. 13**      **Elevation FIG. 14**  
**BASE OF TOWER FOR FLUME AND SAND FEED IN RIVER BED**

The maximum angle at which sand can be dealt with would be about 30 deg., although certain patent types and scraper conveyors will, of course, deal with much steeper gradients. The horizontal feed conveyors should preferably be entirely self-contained, driven by a motor and capable of being moved around in a semi-circle with the lower end of the inclined one as a pivot (Fig. 3). It would be necessary to fix it on rollers or skid plates to facilitate its circuitous movement, and it could be provided with a simple motor driving attachment for the purpose if necessary.

#### Methods of Transporting Stowing Material.

A steam shovel is likely to prove too heavy for the purpose of loading and a conveyor appears to be the most suitable. Should an aerial gear be employed for the transportation line another type of gear might be profitably substituted.

Assuming the case of mines adjacent to the river, with possibly plenty of water, the simplest form of transporting sand appears to be an endless haulage in conjunction with three-ply rubber and canvas conveyors. The plant would be practically automatic, and we might assume the following conditions: The sand would be loaded in a horizontal conveyor, and thence to an inclined one leading into a small loading hopper on the bank. From this it is fed into dump cars and these are moved by endless haulage over a bin; as the cars pass over the bin they are automatically dumped. From the bin the sand is washed into the mine (Figs. 4 and 5).

A constant supply of sand is by no means the least important matter when the tonnage becomes considerable. It might pay to have an inclined plane at the bank, have a supplementary haulage to the main one and run the dump cars on tracks on the bed of the river. A series of light tracks provided with the flat steel ties could be used. This plan omits the conveyors and bin at the bank (Figs. 6 and 7). Pumping the sand direct through a pipe line may be suggested; but it does not overcome any more successfully the problem of loading, while the effect of sand on anything with which it comes in contact is familiar.

#### Examples of Stowing Plants.

It may be mentioned that the dredging plant at the Port Talbot docks included a sand-pumping unit. This dealt with something like 150,000 cu.yd. of spoil material with a 22-in. pump and discharged it at a rate of 200 cu.yd. per hr., at a point 500 yards from the pump. Possibly further investigations of the suitability of such a unit is warranted under certain conditions.

Another method may be considered where the distance to the mine is comparatively short and the sand area is situated on the far side of the river from the mine; the sand for flushing, under these circumstances, would be (for a certain period of the year) carried across the river. The scheme might be outlined as follows (Figs. 10 to 14):

A tower might be set up at some point on the river bank most conveniently situated for sand excavation. A combined conveyor and elevator possibly could be arranged to run from the river sand deposit to the top of the tower, running horizontally in the river bed so as to facilitate loading. At certain times of the year it could be shortened to avoid flood water and to enable the vertical section still to operate should sand be avail-

able. The elevator would discharge sand into a flume at a sufficient height above the receiving point at the mine to allow the material flushed with water to gravitate to the mine. The water for flushing would be pumped up a pipe supported by the same tower. The proposition would necessitate the use of a number of frames or intermediate towers to carry the flume at a suitable grade. The flume towers should be suitably braced to withstand wind pressure and the load, the former possibly proving the most serious consideration. There may be cases where it would prove more advantageous to employ a pipe in the place of the open flume, so that the head necessary to transport the sand may be reduced; this plan would allow water to enter the pipe under pressure, thus preventing the settlement of sand in transit.

The scheme shown in Figs. 10 to 14 would only necessitate power to drive the elevator and necessary pumps. Further, in order to produce the necessary scouring effect the usual proportion of water to sand might be greatly increased. Having completed its work of transporting the sand to the mine, the water could be drained off and let back to the pumps by means of another flume.

#### Details of Hydraulic Features.

Thus the water could be used over again. The sand could be allowed to settle in a bin adjacent to the bore-hole into the mine and the usual proportion of water added to carry it underground.

In considering a suitable coefficient of friction for flume troughs of various dimensions with varying velocities to suit conditions, it should be observed that the scouring power of a flow of water in an open channel does not at all times bear a direct relation to the velocity and depth. In other words, as the hydraulic radius is increased, it does not follow that in order for the water to impart motion to the sand the velocity of the water will increase proportionally.

The depth of flow is an important factor, as the water first subjects the sand to a motion of dragging, and later the particles are lifted up into the stream, the motion then being converted into one of suspension. The water carries a larger quantity of sand in its lower portion than the upper, and generally it could be assumed that the amount is proportional to the depth. Regarding the wear due to friction of the sand on the pipe, it may be an advantage later to investigate carefully the relationship of this to the velocity. For it may be assumed that in pipes the greater amount of material carried will be along the center portion of the water; it remains to be determined to what economical limit the velocity of the water may be accelerated in order to increase the time of suspension of the particles and reduce the friction due to the dragging effect of sand particles.

Where, however, the sand is washed into a bin and precipitated, while the water is allowed to overflow and run back to the pumps at the river bank, then the portion of water to sand may be high so that the inclination of the flume or pipe line can be reduced. Further, at the feeding point the tower can be extended to a greater height so as to increase the head, and this would reduce the requisite height of the other towers in the case of a pipe line.

In the open flume it is doubtful whether a coefficient of friction for sand and iron will be less than one-fifth. Thus, for water to carry 1 lb. of sand a distance of 100 ft. requires  $100/5 = 20$  ft.-lb.; if the proportion

of sand to water is 1 to 10 lb. of water must fall 2 ft. in 100 to give this energy. However, while the water imparts motion to the sand there is a tendency for the former to run at a higher velocity over the latter, so that the inclination of the flume should be more than 2 ft. in 100. Possibly for feeding the sand, in the place of the flume it would be better to employ a pipe, and we may then roughly assume that the grade will be in proportion to the mixture; if one part of sand be used to 25 of water the grade would be also in this proportion, or 4 ft. in 100. The necessary head might be increased at the feed tower, so as to reduce the height necessary for the intermediate towers. The flume bearing the return water to the pumps could be carried across the river (when necessary) below the supply pipe and on the same supports.

#### Stowing Plant at the Mine.

The area of the receiving bin would in this case have to be of sufficient extent to admit of the requisite precipitation of the sand with sufficient rapidity to allow a large proportion of the water to overflow. For this reason the bin might be provided with a well in its floor and the surface graded to meet this, so that an adequate sand pump would be provided. The feeding pipe from the river should terminate at a comparatively deep point in the bin so as to keep the sand at as low level as possible to aid its precipitation; from the bottom of the veil the sand could be led straight to the mine or a supplementary feeding bin. The flume for taking back the surplus water should emerge from a point near the surface-level of the feed bin. A strainer might be put at the entrance of the flume to assist in keeping out the sand. It might be convenient to have this flume follow directly under the supply pipe though possibly set on the ground until it reaches the river when it can be carried across the stream to the pumps on the same support as the upper pipe. Owing to the low grade required for the return water, it is possible that this flume could meet the feed tower at a point considerably above the level of the river. Thus pumps could be situated at this higher elevation and reduce most of the expense of pumping water from the river below.

It is a course doubtful if this project would always prove economical or convenient. But it is possibly worth consideration, particularly where the location of the sand areas necessitates crossing a river which may need bridging for a good portion of the year. This is a case where the mine is comparatively adjacent to the sand area. In the Jharia field the river is generally at a distance from the mines, and the problem involves considerable capacity. This problem may be solved either by the co-operation of a number of collieries or the construction and operation of the main transportation line by a private company.

For transporting the sand, endless haulage appears the most suitable. With this system, if we have a four-mile transportation line and assume each car carries one ton at a speed of two miles per hour, then one car takes two hours to make the round trip. For the sake of illustration we may assume that we have to transport 5000 tons per day of 12 hours, equal to, say, 416 tons per hour. This means 832 full cars and 832 empty ones in transit, or a total of 1664 plus those being loaded at the river bed. Possibly not less than a total of 1800 cars will be employed. Five thousand tons daily means 11 200,000 lb., and at 100 lb. per cu. ft. this equals 112,000 cu. ft. A simple method of loading would be by running the cars on a series of

portable tracks at occasion required. The loading, however, would be a difficult problem as a loaded car would have to leave every eight seconds; and if we consider the sand is excavated to a depth of 2 ft. then every day an area equal to 56,000 sq. ft. will be cleared. Therefore, a simple loading device becomes absolutely necessary, the simplest methods being to employ a conveyor, which by reason of its length is particularly adapted to work of this kind.

In Amercia sand is often excavated and loaded by portable machines consisting of a frame with a number of buckets fixed to an endless chain running over both head and tail wheels. The buckets are about 18 x 18 in. in cross-section, and the apparatus delivers about one ton per minute. The machine is equipped with a chute and only requires about a 7-hp. motor to drive it, the weight with the motor being about 7000 lb. About eight of these machines would possibly help to solve the difficulty of labor trouble with regard to loading and prove more economical. The excavators at the river bed would then feed into a conveyor, and from experiments it is found that one man can load a conveyor with 6.75 cu. ft. of sand in 12 minutes with the material at a distance of 18 ft. from the conveyor. In practice the conveyor could possibly be moved in such a way that the men would be close to it all the time, and would at the most have to carry the sand about 3 ft. In the condition under review it was found that the 6.75 cu. ft. actually were deposited in the conveyor in 12 minutes, as noted. This represents 675 lb. in 12 minutes, or 1.6 tons per hour.

#### Practical Considerations Affecting Plant.

Assuming the conveyor could be moved practically in a circle, we get a superficial area of 783,828 sq. ft.; or excavating to a depth of 2 ft., we would have about 1,567,656 cu. ft. equalling about 70,000 tons, or 14 days' supply. This conveyor then would feed into another one leading up the bank, the latter being 600 ft. long. Since the loading point at the bank is being continually shifted from the bank terminal of the main transportation system, a supplementary haulage would have to be introduced running parallel and close to the bank; a portable bin would have to be provided into which the conveyor running up the bank would feed as the area was evacuated in the river bed, and the conveyors were shifted, the bin would be moved from time to time to suit conditions. Owing to conveyors being more expensive than a track, the former is not to be recommended for feeding direct to the main haulage. The loading bin would have a capacity of about 100 tons (or 2,240 cu. ft.) and if it was 40 ft. long, would accommodate eight trucks at a time; this would enable loading at the speed required to allow them to leave at their eight-second intervals.

In Jharia, the point for depositing the sand from the main transportation line would be about 80 ft. higher than the river bank, the grade being 1 in 230 or a pitch of 0 deg. 16 min. The load on the rope equals 832 tons; to handle this load a 1-in. rope may be used weighing, say, 5 lb. per yd. It will possibly be advisable to have a central power station which could either be situated at the river bank, thus saving the poles and wiring to the conveyor motors; or we may assume a power unit with sufficient power to operate, in conjunction with the main transportation line, and endless haulages in mines adjacent to it. The latter is the more expensive arrangement, but is used, as the grade to the mines is favorable to the load, as a rule.



# Imprisoned Underground

By GEORGE HUSTON.

(Copied from Mining and Scientific Press)

To be imprisoned for over two weeks in the cross-cut by a cave underground and to be rescued unhurt was the remarkable experience of two miners, Peter Grant and Emil Sayko. The accident occurred at 10.45 a.m., November 15, in the Gold Hunter Mine, situated on the outskirts of Mullan, Idaho, in the Coeur d'Alene region. Both men had families in the town.

The cave happened in what is known as the northwest stope, an extension of the Ryan stope. The old Ryan workings had caved in 1913, being filled thereby to the 33rd floor, leaving an opening between the top of the debris and the roof. The roof had not been penetrated, 60 ft. of solid rock intervening between it and the old level above. The extension stope had not been worked for several months, and the two men were cleaning up preparatory to taking a contract for a raise through. They had finished and were descending, when Sayko noticed a crack on one of the walls. Becoming alarmed, he climbed a few floors for his carbide and water. On descending again, he had a slight argument and prevailed on Grant to go back for his lunch bucket. The delays undoubtedly saved the men's lives, for on descending a few floors more, a cap snapped in front of them. They then made all haste to reach 48th footwall prospect cross-cut, barely entering it in advance of the cave, which was thundering behind them.

The Hunter lode is in a wide zone of fissuring, shearing, and sheeting, which crosses the strike of the thin-bedded Wallace formation. The dip of the fissuring is nearly vertical or slightly south. The practice was to timber close to the stopes, to hold the slabby walls apart, then fill for safety, afterward. In this case, the extension stope, consisting of 35 floors, had been filled from the 3rd to the 22nd, excepting three 6-ft. sets that were used for a man-way, timber-slide, and chutes. From the 28th floor up, it was only a raise. The 49-ft prospect cross-cut in which the men took refuge was on the 26th floor. From the third floor down to the tunnel-level the stope was supported on stulls, and as no stoping had been done below the tunnel-level, the stilled ground was not damaged by the cave.

