

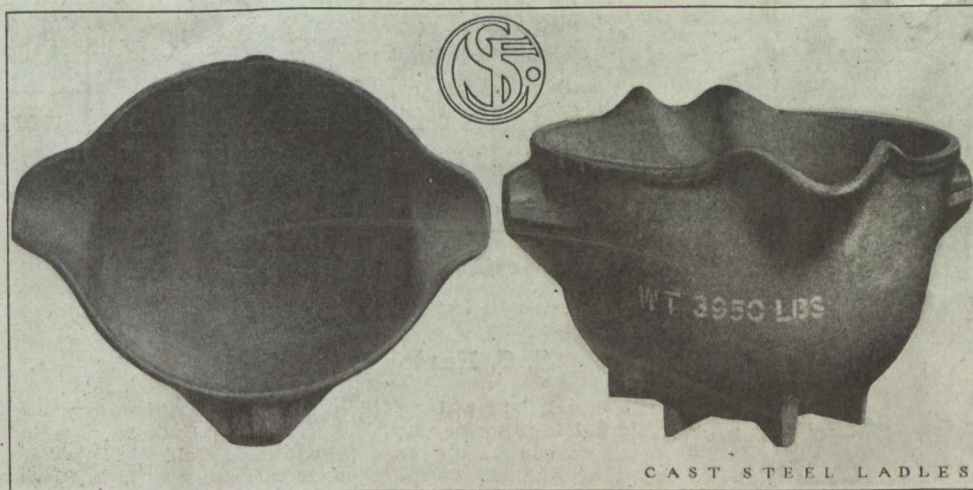
CANADIAN MINING JOURNAL

Vol. XLI.

Gardenvale, P. Q., September 10, 1920.

No. 36.

STEEL and FERRO-ALLOY CASTINGS



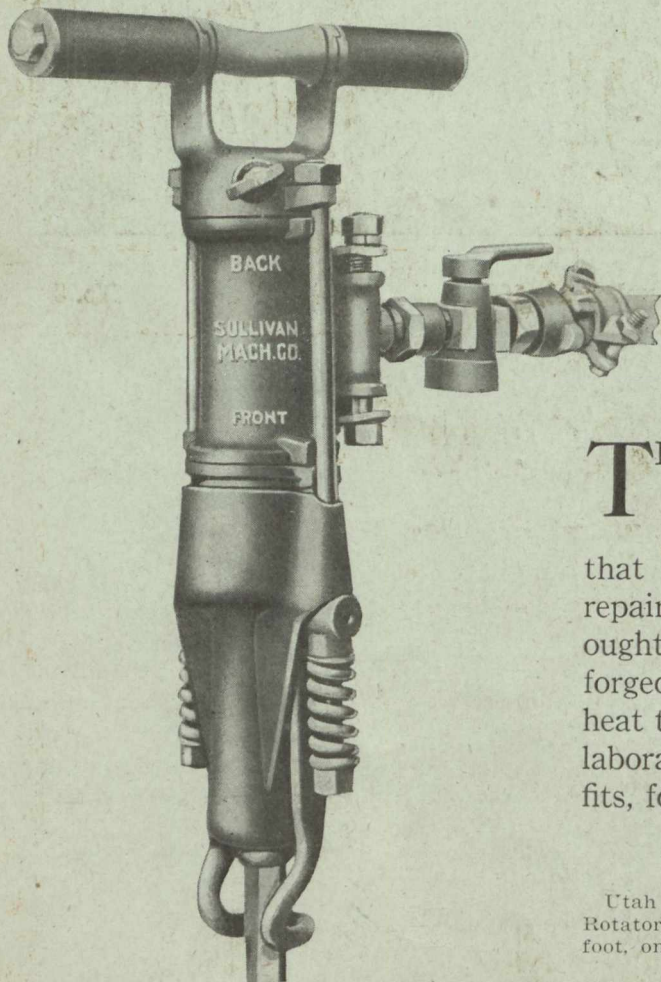
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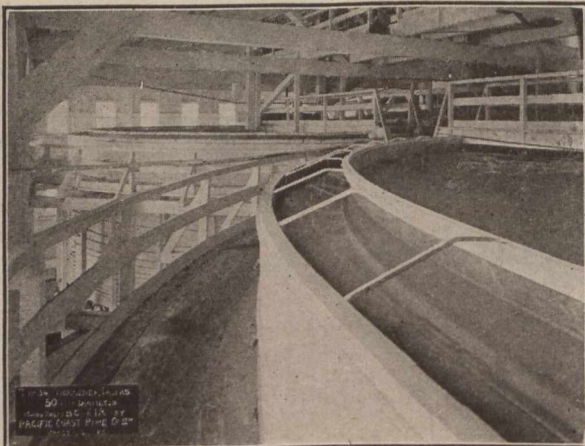
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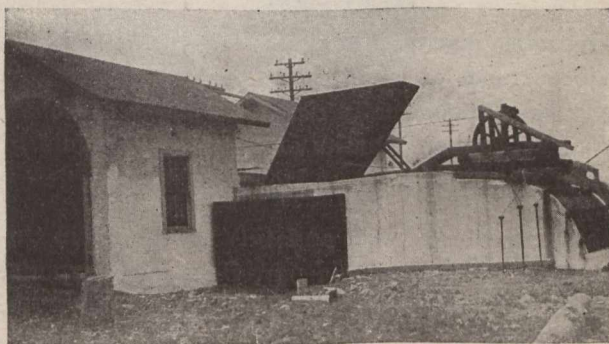
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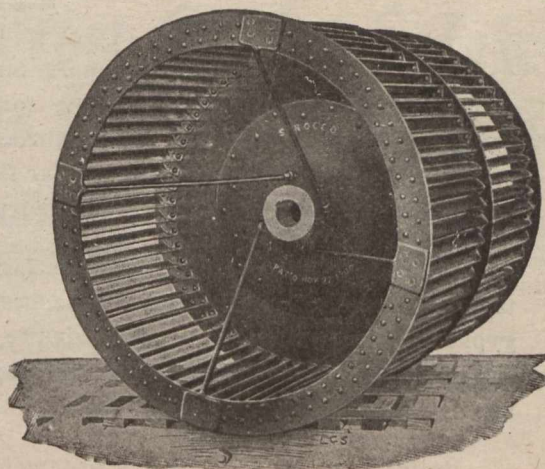
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HON. H. MILLS, Minister of Mines.