What caused the cave was the slipping down of a huge wedge-shaped slab running parallel to the length of the stope, adjacent to the timber, and extending down to the eighth floor; the bottom lodged against the filling, while the top fell over and smashed the upper timbering of the stopes, the subsequent movement effectually sealing all the connecting openings.

Every means was tried to reach the men through old workings, but these were found to be blocked. An incline-raise from a safe floor was started toward the west end, where the extension stope was known to be narrowest, but it became apparent soon that all the chutes were closed and that no openings existed. Efforts were then concentrated on getting up through the muck-pile to the top by the quickest route. The rescue-crew knew the men were alive from faint rappings and the smell of wood-smoke resulting from their efforts to keep warm.

At this juncture the Bureau of Mines at Washington was asked for the use of the new device, the geo-

phone for locating noises incidental to operations of this nature. The Bureau responded at once, directing two experts at widely separated points to report at Mullan, and the apparatus and men arrived as fast as the railway could bring them. In the meantime the men had been reached by a drill-hole, but the mere fact of the ready acquiescence of the Bureau and the sending of some of their best talent gave a high degree of encouragement to the hard-pushed crew and management.

After working six days on the raise, reaching about the 24th floor, through the muck-pile, the whole mass started to move closing the mouth and other portions of the rescue raise, imprisoning two men, Jack Delmarh and James Collins of the rescue-crew.

It was hardly thought possible, in view of the movement of big slabs of rock and fine material, to find Delmarh and Collins alive, so a feverish search for the bodies began. After six hours of strenuous work the men were heard talking. They were removed unhurt, after 15 hours imprisonment.

But the settling left the search for Grant and Sayko where it had started, it being evident that raising through the muck was too dangerous and slow, and that the men would perish before being found.

A raise was started immediately in solid rock at the west end of the stope, utilizing the latter to break against and spiling against the muck. This method favored safety and speed, but the distance was nearly one hundred feet, and some coincident operation had to be carried on to sustain life in the men, who had now been imprisoned for six days.

There being a 1¼-in. diamond-drill outfit on the ground, the Diamond Drill Contracting Co. of Spokane was called by telephone to furnish a crew, which arrived on the next train. A hastily improvised hoist lowered the outfit to the top of the 60 ft. of solid rock capping the Ryan stope, and on November 21 at 8 p.m. drilling was started the 60 ft. of drilling being completed in 15 hours.

The drill crew and management were ignorant of the exact position of the imprisoned men. To avoid end-projections of the stope and filling, the hole was drilled vertically into the Ryan stone, instead of on an incline to reach the cross-cut. When near the bottom the hole lost its water, the seepage attracting the attention of the imprisoned miners. They scrambled in the direction of the seepage with a lunch-bucket, catching the first drink that they had had for four days. After breaking through, the drillers lowered a half-inch galvanized pipe, which struck Grant on the head. The over-joyed man shook the pipe vigorously, conveying the information to those above that their efforts had not been in vain. A whistle had been attached to call the men, and after its removal communication was opened up.

One of the first things for which they asked was light, so a wire was passed down outside the pipe, with a two candle-power bulb, taking current from a storage battery. The pipe, after being warmed by flushing with hot water, served to convey soup, stimulant, milk, etc. The company's physician prescribed the diet, and the hungry men were made as comfortable

as possible. Meanwhile another hole was drilled and reamed out to two inches. Through this, elongated loaves of bread wrapped in paraffined paper were passed and suitable receptacles filled with finely chopped fruit, vegetables, and meats were forced.

On account of the danger from further caving, a two weeks stock of provisions, candles, and other things was lowered and conveyed to the cross-cut; also the 1/2-in. pipe was extended and the men were instructed to stay there until rescued. With plenty to eat and drink, and means of warmth, the question of sustenance was solved.

Meanwhile the work of raising went on with strenuous energy, day and night, until on November 29 at 3 p.m. the men were removed after being confined for 14 days and 4 hours in their underground prison.

It is pleasing to record that the resources of the entire district were placed at the disposal of the Gold Hunter management. With characteristic brotherly feeling, the workers engaged in the rescue gave of themselves freely and without stint. The rescued men after having their eyes bandaged were conveyed to the hospital at Wallace. They were in good condition, and thanks to their pluck and powers of endurance, will soon be out in good health. Their faithful wives who sustained the men's courage after communication was opened, are the happiest of women, never losing their faith in the ultimate rescue.

#### CIVIL SERVICE COMMISSIONERS' STATEMENT REGARDING GEOLOGICAL SURVEY RESIGNATIONS

In a statement from the Commission, on the recent withdrawals of experts from the civil service, it is said: "Many wild and exaggerated statements have been made in reference thereto and some newspaper comments have been none too complimentary to the Civil Service Commission." The Commission says many of the alleged facts are not borne out by careful enquiry. "Dissatisfaction with the classification does not appear to be at the root of the trouble, but rather a wide-spread activity in the commercial world in the direction of increased endeavor to exploit those natural resources which have been wasted so desperately during the past five years of world-wide war and devastation."

The Commission sets forth as typical cases those of a number of the most capable men on the staff of the geological survey who have accepted offers of outside employment. "The principal competitor for the services of these men," says the statement, "is the British Petroleum Company, an Imperial corporation with a capital of \$275,000,000, organized to develop the oil supply of the world, wherever it may be found. This powerful and tremendously wealthy corporation approaches an officer on the staff of the geological survey who has been receiving \$2,600, but who under the classification will at once increase to \$3,300, and offers him \$6,200 to start with. The Government cannot compete with such an offer and the country would not sanction it. Another on the same salary and with the same prospective increase is offered \$5,100 and he too accepts. Neither of these men has one word of criticism for the new schedule, on the contrary, they admit that it is fair and as liberal as the Government is justified in offering, but their services are worth more in the outside market and naturally they go."

The statement concludes by saying that the services of those men are not lost to the Empire, but their value in the wider fields will be enhanced. The Commission states "it is therefore to be hoped and may be expected that those newspapers which have given such wide publicity to the alleged deficiencies and "foolishness" of the Civil Service Commission will give their readers the benefit of an equally widely published statement of the actual conditions under which these defections are taking place."

#### RESIGNATIONS FROM U. S. GEOLOGICAL SURVEY.

##### Conditions similar to those at Ottawa.

That the personnel of the U.S. Geological Survey is facing serious deterioration is indicated by the following statement of the Director of the Survey in his annual report: "The fact that there have been 77 resignations from the scientific force of the U.S. Geological Survey during the last year—17 per cent of the force—suggests inadequacy of compensation, and the percentage of resignations in the clerical and non-scientific force was even larger. This statement, of course, does not include separations to enter military service. The largest inroad upon the Geological Survey personnel comes from the oil companies; the final result of the pioneer work of the Federal geologists in applying geologic methods to the search for oil and gas is that a large proportion of the leading oil geologists the world over are U.S. Geological Survey graduates. Indeed, the future decline in popularity of the Geological Survey as a recruiting station for oil-company employees will be due simply to the fact that the experienced oil geologists who remain in the Government service are from personal preference immune to outside offers. The relation between Government salaries and outside salaries of geologists has been definitely determined in a compilation of the records of 29 geologists who left Government service after receiving an average salary of \$2,271. The average initial salary of these men in private employ was \$5,121, and after about two years of average service this compensation averaged \$7,804, and eight of these geologists receive \$10,000 or more. The disparity is even greater if consideration is given to the large financial returns from investments made by the private geologists in connection with their professional work, a privilege properly denied by statute to the official geologist. That the value of these men as specialists and consulting geologists is far greater to the country at large than to private corporations is undeniable. Furthermore, it is important to note that most of these geologists had persisted to the limit of endurance with a magnificent spirit based on their love of scientific research and their desire to contribute to the sum of geologic knowledge. Most of them have been forced out of the service by sheer financial necessity. Unless adequate measures are taken to ameliorate the situation, the geologic staff is destined to suffer far greater deterioration of morale and depletion in its ablest, most responsible, most experienced, and most valuable members. The Geological Survey is passing into a stage when, with greater need than ever for systematic geologic work in the country, it is ceasing to be attractive to the young men of greatest ability, training, and promise. This situation deserves prompt and effective remedy, for it threatens most seriously to cripple this branch of the public service."

# Our Northern Ontario Letter

## The Silver Mines

In the silver mining areas of Northern Ontario the renewed Asiatic demand for silver has created another wave of enthusiasm. It is believed that any very sustained buying at this time will send quotations soaring once more. The most conservative producers are unable to discern any influence that would cause a recession of prices while the future appears to hold out reasonable promise of the demand over supply becoming even more pronounced.

Believing that the present condition will prevail for at least a few years and confident that no labor difficulties will develop during that time, the mine operators of Cobalt are not only becoming more aggressive in the local field but are evincing a desire to acquire prospective silver properties in the outlying districts, such as Gowganda and Elk Lake.

At the time of writing, negotiations between the Coniagas Mines and the Tretheway-Cobalt Company continue with fair prospects of the Tretheway being taken over by the Coniagas. It is learned officially that the deal, if consummated will include the mill as well as the mine of the Tretheway, at least with the exception of a few small milling parts. Inasmuch as the two properties adjoin, the Coniagas would be in a position to work the Tretheway in conjunction with its own property and thus eliminate the present overhead expense with dual management. The finances would strengthen the treasury of the Tretheway and place that company in excellent position to concentrate its full energies on the development of its large acreage in the Gowganda silver area. The transaction is one that would appear to hold out advantages to each company involved for which reason the successful conclusion of the deal is considered probable.

It is intimated that the La Rose Consolidated has had a very successful year and that agreeable surprises are in store for the shareholders. The company has been a consistent shipper of ore throughout the past year, and it is understood that a part of the ore mined was high grade. The company has commenced the current calendar year by continued aggressive operations and the year 1920 promises to be prosperous. Higher efficiency among the workmen, and high quotations for silver plus high rate of exchange on New York funds all serves to add to the company's prosperity.

The Crown Reserve is considering a plan to mine wide deposits of low-grade material, amounting almost to quarrying. In this way it is believed that some of the old abandoned workings of the mine may be turned to profitable account and a vast tonnage of very low grade material turned into a source of considerable revenue. In the meantime the company is proceeding with the development of the Canadian Kirkland property in the Kirkland Lake district and it is stated that excellent encouragement is being met with.

The Beaver Consolidated has been brought into favor to a greater degree than ever through the announcement that net profits at the company's Cobalt mine are running high and that operations may be

enlarged, and also, because of the success attending mining operations at the Company's Kirkland Lake mine. It is stated that a considerable quantity of the ore recently opened up at the Kirkland Lake mine contains around \$30 to the ton. Steady production is now established and bullion shipments are being made regularly.

In reference to the proposed light narrow-gauge railway from Elk Lake to Gowganda, the leading mining operators have stated that they are strongly in favor of the Ontario Government building a standard-gauge line. It is pointed out that the Elk Lake branch was never intended for a blind line and that it was only due to the war that the extension to Gowganda was held in abeyance. They declare that should the government be so inconsistent as to permit private enterprise to build the narrow-gauge road, it would perhaps forestall the possibility of getting a real railroad. The fact is emphasized that Premier Drury while on his December tour through the district of Temiskaming stated that he wanted to hear the views of those who were in a position to voice the opinion of any branch of industry. As to this, it is stated publicly: "In thus voicing the opinion of the leading mine operators of Gowganda in response to a general request which Hon. Mr. Drury extended to residents of the North while on his December tour through Temiskaming, the measure of attention which this recommendation receives will be accepted as the extent of the sincerity which actuated the request of the Premier."

In dealing with the railroad question, it is found that not a few of the claim holders in the Gowganda district entertain fears that opposition to the light narrow-gauge railroad is attended with some danger of discouraging one and failing to get the other. However, if the government is not prepared to proceed with the construction of the standard gauge road, it does not seem to be likely that they would under any consideration prevent the private narrow-gauge project. The fact is that the camp is greatly in need of rail transportation of some kind—even though it should ultimately be the narrow-gauge and entail the inconvenience and expense of rehandling freight at Elk Lake, the present terminal of the Temiskaming and Northern Ontario Railway.

Another discovery of silver is reported to have been made in the Kenabeek section of the Elk Lake district, on a claim situated in lot three of Cane township and adjacent to the north boundary of the township of Auld. It is stated that considerable cobalt occurs in the vein together with encouraging silver values. The rock formation like that at the Cane Silver Mines now idle, and at the Kenabeek Consolidated, is entirely diabase, lying between wide belts of quartzite.

One of the leading Cobalt mining companies is stated to have recently made an examination of the White Reserve mine in the Maple Mountain section of the Elk Lake district, on which property some exceedingly rich ore was recently encountered at surface.

Traffic to Gowganda is heavy, operators and claim-holders taking advantage of the present winter roads to transport supplies to the camp.