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 talc. This Province has the largest deposits on the continent of talc, 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.

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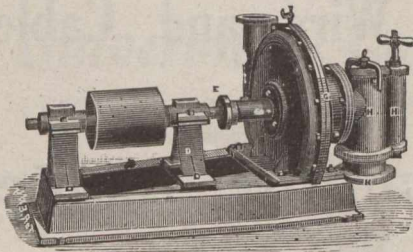
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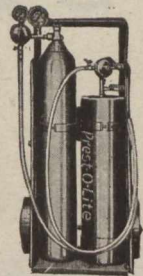
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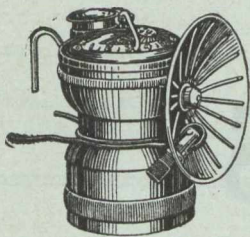
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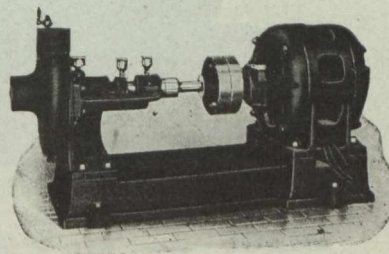
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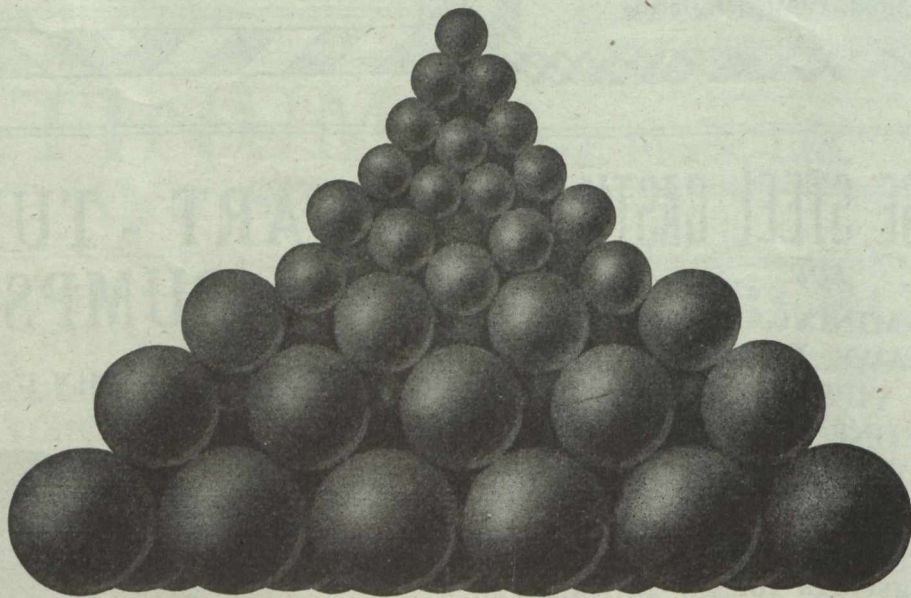
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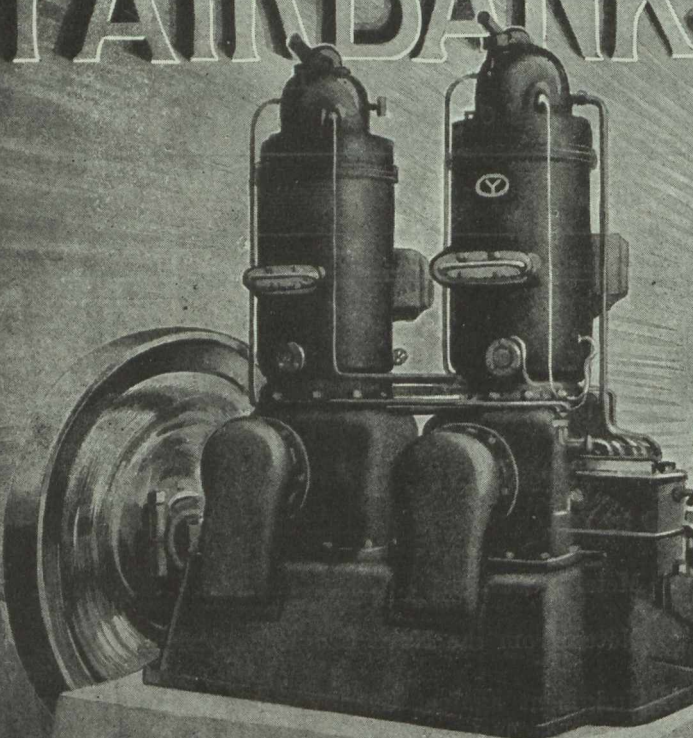
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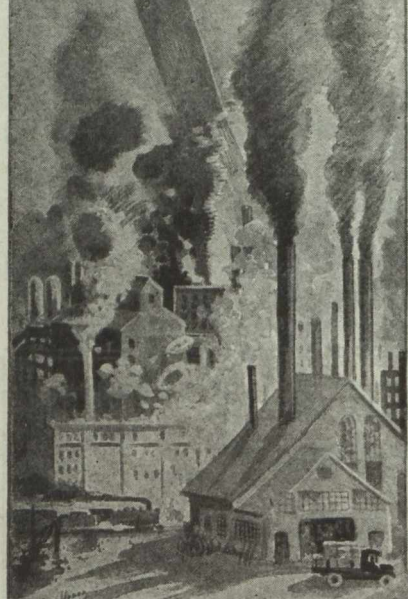
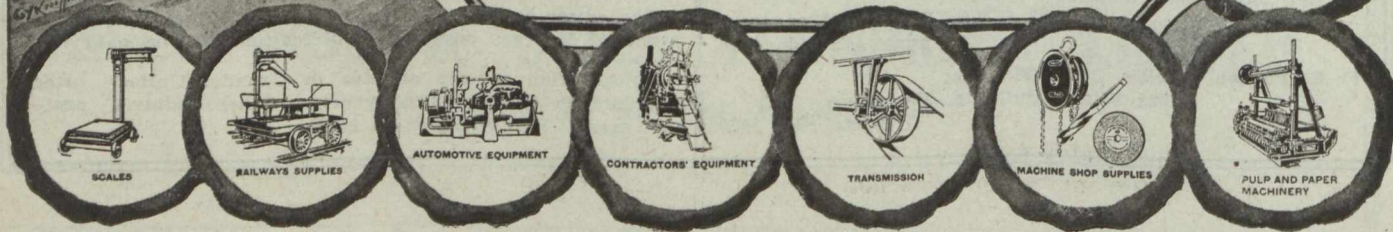
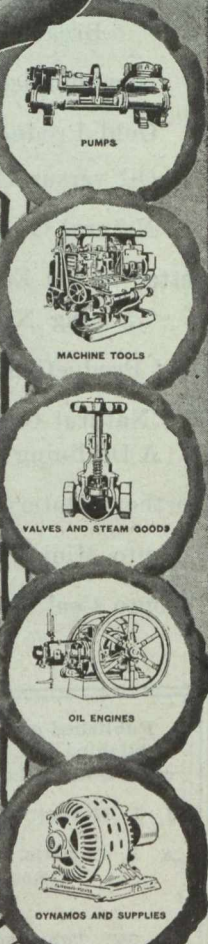
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:~: EDITORIAL :~:

The Proper Use of Self-contained Oxygen Breathing Apparatus

Oxygen breathing apparatus are devices that have suffered in reputation from too enthusiastic advocacy on the part of those who favored their use. Invented in the first instance by an Englishman, forgotten for many years in the land of its birth, and adapted and placed on the market by the Germans, they were hailed by persons uninformed of the obliterating character of modern colliery explosions as a panacea. The reaction of those who knew the realities of colliery explosions, and the very definite limitations of the oxygen breathing apparatus, went too far, and in some instances these devices were as unsparingly condemned as in other quarters their usefulness was overdrawn. The truth is that breathing apparatus are delicately constructed devices, with a limited range of usefulness, requiring to be used with knowledge and discretion by trained persons possessed of expert knowledge of underground conditions. They should never have been named "rescue apparatus," for that unfortunate misnomer has given rise to much misapprehension. The chief usefulness of the self-contained breathing apparatus is as an adjunct to a mine fire-brigade, and in this respect they are as necessary to a metal mine as to a coal mine. The record of self-contained breathing apparatus is combatting mine fires has established these devices as having very great usefulness, and, properly used, they have saved life on a number of occasions following the outbreak of mine fires and mine explosions.

Unfortunately, a number of fatalities have occurred among men wearing the apparatus, but investigation will show that in at least a proportion of the cases, this deplorable result has followed the use of the apparatus under conditions for which it was not designed. It is also due to many brave men who have worn the apparatus under desperately trying conditions to state that some of the earlier types of apparatus were designed in ignorance of certain physiological phenomena, and that some lives were sacrificed because wearers of breathing apparatus were asked to perform feats beyond human endurance. Admitting this, it is nevertheless true that the greater part of breathing apparatus fatalities have been occasioned by failure to recognize the limitations of a delicately constructed device, and to realize that a person wearing a breathing apparatus in irrespirable air must die if his apparatus for any reason does not function.

We would draw our readers' attention to the report of the Chief Inspector of Mines for British Columbia upon the recent fatality at the Black Diamond Mine near Seattle, the gist of which is contained in his statement that the fatalities occurred because men "attempted a feat in ordinary practice that any sane man would have given very serious consideration before permitting even in a case of emergency."* Equally pertinent are the comments of Mr. Rice, the Chief Engineer of the Bureau of Mines of the United States, who fears that misunderstanding of the facts may create a prejudice against "an apparatus which has greatest value when it is carefully used in accordance with well established rules."

To those who are interested in self-contained breathing apparatus there is available a mass of information collected by the United States Bureau of Mines and the Home Office in Great Britain, and by the military authorities of both countries who used oxygen breathing apparatus during the war on a scale that has not been approached in industrial mining.

General agreement among those who have investigated the use of the apparatus under dangerous conditions exists on the following points. The apparatus itself must be in good order, and at least equal care should be given to its condition as is given to the airplane, the diving apparatus, or any other instrument which man has devised to enable him to exist under unnatural conditions of environment. The wearer himself must be in good physical condition, should be certified by a medical man as being a proper person to wear breathing apparatus, not all men being so by any means. The wearer must be expert in the functions of the apparatus, and familiar with the conditions under which it is required to be used. The apparatus must be used with discretion, and with due weighing of the dangers to human life against the object sought to be accomplished.

Self-contained oxygen breathing apparatus is not a plaything, nor a scientific curiosity, nor a device concerning which ignorance is to be excused. It is fitted, within well-recognized limits, to achieve certain objects, but, used as it is under conditions of imminent danger, if these limits are not adhered to, disaster is certain.

*See page 697, issue of August 27th, 1920.

NEWFOUNDLAND.