During the week ended Jan. 16th, the Mining Corporation of Canada shipped 221 bars containing approximately 221,573 ounces of silver. At the present quotation for silver, plus 8 p.c. exchange on New York funds in which the company receives payment the value of the bullion shipment may be estimated at around \$1.40 an ounce or approximately 310,200. This consignment ranks amongst the most valuable in recent months.

During the week ended Jan. 16th, three Cobalt companies shipped an aggregate of 3 cars containing approximately 241,349 pounds of ore. The following is a summary:

Shipper	Cars	Pounds
Temiskaming	1	103,990
Coniagas	1	76,272
Peterson Lake	1	61,087
Totals	3	241,349

### The Gold Mines

In spite of the fact that the chaos of Russia and Eastern Europe is something which the average Anglo-Saxon resires to avoid, Northern Ontario is to-day witnessing the spectacle of a large part of the foreign element joining in a fairly general trek back to the East. Throughout the war these men worked at high wages, until now, with money belts fairly bulging with money the equivalent to a fortune in the land of their birth, these men are setting out upon a great new venture in an old land. For the greater part, fired with the optimism which is a part of success and plenty, they fail to possess the foresight to avoid becoming directly involved in the general shamble of Russia and Eastern Europe. It does not seem to be too much to predict that a large part of these men, once they realize the extent of the stress and the misery of the near East will automatically become advertising agencies for the Dominion. This, when they begin to realize the extent of the freedom the success and the lack of want experienced in Canada during their more or less brief sojourn in this country.

In the meantime, strange to say, the number of men employed at the gold mines is increasing. It goes almost without saying, that under such circumstances the percentage of those races which stand for stability are increasing while those now manifestly "red" or Bolshevik tendencies are diminishing—swarming back into the great cesspool of misery which their kind has created. The impression in the North is that any who desire to return to the Near East should be permitted to do so with all possible speed; because, it is believed those desiring to do so must be friendly to the doctrine of those now in control, else they would have no desire to return, at least not under present conditions.

The return to pre-war conditions in the Porcupine and Kirkland Lake districts is being made more rapidly at present than at any time during the previous year. With a lower percentage of foreigners employed, the efficiency of the workers is stated to be increased. The new year having thus commenced, it may continue so throughout the year, and within the next few months efficiency may be reasonably close to normal, apart of course, from the effects of prevailing high wages and high cost of material. As to this, however, the shortage of efficient labor constituted the chief burden of the mines in recent years.

Considerable discussion is heard regarding the possibility of the Dome Company applying for an extension of time on the option which it holds on the Dome Extension property. The past year having been unsatisfactory for carrying out the desired development work, the Dome is in a fair position to make such a request.

Official figures showing the Hollinger consolidated ore as containing an average of \$9.15 a ton, with facilities for treating a maximum of 3,500 tons of ore daily when ready to run at full capacity, are interpreted as indicating a production of close to \$1,000,000 a month just as soon as it is found possible to procure the desired number of men. At the time of writing it is understood that production is at the rate of 2,800 tons daily or at the rate of close to \$9,000,000 annually.

In the Kirkland Lake district, interest is increasing in that part of the district lying east from the Tough-Oakes Gold Mines where there appears to be fair promise of the camp extending. Heretofore the Kirkland Lake camp has been confined chiefly to a strip of territory about two miles in length, running from west to east and terminating at the east boundary of Teek township. Now, however, it is considered probable that the auriferous zone may be found to extend far into the township of Lebel. As a consequence of this number of deals have been negotiated and a number of others are pending.

The Lake Shore mine is now completely de-watered and operations are proceeding at a normal rate. January production is expected to rank with the early summer months, prior to the labor strike. The year 1920 promises to be a prosperous one for the Lake Shore.

The Fidelity Company is calling for tenders for drifting at the 145 ft. level situated in the North-east part of the township of Teek. The property is situated west from the Lebel-Kirkland.

Dr. C. E. Wettlaufer together with associates in Buffalo, N.Y., has purchased a property near Mud Lake in the township of Lebel. The Boston-McCrea Mining Company has also purchased a claim near Gull Lake in Lebel township.

On the Bidgwood property, lying east of Mud Lake, it is stated that the result of work so far done has highly encouraging and indicates the presence of mineralization over substantial widths.

In the Boston Creek district interest is again increasing. The Miller Independence continues to be the centre of interest. The main or central shaft has now reached a depth of 462 feet and is expected to reach the 500 ft. level before the end of the month. In the meantime, the electrical equipment is being installed, and before the end of February, the transmission of power over the line of the Northern Ontario Light and Power Company will commence and put an end to power problems. Also, preparatory to the advent of electric energy, the management is bending its efforts toward preparing for the resumption of work in "D" shaft in which gold tellurides were opened up in spectacular quantities last year. This inclined shaft was driven to a depth of 200 feet. Electric power will make it possible to add three or four machines and thus hasten development work.

W. E. Simpson, who had some nine years experience in connection with mining and metallurgy of gold tellurides in West Australia has decided to make a careful study of the somewhat similar occurrences in the Boston Creek district, and at present has headquarters at the Miller Independence Mines.

The Boston-Kennedy shaft is now down some 70 feet. The vein which was comparatively narrow at surface is widening out, being close to four feet in gold.

The Boston McCrea has commenced cross-cutting at the first level and is calling for tenders to sink an additional 100 feet. Diamond drilling has been carried on steadily for the past several months and has shown the ore body to have straightened up considerably from its indicated surface dip to the south. The shoot is stated to have a decided rake to the East.

On the Catherine Gold Mine shaft sinking is proceeding, a depth of 30 ft. having been attained at the time of writing. Here, too, although not a great deal will be known until further work is done, the outlook is decidedly promising.

From the Larder Lake district comes reports that the Associated Goldfields Company may yield to the criticism of the press, and has prepared a report showing in more or less detail the result of work to date, and the blocked-out ore-bodies, together with a statement of average values and tonnage.

**WHERE COMMON SENSE FAILS.**

The Geological Survey which has proved to be such a potent factor in the development of Canada for nearly eighty years has just received a serious blow. Its officers carrying on their field-work under hard and hazardous conditions—in the last eight years no less than three have lost their lives in the field under trying circumstances,—have been content with the satisfaction of work well done although until recently hoping for some slight measure of improved recompense in the days to come. The hopes of years, however, have been dashed by the seeming inability of the Civil Service Commission to improve a foolish condition of affairs. In brief, the salary scale of 1908 is to be continued (as nearly as it will fit the new system) quite without any recognition of the normal curve of increased cost of living or even basic justice. As a direct result since October eight of the staff of the Geological Survey as a measure of self preservation have accepted appointments with private corporations; and still others are about to follow the same course. The point to be noted and emphasized is that because of their interest in their work these same men have in the past refused offers equal to those now offered, namely, double their present salaries, in the meantime hoping for a somewhat more liberal scale of salaries in the new classification.

Eight men leaving, out of a staff of twenty-five, is a loss of one-third,—and the end is not yet. The effect will be felt not in Ottawa but in the various parts of the country where they have been so busily engaged in assisting the mining industry. The men lost are drawn from the work of the various provinces as follows:—From British Columbia, 4; from Alberta, 1; from Ontario, 1; from the Maritime Provinces, 2.

How can these men be replaced? By no other means than by making the inducements such that additional

men will spend from seven to ten years training at universities at their own expense. There are no short cuts possible in obtaining this training. As a matter of history, up till about 1913 there remained enough enthusiasm and hope of adequate recompense to interest a number of assistants in preparing themselves for geologists. But with diminishing hope of improvement in Government salaries the positive offers of private firms were too tempting to be refused. For instance, in 1916 alone, all three student assistants finishing their work for their doctor's degree, at once went into private work for their doctor's degree, at once went into private work starting on salaries at least equal to those of their former chiefs and greater than they could hope to obtain on the Dominion Geological Survey after five years. At the present time it is doubtful whether there are more than three men training in anticipation of work on the Survey. But this is not all. Even after completion of the required university training it requires commonly two or three seasons' field experience before a geologist obtains enough intimacy with any field to render his work of special value. In the case of each of the men who are leaving, the country loses the advantage of from five to twelve years' experience. In point of time alone, then, it may be said that the work in the fields now being vacated, pending the development of assistants will be set back for twelve years. But, note again, such assistants are not forthcoming, owing entirely to the lack of prospective remuneration.

The loss within a few weeks of one-third of its staff is the worst blow ever received by the Geological Survey—the most powerful single instrument in the past development of the natural resources of Canada. Coming at the present crisis in the progress of the nation this is nothing short of a calamity.—*Ottawa Journal.*

**THE TANTALUS COLLIERY-YUKON.**

Mr. C. E. Miller arrived in Dawson the latter part of December from the Tantalus coal mine, where he has been acting as manager since last fall.

Mr. Miller reports the property in condition to begin operations in the Spring. It is planned to start about the first of April and continue throughout the season.

The Tantalus Butte properties lie two and a half miles south of the old Tantalus mine, and belong to the same company. They contain deposits of coal in the locality, possibly the largest in the Yukon.

The coal is of good quality and contains, according to Dr. Cairnes, less than 3 per cent ash

Capt. Miller is a pioneer coal miner of the Yukon. He discovered and opened up the Tantalus and Tantalus Butte mines, which he sold to St. Paul people some years ago.

**METAL QUOTATIONS.**

	Cents per lb.
Electro Copper . . . . .	24½
Castings Copper . . . . .	24
Lead . . . . .	10½
Zinc . . . . .	12 1/40
Tin . . . . .	72
Antimony . . . . .	13
Aluminum . . . . .	34

**ENGINEERING INSTITUTE OF CANADA.****Programme of the Annual General Meeting, Montreal, January, 27-29th.**

The Montreal Meeting of the Engineering Institute of Canada, which will be in session when the "Journal" reaches the majority of its readers, promises to be one of the largest and most nationally important meetings yet held by the Institute.

The program of the meeting reflects with much exactness those problems of most pressing urgency in Canada upon which the engineering profession is best qualified to consider and advise. Among the more significant subjects announced for discussion during the meeting may be singled out those of highway transportation, engineering education, and the problems of most efficiently utilising the water-powers and the forests of Canada. As evidence of the wide range of the engineer's province, as it is visioned by those who direct the policies of the Engineering Institute, will be noticed the inclusion of questions of public health, and the peace-time development of the newly discovered possibilities of aviation. The manner in which water-powers, the pulp and paper industry, the chemical industry, the public health, and the science of aviation, are linked up in the programme, indicates that neither romance or progress have yet departed from our midst.

**The Programme.**

The following programme, covering the three days of the convention, may be changed or added to to suit the exigencies of the occasion.

**Tuesday, January 27th.**

8.00 a.m.—Opening of registration at headquarters, 176 Mansfield street.

10.00 a.m.—Calling to order, annual meeting, appointment of scrutineers, reception of reports.

12.50 p.m.—Adjournment until 2.45.

1.15 p.m.—Luncheon at Windsor Hotel for members and ladies and invited guests.

1.50 p.m.—Formal welcome and greeting.

2.00 p.m.—Address, "Modern Highway Problems," by F. W. James, assistant chief engineer, Bureau of Roads, Washington, D. C.

2.45 p.m.—Resuming of business session, annual meeting.

4.10 p.m.—Reception of report of scrutineers.

4.20 p.m.—Address of retiring president.

5.00 p.m.—Inauguration of incoming president.

9.00 p.m.—Reception and dance, Rose Room, Windsor Hotel.

**Wednesday, January 28.**

10.00 a.m.—Calling to order, professional meeting, at headquarters. "The Gateway of the Profession.—The Training of the Chemical Engineer," by R. F. Buttan, M.A., M.D., Sc.D., F.R.S., Professor of Chemistry and Director of the Chemical Laboratories, McGill University. "The Importance of Physics in Engineering Education," by A. H. Eve, D.Sc., C.B.E., F.R.S., Macdonald Professor of Physics, McGill University. Discussion by four authorities on technical education.

1.10 p.m.—Leave Windsor Hotel on special cars for Northern Electric Company's works.

1.30 p.m.—Luncheon, as guests of the president of the Northern Electric Company, Limited. At the con-

clusion of the luncheon the members will be escorted in parties over the works, and will be at liberty to depart any time before the closing hour.

7.45 p.m.—Annual banquet of the Institute. Ross Room, Windsor Hotel.

**Thursday, January 29th.**

10.00 a.m.—Continuation, professional meeting at headquarters. "Engineering Activities of the Province of Quebec."—"Quebec's Water Power Policy and the Work of the Quebec Streams Commission," by Olivier Lefebvre, B.A.Sc., C.E., M.E.I.O., chief engineer, Quebec Streams Commission. "The Operation of the Quebec Public Health Act," by Theo. J. Lafrenière, B.A.Sc., C.E., M.Sc., Chief Sanitary Engineer to the Superior Board of Health of the Province of Quebec. "Quebec Highways," by Alex. Fraser, B.A.Sc., C.E., A.M.E.I.C., assistant chief engineer Quebec Department of Roads.

2.30 p.m.—Resuming of session, professional meeting, "Pulp and Paper."—"The Pulp and Paper industry," by Ferd. van Bruyssel, C.E., D.P.S. "Aviation."—"The Policy of the Air Board of Canada," by Lieut.-Col. O. M. Biggar, B.A., K.C., vice-chairman of the Air Boards of Canada. "Quebec Forests"—"The Forests of Quebec," by G. S. Piche, A.M.E.I.C., Chief of Forests Service, Quebec Lands and Forests Department.

8.30 p.m.—Smoker, Ladies's Ordinary, Windsor Hotel.

**NEW MINES INSPECTOR.****Mr. Thomas R. Jackson, of Nanaimo, Will Succeed Late Mr. Newton.**

To fill the position rendered vacant by the recent death of Mr. John Newton, inspector of mines for the Coast Inspection District, the Provincial cabinet recently authorized the appointment of Mr. Thomas R. Jackson, manager of No. 1 mine of the Western Canadian Fuel Company, Nanaimo.

The new inspector is popular in the coal mine industry at Nanaimo, and his long practical experience peculiarly fits him for the new office. In 1902 he commenced coal mining at Extension and he has progressed steadily through all the various grades to the position of mine manager, being possessed of all the requisite certificates of competency. He is president of the Vancouver Island Mine Safety Association in the work of which he has always taken a keen interest.

**COMMISSION ON COAL.****To Develop and Protect Industry in Alberta.**

Calgary, January, 16.—The immediate formation of a commission to develop and protect the coal mining industry of Alberta was announced by Hon. Charles Stewart, Premier of Alberta, in an address made to the members of the Calgary Board of Trade.

This commission, Premier Stewart intimated, will strive to form a real understanding between miners and operators, to avoid strikes, increase markets and to develop the industry in general. It will be representative of the Government, miners and operators, and will be given sufficient authority to make its rulings effective.

**BRITISH COLUMBIA LETTER.****Alice Arm, B. C.**

A new townsite at Alice Arm is being planned to replace the one now used which is objectionably placed on a minefield. The survey of the new site now is underway. It is situated on the side hill northwest of the present townsite and is owned by the Alice Arm Development Company. Sufficient water is said to be convenient and the installation of other public utilities will not be difficult. In view of the mining development now in progress and the accession to the population expected this year with the commencement of new work on many of the properties tributary to the town of Alice Arm it is thought that the new enterprise not only is warranted but is a necessity.

**Stewart, B. C.**

Grant Mahood, who is just out from Stewart, reports that he accompanied the first winter shipment of ore from the Premier Mine, of Salmon River. It consisted of 300 tons. Total shipments from the Premier during the next few months are expected, says Mr. Mahood, to amount to between three and four thousand tons. Hauling by tractor was tried out but had to be abandoned and horse transport substituted. Mr. Mahood refers to good showings on the '49 Mine, Salmon River, where ten or twelve men are working and to development on the Big Missouri, where extensive development is being done with satisfactory results. He states that considerable interest is being taken in work in progress on the Lakeview Mine, situated on the Bear River side of the Portland Canal. This property was taken over last Fall under bond by F. Welch and associates.

S. G. Benson, owner of the White Mouse Group of Mineral Claims, situated about two miles beyond the '49. Salmon River, reports that, while in Vancouver, B. C. recently, he placed the property in the hands of a Syndicate which will start active development as soon as it is possible to get in with supplies over the snow crust. Richard Elliott, K. C., is at the head of the syndicate. He has had considerable mining experience, having been heavily interested in Bear River properties at the time of the excitement of about nine years ago. Mr. Benson states that the White Mouse has promising surface showings.

The Sunset Group is another Salmon River property on which development will commence as soon as conditions permit. A Vancouver syndicate is furnishing the necessary finances.

It is hoped that the President Group will be another the new properties opened up in the Spring. Situated on the wagon road, and with ore which has given encouraging assay returns, officials of the President Silver Mines, Limited, and looking forward to doing considerable work this year. Stuart Moore, secretary treasurer of the Company, has left for New York on business related to this property and to holdings in the Alice Arm section.

The Salmon River Mother Lode Mining Company, Ltd., has been incorporated with an authorized capital of \$100,000 and with its head office at Vancouver, B. C.

**Grand Forks, B. C.**

A contract has been awarded for the driving of about 1,000 feet of tunnelling on the Little Bertha-Pathfinder Mining Claims, twelve miles north of Grand Forks. This property is an amalgamation of the Companies owing the Little Bertha and the Pathfinder properties, which adjoin. Years ago each property shipped considerable high grade ore, the values running largely in silver. Mining experts who have looked the properties over have been impressed by the showings. The last shipments of ore went to the Greenwood Smelter in 1919.

**Kamloops, B. C.**

The Stump Lake District, situated half way between the towns of Merritt and Kamloops, B. C., has been the scene of considerable mining activity during the past year. At the Mary Reynolds, where R. R. Hedley M. E. is operating, the year's development consists of a 74-foot drift from the shaft and a 140 foot tunnel, with a 30 foot raise and open cuts at the approach. A mountain wagon road two and one half miles in length has been built from the main highway at Rochford to the Mine, giving the company a short route for hauling. About 130 tons of ore have been shipped during the year, returns having been received on 97 tons. The average analysis of this shows the following value: Silver 51.2 ounces; gold, 0.143 ounces; lead, 1.4 per cent; zinc, 2.4 per cent; sulphur, 2.6 per cent; silica, 52.5 per cent; iron, 6.6 per cent; lime, 6.4 per cent.

Since the resumption of operations a few months ago on the property of the Donohoe Mines Company the Joshua Shaft has been unwatered and it is reported that the Joshua vein shows stronger at 420 feet depth than it did at the surface. Some mining has been done and some shipments made but the returns are not available. Major Moon, one of the shareholders has been made General Manager, and J. T. Knapp, M. E. is the superintendent. A working tunnel is to be driven to crosscut the several veins of the property and a new concentrating mill and other machinery is to be installed.

Some fifty or sixty claims have been staked in the Stump Lake District recently. Most of these have been taken up by Smith Curtis, of Kamloops, and associates who are understood to plan quite extensive exploratory and development work this year.

**Fort Steele, B. C.**

It is reported that the building of a concentrator in connection with the Victor Mine, Maus Creek, is about completed. This property has been under development for many years by R. Abernathy, of Spokane, Wn., and associates. The ore is rather complex, the metallic contents consisting of argentiferous galena and zinc-blende associated with iron pyrite in a quartz gangue. The quartz vein, which varies from a narrow width up to five feet, has considerable bodies of this characteristic ore at several points.

**Slocan, B. C.**

The Evening Star Mine, Dayton Creek, near Slocan City, is making favorable progress. The tunnel now being driven has followed the ledge for a considerable distance. Operations on the Silver Nugget, which together with the Evening Star, is owned by Hugh Sutherland, of Winnipeg, Man., are expected to start in the Spring.

**Trail, B. C.**

Ore and concentrates received at the Trail Smelter, Consolidated Mining and Smelting Co., amounted to 6956 tons of ore and 861 tons of concentrates. This brings the receipts at the smelter for the year 1919 up to 308,437 tons of ore and 12,041 tons of concentrates, which is about the same as in 1918.

In the ore statement for the last ten days of the month of December one new shipper appears, the Lincoln at Blaylock, Slocan. The Sullivan Mine tonnage of over 2,000 tons, for the first time since early in September includes a percentage of lead ore.

**Victoria, B. C.**

Led by Major-General R. G. Edwards Leekie, G.O. C., who served with distinction in France with the Canadian forces and who retired recently from the military post of Officer Commanding the Western Canadian Military District, the Great War Veterans of British Columbia intends making strong representations to the Provincial Government regarding the placing of returned soldiers in the field as prospectors. General Leekie endorses the plan first outlined through by the Canadian Mining Institute and laid before the Dominion Government where it was not favorably considered. Briefly the proposition is that the Government shall employ returned men, who are physically fit, to go into the hills in search of mineral. To qualify them for their duties the establishment of a "prospectors's school" is advocated, where those who wish to participate may obtain instruction in elementary mineralogy and geology. After passing through this school the men would be formed into small groups, about ten in each, with one more advanced member as leader. Each group would be outfitted, provided with food, given the necessary prospecting equipment and sent to work in a locality selected by the government. General Leekie does not think that the cost of the government of the maintenance of the school and the "grub-staking" of the men would be excessive and feels that it would be a first-class method both of giving the unemployed something to do and of opening up the mineral resources of the Province. The proposal has not yet been formally presented for the consideration of the Government.

The announcement from Ottawa that an order-in-council has been passed, at the instance of the Department of Indian Affairs, throwing open Indian reserves for the mining of gold and silver is of special interest to British Columbia. Heretofore these lands have been rigidly closed to miners and to mining operations unless a surrender first was secured from the Indians affected, a procedure which involved negotiations with the Indians and an application to the Ottawa authorities through the Provincial Department of mines. Owing to the necessarily long-drawn-out character of such negotiations and the uncertainty of their outcome they have not often been resorted to and, particularly in this Province where the aggregate area of Indian reserves is quite extensive, this has meant a serious handicap to the development of mineral resources.

Recognizing this, Hon. Wm. Sloan, Minister of Mines, introduced legislation at the last session of the Provincial Legislature, amending both the Mineral and the Placer Acts. In respect of the Mineral Act Section 14, which defines the Crown and other lands upon which the holder of a free miners licence may

not prospect or mine, was changed to the extent of eliminating the words "Indian reservations land" while alterations in conformity with the intent of the amendment, were made in the forms set out in the schedule to the Act for the guidance of those making records. An amendment along the same lines was made to the Placer Mining Act, Section 15, which makes reservations as to the right of entry on Crown and other lands, being amended by the striking out of the words "Indian and," so that the last three lines will read "and any land already lawfully occupied for placer mining purposes, and also naval and military reservations." These amending Acts, however, have not yet the force of law the Legislature very properly providing that they should come into effect by proclamation by the Lieut.-Governor-in-Council, owing to the fact that, as the Dominion Government has absolutely jurisdiction over Indian Lands, it was essential that it should take action before the Provincial proposals could be realized.

With the Provincial Legislature on record, and the legal machinery in shape as far as British Columbia was concerned, Mr. Sloan's next move was to induce the Federal authorities to move. Accordingly, while in Ottawa shortly after the session, he took the matter up and was successful in securing the promise which now has been implemented. The admission of prospectors to Indian Lands for mining purposes, therefore, is assured as soon as the Lieut.-Governor-in-Council declares the amendments referred to be law.

As Mr. Sloan has not received a copy of the Order-in-Council as finally passed by the Dominion Government he declines to make any comment on its terms. These terms, as outlined by telegraphic dispatches, are that the Federal Minister is empowered to issue leases for surface rights on Indian reserves upon such terms and conditions as may be considered proper in the interests of the Indians and covering such area only as may be required for purposes of mining, such terms to include provision for compensating any occupant of land for any damage that may be caused thereon.

Any person who has authority under the provincial laws to prospect for and mine gold and silver may enter an Indian reserve upon receiving the necessary permit from the Indian agent and with whom he must deposit a certified copy of his provincial licence. Upon locating and recording a claim upon an Indian reserve and obtaining a lease for mining thereon from the Provincial authorities, the lessee must then apply to the superintendent-general through the Indian agent for a lease of the surface rights, at the same time submitting a plan and description of the lands and offering to pay a yearly rental of such amount as the Indian agent shall designate. Any timber required for mining purposes must be purchased at a price agreed upon by the Indian agent and the lessee.

The minister may incorporate in any lease such terms and conditions as may in his discretion appear necessary to safeguard the interests of the Indians individually or collectively, and if considered advisable, leases may provide that if the lessee should be convicted of the violation of any provision of the Indian Act or be guilty of creating any agitation or discontent among any of the Indians, the minister may immediately terminate the lease and the lease thereafter be regarded as a trespasser on the reserve, reasonable time, however, being given to remove fixtures and equipment if all rentals are fully paid.



**NOVA SCOTIA NOTES.**

The lessee of the Stirling Mine, Richmond Co., Cape Breton, reports that additional development has uncovered a continuation of the main ore body about two thousand feet from the main operation. \$40,000 has been expended in developing the prospect, and the ore body has been touched by the drill at a depth of 325 ft. The ore, by recent analysis, is stated to run, zinc, 32.7 per cent; lead, 10.44 per cent; copper, 5.9 per cent; with ten ozs. of silver to the ton. How representative this analysis is of the general tenor of the ore values is we are not informed. The property is distant from Framboise Cove, south of Louisburg, about four miles, and is 35 miles from the nearest railway at St. Peter's. A line running from St. Peter's to Louisburg, connecting there with the Sydney & Louisburg Railway, has been surveyed, and the construction of this road has been mooted on several occasions. Such a road would open up a district of Cape Breton that has many possibilities agriculturally, and is apparently well mineralized.