We have pleasure in publishing the letter which appears in this issue from Mr. P. B. McDonald of New York. The "Journal" has from time to time given news of mining progress in Newfoundland, but confesses that its extent has been disproportionate to the importance of the subject. The fault is not altogether ours, but, as we have previously pointed out, is one of the disabilities under which Newfoundland must suffer until a government geologist is appointed. It is not to be wondered at that the outside world is poorly informed of mining possibilities in Newfoundland, seeing that the people of Newfoundland are themselves only very partially informed thereon. The best monograph on a Newfoundland mineral deposit was made by an official of the Canadian Geological Survey, and published by the Mines Branch at Ottawa. We refer to Dr. A. O. Hayes's Report on the Iron Ore Deposit of Wabana. This deposit, as Mr. McDonald points out, is not by any means the only one in Newfoundland, although, so far as is known, it is the most important one. We believe that the situation is accurately represented when we state that Newfoundland has not yet been either surveyed or studied from a geological point of view in anything approaching an adequate manner. There is one district, hinted at by Mr. McDonald, near Port-au-Port, the stratigraphy of which is only obscurely understood, but which seems to have very promising mineral occurrences.

If Newfoundland is to progress, it must be in mining, fishing and lumbering, as agriculturally, the country has definite limitations. The appointment of a government geologist, and the provision of some centre from which accurate and informed news of mining progress and possibilities can be disseminated, are two matters long overdue in Newfoundland, and their omission, so long as it is continued, constitutes a definite source of hindrance to the country's progress. Newfoundland played her part well during the war. The drain on her all too meagre man-power was proportionately very heavy, and the bill is proving onerous. All who know the Ancient Colony—now a Dominion—will wish her well, and we trust these comments will be taken in the kindly spirit in which they are conceived.

GOLD PRODUCTION IN ONTARIO.

Ontario, according to the figures recently issued by the Ontario Bureau of Mines, shows an increase in gold production in 1920 for the first half of the year of 22 per cent compared with 1919. In face of the declining gold production of other countries—the United States in particular—this is altogether a matter for sincere congratulation. The passing of the silver production by the output of the gold mines is an interesting phase of the half year's work, but

we think the greatest significance attaches to an increase of gold production in face of all the adverse conditions that are now attached to the production of gold. It bears witness, most effectively, to the favorable conditions under which gold is being mined in Northern Ontario. It is also worthy of note that three great mines, situated not far from each other, contribute 97 per cent of the gold production of the Porcupine area, and 88 per cent of the total gold output of Ontario, to wit, the Hollinger, McIntyre and Dome Mines.

OIL vs. COAL.

The conversion of the "Empress of France" to an oil-burner is not without significance to the Maritime coal trade. When this vessel, under her previous name of "Alsatian" called at Halifax, with other large converted passenger liners, during the war, their coal requirements made large drafts on the coal-handling capacity of Halifax, and on the output of the Nova Scotia collieries. Such vessels as the "Caronia" and the sister ship of the "Empress of France," the "Cargarian," took up to six thousand tons of coal at one time. The available quantity of bunker coal is at this time so insufficient that it matters little where it is obtained, whether in Canada, in Britain or at United States Atlantic ports. It affects the general market fairly equally in any case.

The adoption of oil in substitution for coal is more a matter of convenience than of cost. Many troubles are avoided by the use of oil fuel, notably complications with that trial of the chief engineer, the boiler fireman. It is also typical of the reaction of scientific minds against that most unscientific process, the burning of coal as it is ordinarily employed to raise steam power. It is one of the surprising features of our times that we should have improved so little in practice in the methods employed in the use of coal. Most persons who have given the subject thought are agreed that the use of powdered coal, the use of producer gas made from coal, or one of the fuel oils that can be made from coal, are all preferable to the burning of the raw material under a water-boiler. In each case the advantage lies in the more intimate combination of the fuel with the oxygen of the air that is possible with fuel capable of fine sub-division.

Those who control the coal areas of the world will find it a useless employment to rail against the substitution of what might be termed "fuel essences" for raw coal. A better and more profitable employment will be to adapt their collieries and preparation plants to deliver coal in the forms that the future will demand.

In the above connection it is interesting to note the interest taken in our western cities in the use of pulverized coal for domestic heating and small industrial

plants. The difficulty of adopting pulverized coal, in the case of a small consumer, consists not so much in the actual employment of the powdered fuel, but in its reduction to the powdered state. It is becoming customary now for firms that specialize in the manufacture and sale of apparatus for consumption of powdered fuel to provide a central pulverizing plant, from which delivery is made of powdered fuel. This system is well adapted to territories having access to fuel of only moderate grade, and it has proved successful, for example, in Washington State in the utilization of coals of Tertiary age.

There have been rumors that the rule of King Coal was endangered by the coming dominance of oil fuel, but those interested in coal need worry but little on this score. While it is certain that the future will see coal employed in more practical and scientific ways than has been the case in the past, it is equally certain that the coalfields of the world contain the only reliable and definitely ascertainable reserve of light, heat and power of the future. Oil is, of course, a most important fuel, and one upon which modern transportation is largely based, but it has many elements of uncertainty.