The Anglo Coal Company, at New Campbellton, Cape Breton, has been operating approximately one year. Since the mine was re-opened a great deal of prospecting and cleaning-up has been done, and at the present time about sixty men are employed, producing up to one hundred tons daily.

This property is in many respects an interesting one. The coal seams worked occur on the extreme edge of the Sydney coalfield, and the coal-seam can be seen standing almost vertically on the pre-Cambrian spur which ends in the abrupt cliff of Cape Dauphin. As presumably the carboniferous sediments were laid down in quiet waters along the sides and valleys of the pre-Carboniferous uplands, the present vertical position of the coal measures, at their contact with the older rocks, is due to subsequent earth movements as the coal measures flatten out not far from the contact and proceed seawards with normal dips.

The mine is entered by slopes from the outcrops, which occur at a considerable elevation on the mountain side, and is connected with the shipping wharf in Kelly's Cove by a narrow-gauge railway. The surroundings of this mine are unusually picturesque, even for this district of Cape Breton. An interesting feature is that near the mine the Carboniferous Limestone crops conformably under the Millstone Grit and formerly, when the mine was operated by Messrs Burchell, a high-grade dolomite was mined and shipped to Sydney for use in the open-hearth furnaces. Not far away, also is one of those seasonal lakes, not uncommon in this district, which has a bottom of what is apparently an infusorial earth that possesses quite excellent polishing properties. Also in this district, as is not unusual in limestone formations, caverns are to be found, one well-known example being locally known as the Faery Hole. No better spot for Campbellton, as the Coal Measures proper, the Millstone Grit and the Carboniferous Limestone crop on the Cape Dauphin spur within a superficial distance of less than a quarter mile, and a short walk will bring one on the mountain plateau of the spur—locally known as Blueberry Mountain—at an elevation of 1045 feet, affording an excellent prospect of the Bras d' Or Lakes and the Sydneys. Blueberry Mountain it may be mentioned in passing is a favorite haunt of the local Micmac Indians and is the reputed scene

of many of the exploits of the Indian tribal demigod Glooscap.

The coal production of the Anglo Mine must be shipped by water, as there is no railway on the Baddeck slide of the Bras d' Or Channel. The present General Manager is Mr. John S. Barton formerly General Manager of the Minudie Colliery at River Hebert, Cumberland Co., N.S., and the President is Mr. J. C. Douglas, M.P., of Glace Bay.

At one time the mine was operated by Mr. James T. Burchell, who sold the property to the Harmsworth's who contemplated supplying coal to the Newfoundland paper mills in Newfoundland, but have not operated the mine. The present operators it is understood, have a lease of the property from the Harmsworth interests.

The several Conciliation Boards appointed to consider the questions associated with wage classification Scotian collieries are proceeding with their duties.

Discussion of a revision of the wage classification has been continued between representatives of the Dominion Coal Company and its employees since early in December, and an agreement has now been arrived at, which only requires ratification by the locals to go into effect. Details of the new classification have not been published but are stated to include 300 differing rates. The new agreement is to continue for a year, and contains provision for revision at specified intervals should circumstances require.

Following upon the increase in wages given to its employees, the Dominion Coal Company has announced an increase in the price of coal to domestic consumers in the Sydney District from \$5.65 to \$6.20 per ton. The workmen's rate still continues unchanged from the rate of 1908, namely \$1.50 per ton, which today represents probably one-third of the cost of producing the coal. The increase announced is applicable to the colliery doctors and to the churches, who have customarily received preferential rates.

The Conciliation Board appointed to consider the wage question at the mines of the Nova Scotia Steel Company will shortly commence its work.

The high cost of coal production in Nova Scotia has its most serious reflex upon the production of steel and presents probably the most serious problem of the future to the steel industry, which, it should always be borne in mind, is the child of the coal industry.

It is announced that the Dominion Coal Company is shortly to proceed with the sinking of a new shaft to the Phalen Seam at Quarry Point, which is situated about  $1\frac{1}{4}$  miles from the present Caledonia Colliery, on the cliffs overlooking the ocean to the southward of the mouth of Glace Bay Harbour. The Phalen Seam is expected to be about 600 ft. deep at this point, and the new shaft will be equipped to handle the coal from the submarine territory lying between the assigned barriers that bound the workings of No. 2 Colliery and No. 6 Colliery. The new shaft will form the main outlet for the submarine coal, the original Caledonia Colliery having been opened in 1866 to mine the land area, now entirely exhausted. It is amusing to go back to the evidence given before the Supreme Court in Sydney during the Steel-Coal trial in 1907, when it was gravely argued on behalf of the Steel Company that No. 6 Colliery was not operating upon the Phalen Seam. The workings of

Dominion No. 6 must by this time be closely abutting upon the workings of No. 4 Colliery, in submarine territory; but, as a matter of ascertained fact, the continuity of the Phalen Seam from the workings in the Glace Bay District to those at No. 6 Colliery was just as definitely established in 1907 as it is today, twelve years later.

### PORT ARTHUR NOTES.

By J. J. O'CONNOR.

A deputation from the City Council of Port Arthur, headed by Mayor Blacquier, had a very cordial reception from the Hon. Harry Mills, Minister of Mines, when they waited on him recently for the purpose of placing before his attention some of the needs of this part of Ontario.

While the Hon. Mr. Mills did not make any definite promises, he commented favourably on the various suggestions made by the deputation, and it is expected that they will have his closest attention, and be implemented at an early date.

The main points urged by the deputation were as follows:

1. That the government aid iron ore mining by adopting the policy of the Nova Scotia Department of Mines, in providing core drills for prospecting purposes, and defraying half the cost of drilling.
2. That the Ontario government examine exhaustively the merits of the proposed Federal subsidy in aid of iron ore mining, and, if it is deemed worthy of support, to co-operate with municipalities, and other public bodies already promoting this measure.
3. That the government demand more attention from the Geological Survey of Canada, to the neglected mineral bearing regions of Ontario, more particularly this part of the province.
4. That he be pleased to instruct the Ontario Bureau of Mines, to include the mineral areas tributary to the head of the Lakes, in the field work of its officers.
5. That his Department supply much needed areal maps, at cost, to prospectors.
6. That he cause to be added to the staff of the Ontario Bureau of Mines, a competent official, whose sole duties it shall be to attend to adequate publicity of Ontario's mineral wealth.
7. That the Mining Act of Ontario be amended, so as to permit of Crown Patents being issued, instead of Licenses of Occupation, as at present, for land covered by water, in mining claims, where there is no interference with navigation.
8. That he cause to be established here, a branch of the Provincial Assay Office, for the purpose of facilitating the securing of assays, cheapening the cost, avoiding delays, and increasing the number made.
9. That the alleged practice of staking mining claims for the sole purpose of securing the timber on the lands, be investigated.

### ONTARIO AND COAL.

#### An Informed Toronto Opinion.

Once an idea becomes firmly established, whether right or wrong, it receives general acceptance, and while conditions may change entirely, most people will still think that something different is impossible. Most of us hope to live to see the day when the whole of Ontario will be supplied with coal, whether raw or treated, from Canadian mines. This is by no means

the impossible dream it is supposed to be at present. Those who are perhaps best informed on this question have, at various times, outlined plans whereby this may reasonably become possible. Mr. F. W. Gray, editor of the Canadian Mining Journal, is perhaps as well qualified to speak regarding the possibilities of Eastern Canada coal fields as any one, following his long connection with the producing companies of Nova Scotia. He has recently pointed out what must be done to place this coal on a competing basis in Ontario, and the problem resolves itself into one of greater production, where costs are lowered, and ocean transportation to the Great Lakes. Those who remember the large fleet which, in former years, carried coal from Sydney to Montreal, should only consider this transportation factor trebled and it might be surprising how well our own coal would stand up against that otherwise imported. We are in a position where we may hope to reduce our costs on eastern coal by increasing production and by better water haulage facilities, but it is very questionable if American coal can ever be placed here again much cheaper than the present price. Besides these factors, there is every likelihood that carbonization plants will prove a factor and with those established along the St. Lawrence River, we have possibilities of the greatest importance.

From the other side, it would appear that a greater measure of co-operation on the part of the mine owners in Alberta along with a fair amount of success with briquetting schemes, must eventually allow western coal not only to extend its market into the United States, but at least to meet competition at the head of the Lakes. These pictures are not dreams, but they will not come true very quickly if we do not realize that here is one place that by stopping the gap, we could save perhaps \$100,000,000 on our trade balance in a year. With a hundred Canadian boats on the St. Lawrence, and a few more thousand miners in Nova Scotia, it might even surprise Buffalo where all the coal was coming from. Lest we should be forever begging, is it not worth trying for?

—Canadian Chemical Journal, Toronto.

### GENERAL MINERAL PRODUCTION IN NOVA SCOTIA DURING THE MINES YEAR 1919.

By the courtesy of the Deputy Commissioner of Mines, we have been furnished with some statistics relative to the mineral production of Nova Scotia in the fiscal year 1919.

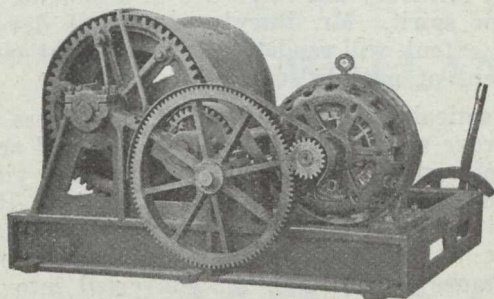
Gold production will not exceed 950 ozs. Nova Scotia, in common with the other gold-producing areas of Canada, has suffered from the incompatibility between the fixed price of gold and the rising costs of production. This is the smallest gold production on record in Nova Scotia.

The most important new development of the year 1919 was the discovery of salt at Malagash. (See issue of 8th January, 1919, and May 14th, 1919, for full descriptions of this deposit by L. Heber Cole). Dr. Hayes, of the Geological Survey, has also examined this deposit during the year, and further development is proving that the deposit is extensive, and that a portion of it, at least, is high-grade material. It is reported that occurrences of soluble potassium salts have been found associated with the Malagash area, and we hope to give further particulars of this in a later issue of the "Journal."

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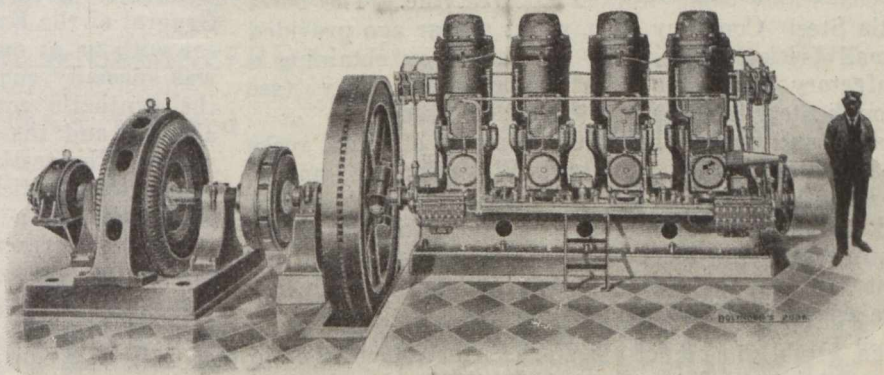
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The production of coal during the fiscal year may be stated as 5,005,000 long tons, compared with 5,211,000 long tons during the fiscal year 1918. This aspect of Nova Scotia's mineral production was fully dealt with in the last issue.

There was no production of scheelite or molybdenum. About 150 tons of manganese ore was mined and shipped, and about 50 tons of barytes was produced.

No iron ore was reported as having been mined in the Province, but iron-ore was imported to the extent of 646,000 tons—chiefly of course from Wabana, Newfoundland and ferro-manganese was also imported to the extent of 1,100 tons.

During the fiscal year, 334,500 tons of pig iron, 374,900 tons of steel ingots, 353,400 tons of limestone for flux, and 518,700 tons of coke were produced, all in connection with the iron and steel works of the province.

Structural materials comprised 12,900,000 bricks, 12,000 tons of cement blocks and 605,900 feet of tile pipe, the figures being approximate in each case.

About 6,700 tons of ammonium sulphate were recovered at the coke-ovens of the Dominion Iron & Steel Company at Sydney.

Gypsum mining has been at a complete standstill, but with the revival of building mining should be resumed as Nova Scotia contains large deposits of high-grade "plaster."

An interesting development of the year, although only officially announced in 1920, is the intention of the Dominion Iron & Steel Company to provide a brick-plant for the manufacture of fire-bricks and other shapes of refractory brick, for use in the metallurgical processes and the coking plant of the company. It is now publicly announced that an expenditure of up to \$500,000 is contemplated in brick-making equipment and kilns. It is the intention to make silica bricks and the ordinary fire-brick, for the manufacture of both of which suitable materials have been found locally.