NATURAL GAS IN ONTARIO.

The Report of the Commissioner of Natural Gas for Ontario, elsewhere referred to in this issue, is not a comforting document for the fifteen per cent of the population of Ontario, which, as Mr. Estlin has pointed out, have depended largely on natural gas for household cooking, heating and lighting. The Ontario natural-gas supply is evidently a failing one, and is following the course of other districts in North America, where the supply of natural gas has proved to be limited when subjected to intensive consumption.

The most satisfactory part of the situation as it is revealed by the Commissioner's Report is that under recent legislation the Ontario Government has been able to compile accurate statistics, and is in a position to assess the gravity of the situation. The tendency has been to conserve the diminishing supply of natural gas for domestic uses, and to require industrial users to find other sources of fuel supply. In view of the onerous conditions under which domestic fuel has to be obtained in Ontario, the policy of the Provincial Government appears to be correct. Mr. Estlin points out that the 1919 production of natural gas was the equivalent in heat value of 578,120 tons of coal, worth delivered at present day prices, we calculate, not far from ten million dollars.

The Report states that many of the homes in the district hitherto supplied by natural gas are fitted for gas consumption only. This suggests the thought that instead of a general substitution of individual coal-burning appliances, which will take place gradually as the natural gas supply diminishes, some con-

sideration might be given to the generation and distribution through the existing channels of coal gas from a central station, designed to take advantage of the latest methods of by-product recovery, both of distillates and of coke residues.

MINING NEWS OF NEWFOUNDLAND.

To the Editor of the "Canadian Mining Journal".

Sir—As I have scanned the pages of your excellent mining journal I often have wondered at the paucity of mining news from Newfoundland. That Dominion, while separate from Canada, is nevertheless a territory of great mineral possibilities, and exploration goes on there from time to time, news of which would make interesting reading if printed in your journal. For instance, have you published an account of the new iron-ore discoveries at Indian Head, Port-au-Port, on the west coast, which are said to equal the famous Bell Island deposits? Or, have you published an explanation of the efforts being made to work the coal seams at Howley, also in the western part; and what is the present status of the renowned carbide-manufacturing scheme that was interrupted by the death of "Carbide" Wilson? There are, I believe, some indications of a boom coming to England's oldest colony, but, strange to say the capital and enterprise are coming from Scandinavians, who are alive to the immense possibilities in wood pulp, electric power and minerals of this 40,000 square miles of island in many respects so similar to Norway. As a native Newfoundlander remarked recently: "The Norwegians seem to have re-discovered Newfoundland, but I'd like to see a few more Anglo-Saxons coming in." In addition to the iron and coal already mentioned, there are, of course, on the island deposits of copper, pyrites, lead, barytes, oil, etc.

P. B. McDONALD,

New York University, Bronx, New York.
August 30, 1920.

GOLD PRODUCTION OF YUKON IS LESS.

Dawson, Aug. 26.—The gold yield of the placer camps of the Yukon Valley for 1920, as estimated by competent authorities, will total \$4,485,000. Six weeks more will wind up the season, as the Winter freeze-up will begin then.

Volney Richmond, superintendent of the Northern Commercial Company, having posts throughout the North, has arrived here after a tour of 3,000 miles, visiting posts in interior Alaska. He estimates that camps in that region for the season will yield \$2,985,000.

George J. Jeckell, royalty collector at Dawson for the Canadian Yukon, estimates the season's yield for this territory, which nearly all comes from the immediate vicinity of Dawson, at \$1,500,000. Practically every camp in the North has suffered a heavy decline in output this season. One reason is that it has been the driest season in the history of the North, this largely curtailing hydraulic operations.

Some plants practically operated none of the season. Other reasons for the curtailment include the heavy cost of supplies, materials being practically twice what they were in normal times, while gold remains at a fixed value, thus reducing its purchasing power one half. This means the cheapening of the commodity to the miner.

The Natural Gas Supply in Ontario

Part V, of Vol. XXIX, the 29th Annual Report of the Ontario Department of Mines, consists of the findings of an Enquiry into the natural gas supply of Ontario made in 1920, and a report on the industry during 1919, from E. S. Estlin, the Commissioner of Natural Gas.