For some time the Steel Company have experimented with a small kiln with local clays and silicious materials. Quite good fire-clays, of moderately refractory character are found associated with the coal measures in Nova Scotia. For a good many years the Intercolonial Coal Company at Westville has made a fire-brick, much used locally, from a clay associated with one of the coal-seams being worked at Westville. The Nova Scotia Steel Company, also, about a year ago provided a small brick-making plant and has been obtaining a satisfactory fire-brick from Shubenacadie Clay (see "Iron & Steel of Canada," Oct., 1919, issue).

Large and really important deposits of silica rocks are found near Salt Mountain, Whycocomagh, and it is probably not too much to anticipate that if a silica brick industry is commenced in Sydney, the sale of the manufactured products may not be restricted to the plant uses of the resident steel companies, although these are very extensive in themselves.

The establishment of fire-brick manufactories in Nova Scotia will do much to make the steel and metal trades in the province self-contained. The dependence of the steel industry on outside sources for refractories has been very severely felt during the war period, and will, of course, be still more felt, in view of the large increases in freight rates that may be shortly expected.

## ALCOHOL FROM COAL.

### Extraction on Commercial Scale.

Mr. Ernest Bury, of the Skinningrove Iron and Steel Works, read a paper before the Cleveland Institution of Engineers, in which he revealed that at the Skinningrove works he had succeeded in extracting ethylene, alcohol, and their derivatives on a commercial scale from coke oven gas.

The work is still to some extent in the experimental stage, but Mr. Bury has succeeded in producing a perfect motor spirit. Mr. Bury's process, if developed to its full extent, will render us largely, if not entirely, independent of outside sources of supply.

The practical working of Mr. Bury's process at the Skinningrove works, where 5,800 tons of coal are carbonized per week, has revealed an average yield of 1-6 gals. of alcohol per ton of coal carbonized. Having regard to the scarcity of liquid fuel, that in itself is important; it is national suicide to continue to burn any substance which might be converted into liquid fuel. He pointed out that the recovery of alcohol at the gas works of the country would yield 27,000,000 gals., or, taking alcohol and benzol together, the total quantity of liquid fuel available for extraction, through the carbonizing of coal would be 114,000,000 gals., as against the country's present total requirement of 16,000,000 gals. per annum.

The process of extraction by contact with sulphuric acid is not a new discovery, but Mr. Bury has been the first to establish it as a commercial proposition. His principal discovery is that the best results are achieved at a temperature of 60 to 80 degs. Cent., and in his process he has carried the utilization of heat from the coke oven plant to the utmost limit. Either, chloroform, iodoform, acetic acid, and acetone are among the derivatives he has obtained from this coke oven gas after the benzol has been extracted. Dr. J. E. Stead paid tribute to the brilliant young scientist, and also to the progressive policy of the company at whose works these experiments were carried out.

The Inter-Departmental Committee on Power Alcohol, in their report recently issued, stated: "We have received exhaustive technical evidence from representatives of the Ministry of Munitions concerning the investigations made by them during the war in respect of the extraction of ethylene from coal coke oven gases, and concerning quantitative results so obtained. Lord Moulton, in his capacity of Director-General of the Explosives Department of the Ministry, sat with us at one of our meetings when this subject was specially considered in relation to future output, the synthetic conversion of the ethylene into ethyl alcohol, and the estimated costs of the processes involved. The testimony of witnesses and records of work done indicate that there is thus available in Great Britain a large potential source of power alcohol, but further investigations are necessary in this connection, particularly as regards the conversion of the ethylene into alcohol, before definite figures as to quantities and price can be given."

The Shipton Electric Pig Iron and Steel Smelting Company, Limited, has been incorporated with an authorized capital of \$250,000 and head offices at Vancouver, B. C. No definite information is available as to the immediate plans of this new concern.

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**CANADIAN COAL MEN.**

M. A. McINNIS.

Mr. McInnis has in a sense deserted his first love, inasmuch as he has transferred his very considerable energy from the work of producing coal in Cape Breton to the sale of coal in Montreal. "Mick" McInnis, as he is known to his friends—and they are many—commenced his coal mining experience as a boy at the Gowrie Mine at Morien, Cape Breton, a place that in those days ranked first in the coal-mining activities of the Glace Bay field, and will at some future date be again the scene of coal mining on a large scale, as a very extensive undersea coal tract is accessible from the vicinity of Morien. Later, he entered the service of the Warehouse Department as a junior, and rose successively to be mine manager and eventually Superintendent of No. 3 District of the Dominion Coal Company's mines. After having been in the service of the Dominion Company and its predecessors for over thirty years, and being still a young man, Mr. McInnis migrated to Montreal, and was for some months engaged in the service of the Fuel Controller in the work of facilitating the transportation and distribution of coal imported from the United States into Canada during the memorable coal shortage and severe weather conditions of the winter of 1917-1918, a period that should not be forgotten by Canadians, who were saved from something approaching disaster by the work of Mr. Magrath and his assistants, aided by the whole-hearted support of the United States Fuel Administration at a time when in the United States itself there was seen the phenomenon of "heatless Mondays" and other unprecedented occurrences.

Later, after an extraordinary instance of political bias, which raised objection to Mr. McInnis's employment because he has always been a Liberal in politics, Mr. McInnis entered into the business of selling coal on his own account, and has been as unqualifiedly successful in the coal sales business as he was in producing coal in Cape Breton, thanks to his complete knowledge of the business in all its ramifications and to his capacity for unremitting work. Recently, he has been placed in charge of the consolidated business of the Lackawanna Coal Co., and the P. McCrory Co., which are now merged as the Lackawanna McCrory Coal Co., with offices at 192 St. James St., Montreal. Mr. McInnis is still a young man, and is a good sample of the men of Highland descent, who so largely compose the staffs of the Cape Breton coal and steel companies, and who also, to a very large extent have supplied the impulse that has developed the coal mines of the Canadian West. To those unacquainted with the ethnological survivals of Cape Breton, and the principles of self-determination that have always marked the settlers in that Island, we would mention that our friend's name is not Maginnis, nor, to hint at another racial subtlety, is it MacInnes.—Ed.

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**Gold**

	High.	Low.	Close.
Atlas .....	40	20	36
Apex .....	5	2 1/2	3
Baldwin .....	39	20	30
Boston Cr. ....	32	19	20
Crown Croe .....	34 1/2	30	30
Davidson .....	79	50	70
Dome Ex. ....	37	20	36

Dome Lake .....	29 1/2	13	17
Dome Mines .....	16.20	11.00	14.00
Dome Con. ....	4 3/4	4 1/2	4 3/4
Eldorado .....	1	1	1
Elliott .....	28	27	27
Gold Reef .....	6 7/8	1 1/2	5 1/4
Hattie .....	43		43
Hollinger Con .....	7.62	6.75	7.05
Inspiration .....	14	2	4
Keora .....	23 1/2	9	18 1/2
Kirkland Lake .....	56	34 1/2	55 1/2
Lake Shore .....	1.27	91	1.19
McIntyre .....	2.18	1.63	2.15
Moneta .....	18 1/2	9 3/4	16 3/4
New Ray .....	19 1/2	12	12 1/4
Pearl Lake .....	1 1/2		1 1/2
Por. V. N. T. ....	26	17	21 1/2
Por. Crown .....	35 1/2	25	29
Por. Gold .....	1 1/2	7/8	1 1/2
Por. Imperial .....	3 3/8	1 1/2	1 3/4
Por. Tisdale .....	3 3/8	1 1/2	1 1/2
Preston .....	6 1/2	3	3
Vipond .....	22		22
Schumacher .....	47	20	24
Tech Hughes .....	38	17	18
Thomson Krist .....	10 3/4	6 1/2	7
Tough Oakes .....	1.00	95	95
West Dome .....	18	9	9 3/4
Wasapika .....	1.10	35	45
West Tree .....	30	9 3/4	10 1/2

**Silver**

	High.	Low.	Close.
Adanae .....	27	6	6
Bailey .....	6 1/2	3 1/2	4
Beaver .....	54	31	54
Buffalo .....	50	45	50
Chambers Fer. ....	18	8	14
Crown Reserve. ....	61	30	44
Coniagas .....	3.25	2.25	3.10
Foster .....	6	3	3
Gifford .....	5 1/4	1	2 1/8
Gr. Northern. ....	5 1/2	2 3/4	3 1/2
Hudson Bay Mines .....	60	53	56
Hudson Bay .....	42.25	30.00	45.00
Kerr Lake .....	6.10	3.85	4.40
Lorrain Con. ....	2	1	1
La Rose .....	51	28	45
McKinley. ....	75	43	63
Mining Corp. ....	2.45	1.50	2.00
National .....	17	9 1/2	10 1/2
Nipissing .....	14.50	8.75	13.65
Ophir .....	12	2 1/2	3 3/4
Peterson Lake .....	22	7	20
Rochester .....	5	2	2
Right of Way .....	4 3/4	2	4 1/2
Shamrock .....	1	1	1
Silver Leaf .....	5	1 1/2	2 1/2
Temiskaming .....	52	30	47
Trethewey .....	51	19	49 1/2
White Reserves .....	20	11	17
Wettlaufer .....	7	3 1/4	3 1/2
York .....	1	1/2	1

**Miscellaneous.**

Vac. Gas .....	32 1/2	6 1/2	24 1/2
Rockwood .....	14 1/2	2 1/8	2 1/2
Petrol Oil .....	72	50	50
Con. Min. & Smelt. ....	26.00	..	26.00
Star. ....	5 1/4	2	4

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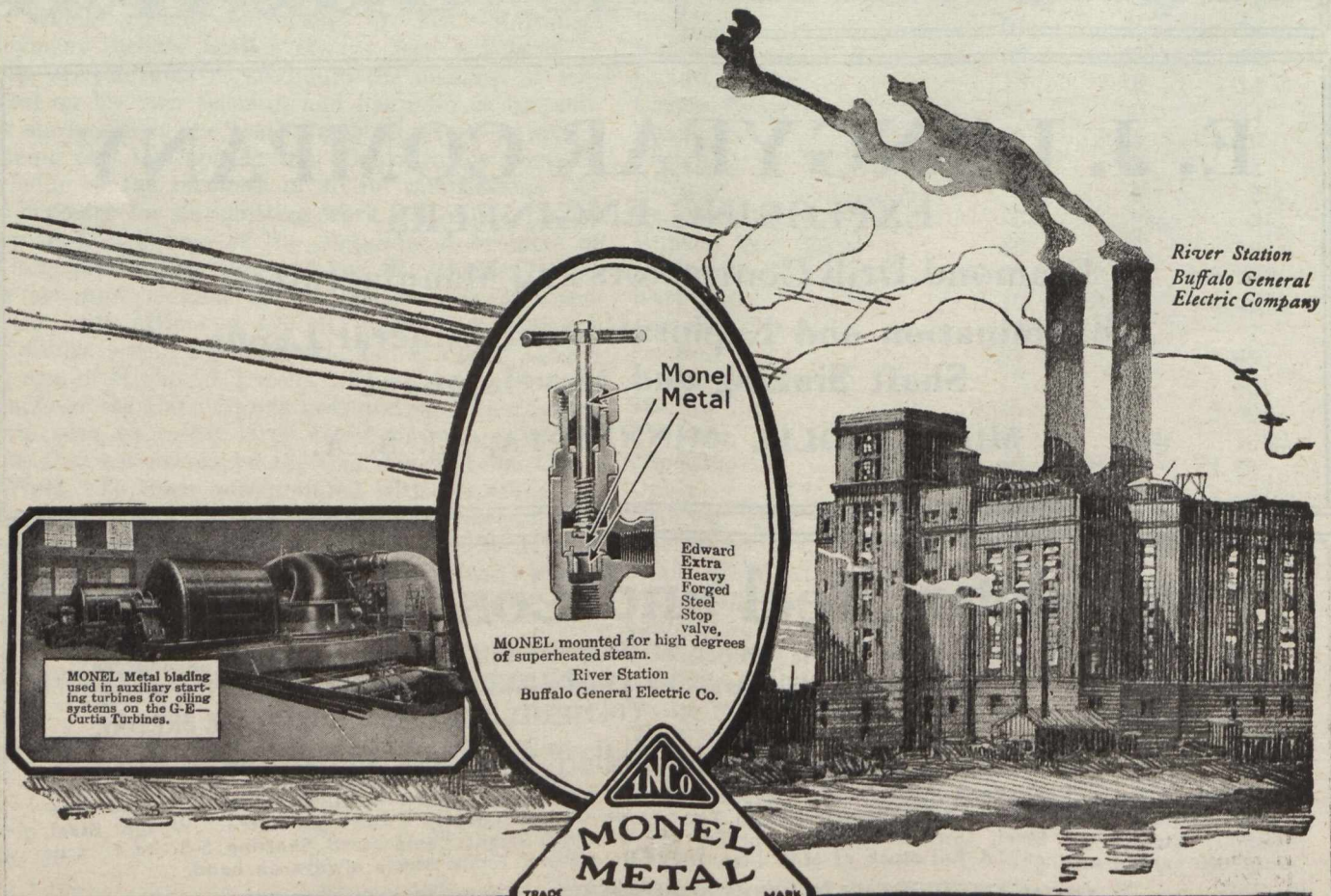
Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies. Blued Machinery Steel 3-8" to 1-4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 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.