The gist of Mr. Estlin's Report is contained in the prefatory note to the volume, which is as follows:

"The natural gas situation as it stands today is brought out in the following summary of the evidence taken at recent hearings, the general trend of which indicates that:

(1) There are two recognized areas of production commonly known as the eastern and western gas fields, the former having been drawn upon for about thirty years and the latter for about fourteen. Some of the conditions affecting the life of the two fields differ, and they are separately mentioned, where possible, in the evidence.

(2) There is a shortage of natural gas for home use in cold weather, at a time when it is most required.

(3) The shortage is caused primarily by a field depletion common in the history of all gas areas, but this depletion was accelerated by excessive consumption during the war period.

(4) This depletion is not being offset by development work because of prohibitive costs, and for this reason will become more acute each year.

(5) Gas enterprises no longer hold out hope of financial gain under present conditions, and do not attract further capital, which is necessary for the development of new gas-bearing territory.

(6) If a general readjustment in the whole situation does not take place immediately the business will pass into decline, and this valuable fuel supply will be lost to about fifteen per cent. of the population of the Province.

(7) The need of seeking for new sources of natural gas at greater depth is apparent; this not only brings greatly increased costs, but also multiplies the risks, and the production end of the natural gas business is a miner's risk not lightly undertaken.

(8) The commercial end of the enterprise is hedged in with contractual obligations assumed when the fields were young and the wells flush, and the whole situation under prevailing conditions holds out no promise of improvement."

Two significant charts are included in the report on 1919 conditions. One shows the rock pressures in the Kent Field from 1907 to 1919. Pressure has declined from about 565 pounds per square inch in 1910 to about 317 pounds in 1919. During a similar period, namely from 1906 to 1919, the consumption rose from 2.7 million cubic feet to 20 million cubic feet in 1917 and was shown at the end of 1919 as being about 11 million cubic feet. Such a decrease in rock pressure, accompanied by unprecedentedly heavy consumption can have but one result.

The following information is condensed from the text of the Report on 1920 conditions, which itself is an abstract of the evidence submitted during the enquiry.

Shortage

That a serious and general shortage of natural gas exists throughout the gas area of Ontario is fully borne out by the testimony of many witnesses who gave evidence at the several localities where hearings were held. This shortage occurs during the winter months only, and is most acute when the weather is severe.

The residents of cities have been deprived of gas in about an equal degree throughout the various sections of the city. Here and there a very few urban consumers appear to have suffered less inconvenience owing to their proximity to the point of intake at the city limits.

Some suffering and considerable inconvenience have resulted from the lack of gas during the past winter; the general shortage was first felt in the winter of 1917-18.

The classification provided for in the Natural Gas Act, 1919, and Regulations thereunder, was put into effect at Sarnia, Windsor and Chatham during the past winter. This classification cut off certain large users in the given order of preference in favour of the homes, but in spite of these precautions the shortage continued on very cold days.

During the winter of 1918-1919 the gas supply was fairly adequate to meet the demand, with the exception of a few days of low temperature, because the winter was unusually mild.

The shortage through the winter of 1919-1920 just passed, was fairly uniform throughout the districts supplied by the Kent county gas fields. Gas was not obtainable in the cities even for cooking purposes in many instances on severely cold days.

Some of the evidence shows that rural consumers taking their supply from lines tapping the high pressure pipe-lines have never experienced a shortage except in cases of breakage, etc.; this also applies to smaller towns located near the source of supply.

The general tone of the evidence on gas shortage goes to show that the situation is a serious one. People have used gas for many years, and the shortage has come practically within the last two years. The homes are equipped with gas-burning appliances which do not admit of successful change to coal burning, and the chimneys require in many cases remodelling and rebuilding.

There can be no question that the evidence brings out very clearly the fact that the present available supply of gas is not adequate, under the present conditions of market and consumption, to supply the wants of the people in large centres.

It has been demonstrated that the period of greatest shortage occurs during the meal hours. During a cold wave the pressure at the city limits might be ample in the early hours of the morning, but when all the consumers lighted their cooking fires about the same time, the pressure would very soon drop to a point which made equal distribution impossible. This low pressure would be maintained during the day, but at night when the pull became steadier and more normal the lines would "pack up" and pressure rise again.

Several witnesses point out that the nocturnal rise in pressure is a source of great danger, as it is impossible sometimes to regulate the heaters so that the fire will neither go out nor increase to such an extent as to cause serious damage. No shortage occurs in the summer or during mild days through the winter except where there may be physical reasons such as small or choked service lines.