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Brass stud bolts were originally used to fasten the heating coils to the manifolds of the evaporator

equipment. After experiencing considerable trouble with these brass studs they were replaced with MONEL Metal studs which thus far have proved satisfactory, giving greater tensile strength without losing the non-rust feature which is of considerable importance in this location.

MONEL Metal is a natural alloy of nickel and copper—strong as steel—tough and ductile. Withstands acids, alkalies, high temperatures, corrosion and the erosive action of hot gases and superheated steam. Can be cast, forged, rolled, machined, drawn, soldered, brazed and welded by electric or oxy-acetylene method. Takes and retains a perfect nickel finish.

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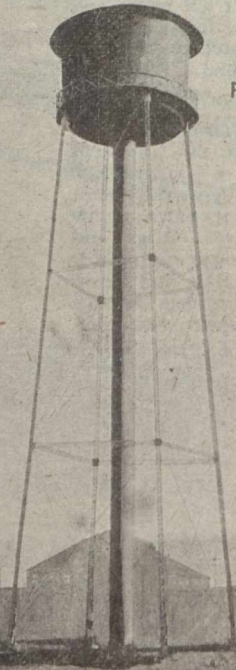
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# CANADA

## DEPARTMENT OF MINES

HON. MARTIN BURRELL, *Minister*

R. G. McCONNELL, *Deputy Minister*

### MINES BRANCH

#### Recent Publications

Iron Ore Occurrences in Canada, Vol. II. Compiled by E. Lindeman, M.E., and L. L. Bolton, M.A., B.Sc. Introductory by A. H. A. Robinson, B.A.Sc.

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.

Occurrences and Testing of Foundry Moulding Sands. Bulletin No. 21, by L. H. Cole, B.Sc.

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

Clay Resources of Southern Saskatchewan, by N. B. Davis, M.A., B.Sc.

Summary Report of the Mines Branch, 1917.

The Mineral Springs of Canada. Part II., by R. T. Elworthy, B.Sc.

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 95. Onaping Map-Area, by W. H. Collins.

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

Memoir 107. Road materials in the vicinity of Regina, Saskatchewan, by L. Reinecke.

Memoir 108. The Mackenzie River basin, by Charles Cam-sell and Wyatt Malcolm.

Memoir 109. The Harricanaw-Turgeon basin, northern Quebec, by T. L. Tanton.

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

Memoir 112. Geology of the district belt of southwestern Alberta, by J. S. Stewart.

Map 42A. Duncan sheet, Vancouver Island. Geology.

Map 44A. Sooke sheet, Vancouver Island. Geology.

Map 115A. Sheep river, Alberta. Topography.

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

Map 179A. Onaping; Sudbury and Timiskaming districts, Ont. Geology.

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

Map 1585. Mackenzie River basin. Geology.

Map 1680. Portions of Grenville, Harrington, Chatham and Wentworth townships, Argenteuil county, Quebec. Geology.

Maps 1697 and 1698. Explored routes in a belt traversed by the Canadian Northern Ontario railway,—in two sheets: Sheet 1 Gogama to Missonga, Sudbury district; Sheet 2 Oatland to Penhurst, Algoma district, Ontario.

Map 1690. Whiteburn Gold District, N.S. Geology.

Map 1702. Klotassin, Yukon Territory. Geology.

Map 1708. Bridge river, Lillooet district, B.C. Topography.

Map 1710. Bothwell-Thamesville oil region, Kent county, Ontario.

Map 1712. Foothills of Southern Alberta, St. Mary river to Hig-wood river. Geology.

Map 1714. The Niagara peninsula, Ontario. Geology.

Map 1715. The Ontario peninsula. 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.

Communications should be addressed to The Director, Geological Survey, Ottawa.

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# The Canadian Miners' Buying Directory.

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Wabi Iron Works.

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The Wabi Iron Works.  
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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—Hessler:**

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

**Rabbit Metals:**

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

**Ball Mill Feeders:**

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Hardinge Conical Mill Co.  
Hull Iron & Steel Foundries, Ltd.

**Ball Mill Linings:**

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Hull Iron & Steel Foundries, Ltd.

**Belting—Leather, Rubber and Cotton:**

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

**Belting:**

R. T. Gilman & Co.

**Belting (Transmission):**

Goodyear Tire & Rubber Co.

**Belting (Elevator):**

Goodyear Tire & Rubber Co.

**Belting (Conveyor):**

Goodyear Tire & Rubber Co.

**Blasting Batteries and Supplies:**

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

**Bluestone:**

The Consolidated Mining & Smelting Co.

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MacGovern & Co., Inc.  
Northern Canada Supply Co.  
Fraser & Chalmers of Canada, Ltd.

**Boilers:**

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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.

**Bronze, Manganese, Perforated and Plain:**

Hendrick Manufacturing Co.

**Buckets:**

Canadian Ingersoll-Rand Co., Ltd.  
The Electric Steel & Metals Co.  
R. T. Gilman & Co.  
Hendrick Manufacturing Co.  
Link-Belt Co.  
M. Beatty & Sons, 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:**

Hendrick Mfg. Co.

**Cable—Aerial and Underground:**

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

**Cableways:**

M. Beatty & Sons, Ltd.  
Fraser & Chalmers of Canada, Ltd.  
Mussens, Ltd.  
The Wabi Iron Works  
R. T. Gilman & Co.

**Cages:**

Canadian Ingersoll-Rand Co., Ltd., Montreal, Que.  
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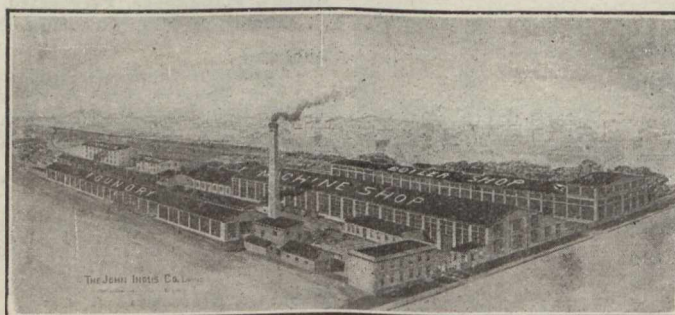
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Canada Wire & Cable Co.  
Fraser & Chalmers of Canada, Ltd.  
Northern Electric Co., Ltd.  
R. T. Gilman & Co.

**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.

**Carbide of Calcium:**

Canada Carbide Company, Ltd.

**Cars:**

Canadian Foundries and Forgings, Ltd.  
Canadian Ingersoll-Rand Co., Ltd.  
Canadian Fairbanks-Morse Co., Ltd.  
John J. Gartshore  
MacKinnon Steel Co., Ltd.  
The Electric Steel & Metals Co.  
Northern Canada Supply Co.  
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.  
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.  
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.  
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.  
Link-Belt Co.  
Greening, B., Wire Co., Ltd.

**Chain Drives:**

Jones & Glassco

**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

**Coal:**

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Nova Scotia Steel & Coal Co.

**Coal Cutters:**

Sullivan Machinery Co.  
Canadian Ingersoll-Rand Co., Ltd.

**Coal Mining Explosives:**

Canadian Explosives, Ltd.

**Coal Mining Machinery:**

Canadian Ingersoll-Rand Co., Ltd.  
Sullivan Machinery Co.

March Engineering Works

Hadfields, Ltd.  
Hendrick Mfg. Co.  
Fraser & Chalmers of Canada, Limited  
Mussens, Limited  
R. T. Gilman & Co.

**Coal and Coke Handling Machinery**

Link-Belt Co.

**Coal Pick Machines:**

Sullivan Machinery Co.

**Cobalt Oxide:**

Coniagas Reduction Co.  
Everitt & Co.

**Compressors—Air:**

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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:**

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

**Condensers:**

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Smart-Turner Machine Co.  
Northern Canada Supply Co.  
MacGovern & Co., Inc.

**Concentrating Tables:**

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Delster Concentrator Co.  
The Wabi Iron Works

**Converters:**

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MacGovern & Co., Inc.

**Contractors' Supplies:**

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**Conveyor Flights:**

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Hendrick Mfg. Co.  
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**Conical Mills:**

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Consolidated Mining & Smelting Co.

**Cranes:**

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Link-Belt Co.  
R. T. Gilman & Co.  
Smart-Turner Machine Co.  
M. Beatty & Sons, Ltd.

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

**Crusher Balls:**

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Hull Iron & Steel Foundries, Limited, Hull, Que

**Crude Oil Engines:**

Swedish Steel & Importing Co., Ltd.

**Crushers:**

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Canadian Steel Foundries, Ltd.  
Hull Iron & Steel Foundries, Ltd.  
Hardinge Conical Mill Co.  
The Electric Steel & Metals Co., Ltd.  
R. T. Gilman & Co.  
Lymans, Ltd.  
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Hadfields, Limited  
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Mussens, Limited  
Swedish Steel & Importing Co., Ltd.
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Sullivan Machinery Co.  
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MacGovern & Company
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Canadian Fairbanks-Morse Co., Ltd.  
Canadian Ingersoll-Rand Co., Ltd.  
Northern Canada Supply Co.
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Northern Canada Supply Co.  
Hadfields, Limited  
Fraser & Chalmers of Canada, Ltd.  
Mussens, Limited  
The Wabi Iron Works
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- Engines—Automatic:**  
Canadian Fairbanks-Morse Co., Ltd.  
Fraser & Chalmers of Canada, Ltd.
- Engines—Gas and Gasoline:**  
Canadian Fairbanks-Morse Co., Ltd.  
Alex. Fleck  
Fraser & Chalmers of Canada, Ltd.  
Sullivan Machinery Co.  
Gould, Shapley & Muir Co., Ltd.  
MacGovern & Co., Inc.  
The Mine & Smelter Supply Co.
- Engines—Haulage:**  
Canadian Ingersoll-Rand Co., Ltd., Montreal, Que.  
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.  
M. Beatty & Sons  
R. T. Gilman & Co.  
MacGovern & Co., Inc.  
Fraser & Chalmers of Canada, Ltd.
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- Engineers:**  
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- Feed Water Heaters:**  
MacGovern & Co.
- Flashlights—Electric:**  
Spielman Agencies, Regd.
- Flood Lamps:**  
Northern Electric Co., Ltd.
- Flourspar:**  
The Consolidated Mining & Smelting Co.  
Everitt & Co.
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- Forging:**  
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Hull Iron & Steel Foundries, Ltd.  
Smart-Turner Machine Co.  
Hadfields, Limited  
Fraser & Chalmers of Canada, Ltd.
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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  
Northern Canada Supply Co.
- Gears (Cast):**  
Hull Iron & Steel Foundries, Ltd.  
The Link-Belt Co.
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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)

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Canada Chicago Bridge & Iron Works
- Hose (Air Drill):**  
Goodyear Tire & Rubber Co.
- Hose (Fire):**  
Goodyear Tire & Rubber Co.
- Hose (Packings)**  
Goodyear Tire & Rubber Co.
- Hose (Suction):**  
Goodyear Tire & Rubber Co.
- Hose (Steam):**  
Goodyear Tire & Rubber Co.
- Hose (Water):**  
Goodyear Tire & Rubber Co.
- Hammer Rock Drills:**  
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.  
Hadfields, Limited  
International High Speed Steel Co., Rockaway, N.J.
- High Speed Steel Twist Drills:**  
Canadian Fairbanks-Morse Co., Ltd.  
H. A. Drury Co., Ltd.  
Northern Canada Supply Co.
- Hoists—Air, Electric and Steam:**  
Canadian Ingersoll-Rand Co., Ltd.  
Canadian Fairbanks-Morse Co., Ltd.  
Jones & Glassco  
M. Beatty & Sons  
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  
Link-Belt Co.
- Hoisting Engines:**  
Canadian Fairbanks-Morse Co., Ltd.  
The Electric Steel & Metals Co.  
Mussens, Limited  
Sullivan Machinery Co.  
Canadian Ingersoll-Rand Co., Ltd.  
M. Beatty & Sons  
Marsh Engineering Works  
Fraser & Chalmers of Canada, Ltd.  
The Mine & Smelter Supply Co.
- Hose:**  
Canadian Fairbanks-Morse Co., Ltd.  
Northern Canada Supply Co
- Hydraulic Machinery:**  
Canadian Fairbanks-Morse Co., Ltd.  
Hadfields, Limited  
MacGovern & Co., Inc.  
Fraser & Chalmers of Canada, Ltd.  
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- 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.
- Levels:**  
C. L. Berger & Sons
- Locomotives (Steam, Compressed Air and Storage Steam):**  
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.  
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  
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
- Metallurgical Engineers:**  
The Dorr Co.
- Metallurgical Machinery:**  
The Dorr 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.  
International High Speed Steel Co., Rockaway, N.J.
- Mining Requisites:**  
Canadian Steel Foundries, Ltd.  
Dominion Wire Rope Co., Ltd.  
Hadfields, 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:**  
International Nickel Co.
- Motors:**  
Canadian Fairbanks-Morse Co., Ltd.  
R. T. Gilman & Co.  
MacGovern & 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.  
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The Mond Nickel Co., Ltd.

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The Mond Nickel Co., Ltd.

**Nickel Sheets:**  
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Northern Canada Supply Co.

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Ledoux & Co.  
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Hoyt Metal Co.

**Ores and Metals—Buyers and Sellers of:**  
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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.

**Paints—Special:**  
Spielman Agencies, Regd.

**Perforated Metals:**  
Northern Canada Supply Co.  
Hendrick Mfg. Co.  
Greening, B., Wire Co.

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

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

**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.  
Jones & Glassco  
R. T. Gilman & Co.

**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, Ltd.  
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.  
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:**  
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The Wabi Iron Works

**Pulverizers—Laboratory:**  
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The Wabi Iron Works  
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Northern Canada Supply Co.  
Canadian Fairbanks-Morse Co., Ltd.  
Fraser & Chalmers of Canada, Ltd.  
Mussens, Limited  
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**Pumps—Centrifugal:**  
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Smart-Turner Machine Co.  
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Mine & Smelter Supply Co.  
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The Wabi Iron Works

**Pumps—Diaphragm**  
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**Pumps—Electric**  
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Fraser & Chalmers of Canada, Ltd.  
Mussens, Limited  
Smart-Turner Machine Co.

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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:**  
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Hadfields, Limited  
Mussens, Limited  
R. T. Gilman Co.

**Rails:**  
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Mussens, Limited

**Railway Supplies:**  
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**Refiners:**  
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**Rope—Manilla and Jute:**  
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## Canadian Miners' Buying Directory.—(Continued)

**Rope—Wire:**

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Northern Canada Supply Co.  
Mussens, Limited

**Rolls—Crushing**

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Canadian Brakeshoe Co., Ltd.  
Canadian Steel Foundries, Ltd.  
Fraser & Chalmers of Canada, Ltd.  
Hull Iron & Steel Foundries, Ltd.  
The Electric Steel & Metals Co.  
Hadfields, Limited  
The Wabi Iron Works

**Steel Drills:**

Canadian Fairbanks-Morse Co., Ltd.  
Sullivan Machinery Co.  
Northern Canada Supply Co.  
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Canadian Ingersoll-Rand Co., Ltd.  
Mussens, Limited  
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**Tables—Concentrating:**

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

**Tanks:**

R. T. Gilman & Co.

**Tanks—Acid:**

Canadian Chicago Bridge & Iron Works

**Tanks (Wooden):**

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

**Tanks—Cyanide, Etc.:**

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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  
MacKinnon Steel Co.  
Fraser & Chalmers of Canada, Ltd.  
The Electric Steel & Metals Co.  
Hendrick Mfg. Co.  
The Wabi Iron Works

**Tanks—Oil Storage:**

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**Tanks (water) and Steel Towers:**

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

## Canadian Miners' Buying Directory.—(Continued)

**Tramway Points and Crossings:**  
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Hadfields, Limited

**Transits:**  
C. L. Berger & Sons

**Transformers:**  
Canadian Fairbanks-Morse Co., Ltd.  
R. T. Gilman & Co.  
Northern Electric Co., Ltd.

**Transmission Apparatus:**  
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**Troughs (Conveyor):**  
Hendrick Manufacturing Co.

**Trucks—Electric:**  
Canadian Fairbanks-Morse Co., Ltd.

**Trucks—Hand:**  
Canadian Fairbanks-Morse Co., Ltd.

**Trucks:**  
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.

**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

**Winding Engines—Steam and Electric:**  
Canadian Fairbanks-Morse Co., Ltd.  
Canadian Ingersoll-Rand Co., Ltd.  
Marsh Engineering Works  
Fraser & Chalmers of Canada, Ltd.  
The Electric Steel & Metals Co.  
Mussens, Limited  
R. T. Gilman & Co.  
The Wabi Iron Works

**Wire:**  
Canada Wire & Cable Co., Ltd.  
Greening, B. Wire Co.

**Wire Rope:**  
R. T. Gilman & Co.  
Dominion Wire Rope Co., Ltd.

**Wire Cloth:**  
Northern Canada Supply Co.  
Greening, B. Wire Co.

**Wire (Bars and Insulated):**  
Standard Underground Cable Co. of Canada, Ltd.  
Northern Electric Co., Ltd.

**Wolfram Ore:**  
Everitt & Co.

**Woodworking Machinery:**  
Canadian Fairbanks-Morse Co., Ltd.

**Zincium:**  
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ALPHABETICAL INDEX TO ADVERTISERS

**A**

Allan Whyte & Co. . . . . 207  
 American Zinc & Lead Smelting Co.

**B**

Balbach Smelting & Refining Co. . . . . 47  
 Bell, J. M. . . . . 10  
 Blackwell, G. C., Sons & Company . . . . . 12  
 Beatty, M. & Sons . . . . .  
 Berger C. L. & Sons . . . . . 12  
 Brigstocke, R. W. . . . . 11  
 British Columbia, Province of . . . . . 8  
 Burns, L. P., Ltd. . . . . 12  
 Burnett & Crampton . . . . .

**C**

Canadian Allis-Chalmers . . . . . 13  
 Can. Chicago Bridge & Iron Works . . . . . 36  
 Canadian Explosives, Ltd. . . . . 38  
 Canadian Fairbanks-Morse Co., Ltd.  
 Canadian Milk Products, Ltd. . . . . 7  
 Canadian National Railways . . . . . 36  
 Canadian Ingersoll-Rand Co., Ltd. . . . . 3  
 Canadian Link-Belt Co., Ltd. . . . .  
 Canadian Laboratories, Ltd. . . . . 10  
 Canada Foundries & Forgings, Ltd. . . . . 47  
 Canada Wire & Cable Co. . . . .  
 Canadian Rock Drill Co. . . . . 49  
 Canadian Steel Foundries, Ltd. . . . .  
 Canada Carbide Company . . . . .  
 Canada Metal Co. . . . . 8  
 Canadian Brakeshoe Co. . . . . 7  
 Canadian Sirocco Co. . . . .  
 Capper Pass & Son, Ltd. . . . . 10  
 Consolidated Mining & Smelting Co. . . . . 7  
 Crane, Ltd. . . . . 33  
 Coniagas Reduction Co. . . . . 40  
 Constant, C. L. & Co. . . . . 7

**D**

Deister Concentrator Co. . . . . 9  
 Denver Rock Drill Mfg. Co. . . . . 49  
 Deloro Smelting & Refining Co. . . . . 13  
 Dewar Mfg. Co. . . . . 33  
 Department of Mines, Canada . . . . . 37  
 Diamond Drill Carbon Co. . . . . 48  
 Diamond Drill Contracting Co. . . . . 12  
 Dominion Coal Co., Ltd. . . . .  
 Dominion Wire Rope Co., Ltd. . . . . 7  
 Donald, J. T. & Co. . . . . 10  
 Dorr Co. . . . . 11  
 Dresser, Jno. A. . . . . 11  
 Drury, H. A. Company . . . . . 9  
 Dwight & Lloyd Sintering Co., Inc . . . . . 10  
 Dominion Engineering & Inspection Co. . . . . 10

**E**

Electric Steel & Engineering, Ltd. . . . . 31  
 Electric Steel & Metals Co. . . . . 31  
 Engineering & Machine Works of Canada . . . . .  
 Everitt & Co. . . . .

**F**

Fleck, Alex. . . . .  
 Ferrier, W. F. . . . . 11  
 Fasken, Robertson, Chadwick & Sedgewick . . . . . 10  
 Fraser & Chalmers of Canada, Ltd.

**G**

Gartshore, John J. . . . . 12  
 General Engineering Co. . . . . 12  
 Goldie & McCulloch . . . . .  
 Goldsmith Bros., Smelting & Refining Co., Ltd. . . . . 12  
 Goodyear Tire & Rubber Co. of Canada, Ltd. . . . .  
 Grover & Grover . . . . . 10

**H**

Hadfields, Ltd. . . . . 50  
 Hamilton Gear & Machine Co. . . . . 12  
 Hardinge Conical Mill . . . . . 16  
 Hasson A. A. . . . . 11  
 Hendrick Mfg. Co. . . . . 12  
 Hersey, Milton Co., Ltd. . . . . 11  
 Heys Thomas & Son . . . . . 11  
 Hull Iron & Steel Foundries, Ltd. . . . . 14  
 Hore, Reginald E. . . . . 11  
 Hoyt Metal Co. . . . . 50

**I**

Imperial Bank of Canada . . . . . 36  
 International Business Machines . . . . .  
 International Nickel Co. of Canada, Limited . . . . . 5  
 International Nickel Company . . . . . 34-35  
 Inglis, J. & Co. . . . . 40

**J**

Johnston, Matthey & Co. . . . . 10  
 Jones & Glassco . . . . .

**L**

Laurie & Lamb . . . . .  
 Ledoux & Co. . . . . 10  
 Lindsey, G. C. S. . . . . 11  
 Longyear, E. J. Company . . . . . 33  
 Lymans, Ltd. . . . . 36

**M**

Manitoba, Province of . . . . .  
 McDonald, M. P. . . . . 11  
 MacGovern & Co., Inc . . . . .  
 MacKinnon Steel Co., Ltd. . . . .  
 Marsh Engineering Works . . . . . 29  
 McEvoy, Jas. . . . . 11  
 Mine & Smelter Supply Co. . . . .  
 Mond Nickel Co. . . . .  
 Mussens, Ltd. . . . . 1

**N**

Northern Canada Supply Co. . . . .  
 Northern Electric Co., Ltd. . . . .  
 Nova Scotia Government . . . . . 6  
 Nova Scotia Steel & Coal Co. . . . . 33

**O**

Ontario, Province of . . . . . 4  
 Osborn Sam'l Co., Ltd. . . . . 2

**P**

Pacific Coast Pipe Co. . . . .  
 Peacock Bros., Ltd. . . . . 50  
 Pennsylvania Smelting Co. . . . . 10  
 Prest-O-Lite Co. of Canada . . . . .

**Q**

Quebec, Province of . . . . . 6

**R**

Ridout & Maybee . . . . . 12  
 Rogers John C. . . . . 11  
 Rogers, Geo. R. . . . . 11  
 Reddaway, F. & Co. . . . .

**S**

Shayne & Jaffe Co., Ltd. . . . .  
 Smart-Turner Machine Co. . . . .  
 Smith & Travers Company . . . . . 10  
 Standard Underground Cable Co. of Canada, Ltd. . . . .  
 Stewart, Robert H. . . . . 11  
 Spielman Agencies, Regd. . . . . 47  
 Sudbury Diamond Drilling Co., Ltd. . . . . 10  
 Sullivan Machinery Co. . . . .  
 Swedish Steel & Importing Co. . . . .  
 Swedish Steel (Bolinder's) . . . . . 29

**T**

Toronto Iron Works . . . . .  
 Toronto District Salvage Board . . . . . 42  
 Tyrrell, J. B. . . . . 11

**U**

University of Toronto . . . . . 33

**W**

Wabi Iron Works . . . . .  
 Whitman, Alfred R. . . . . 11

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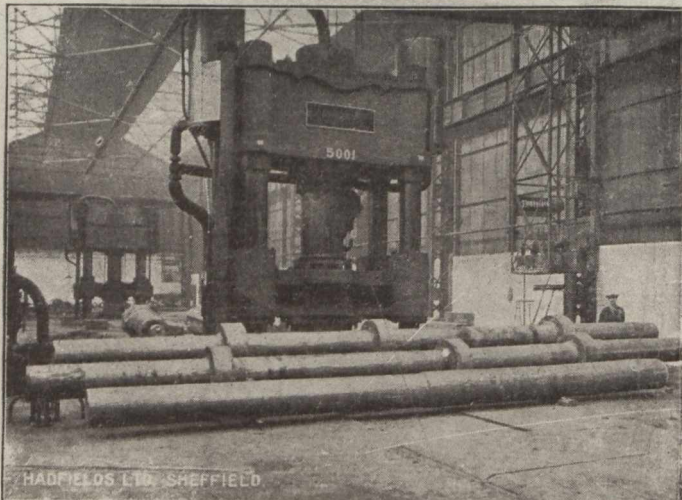
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