Causes of Shortage

The chief reason given for the shortage is the decline of the gas fields and the small area of new producing territory explored. It has been shown that the shortage and high price of coal increases the demand for gas. Weather conditions affect the consumption of gas to such an extent that there is four times as great demand on cold as on mild days. The output of the gas fields does not provide for the domestic "peak load", which occurs at a time when the weather is most severe. The decline of the Kent gas field was increased by the heavy output during the war, when industries were using immense quantities.

Supply

Distributing companies have no power to increase the supply of gas. They take the volume as indicated by the available pressure at the point where the distributing system connects with the high pressure supply line, and transmit to their customers what they can get. Distributing companies do, however, make every effort to relieve the situation during a sudden drop in temperature by cutting down the less important consumption. Only small amounts of gas are used in winter for industrial purposes, where gas is an essential part of the manufacturing process.

The number of domestic services is always increasing slightly, so that the domestic load does not become lighter. The supply is adequate at night even in cold weather. It is shown that, while gas is being consumed under present conditions in the homes, as high as thirty to thirty-five pounds "high" pressure at city limits is required to maintain a full distribution service.

The Union Natural Gas Company issued a notice of expected shortage to their consumers in 1917. The general supply will decline more rapidly in the future because adequate development work is not being carried on to offset the decline of the wells. There is a natural depletion of all gas fields which ultimately results in shortage and rearrangement of consumption. The rate of delivery of gas from the field depends upon the pressure behind it, and when this field pressure decreases the supply from the wells diminishes.

Under a general adjustment of consumers' appliances a constant pressure of two ounces would prove satisfactory. There would be sufficient gas in the Kent field for a reasonably good service if suitable changes in burning and handling were made. There should be enough gas for heating with eight to ten pounds at city limits. It can be expected that eight to ten pounds pressure will be the limit if no new wells are drilled and no further supplies of gas located. The service is good for nine months in the year and bad for three.

All distributing and other regulators are seriously affected by the corrosive elements in the Tilbury gas; this is the reason why varying pressures are difficult to regulate. Witnesses claim that the use of coal nearly doubles the cost of heating, and that natural gas should be restricted entirely to household use. If furnaces were taken off in severe weather during part of the winter, there would be ample gas for other purposes.

Consumption Data

If the pressure drops from four ounces to one ounce the reduction in gas volume is 1.3 per cent. As temperature rises and falls, gas expands and contracts; every five degrees drop in temperature causes one per cent. contraction. If gas temperature drops from fifty degrees in summer to thirty degrees in winter, causing a reduction of twenty degrees, the volume of gas is reduced four per cent., and this gives the consumer four per cent. more heat, so that contraction by temperature more than compensation for loss in volume due to low pressure.

On a gas bill of \$10.00 there would be an advance of thirteen cents if pressure dropped from four ounces to one ounce. The correct proportion of air for proper combustion is $9\frac{1}{2}$ parts to one of gas. If varying gas pressures prevent the use of proper proportions of air and gas, improper combustion results and the consumer complains of absence of heat. Great waste is also caused in this way. Domestic gas burners are connected with mixers which are set to draw in $9\frac{1}{2}$ parts of air, but when the pressure drops to one ounce the right mixture of air and gas will not result.

Air cannot be introduced into the mains or pipe lines by gas companies because it forms a highly explosive mixture when mixed with gas under pressure. A case is cited where fifteen miles of new pipe-line was blown up by turning in gas to test the line before air had been allowed to escape; the result was that there were not a dozen lengths of pipe left worth picking up.

The best results can be obtained from the use of low pressure gas, but the present equipment in the homes is not suitable. The case of gas engines is cited, where low pressure gas gives the best combustion mixture. The same principle applies to gas used for cooking and other purposes. Satisfactory service was rendered in one home in Petrolia at one ounce pressure. Witnesses complain that at times the flame is yellow and at other times blue. When the pressure is low the efficiency of the flame is impaired and the heat units are not utilized. There is no difference in the quality of the gas; it is the same as it was ten years ago; the difference noticed by consumers lies in there not being enough air introduced at the burner on account of low pressure.

Meters are set to register correctly at two ounces when manufactured and tested, but will record accurately at four ounces with the difference that there will be a better flow of gas at four ounces. If pressure drops to one-quarter ounce the meter will still register the actual amount going through. If gas were flowing through a meter at one pound the customer would gain, because of the increased density of the gas. When pressures are low, the consumer is burning raw gas instead of gas and air in right proportions.

Many complaints were made by witnesses giving evidence at Woodstock, where Tilbury gas is supplied, that the odour given off goes through the homes and is injurious to health and destructive to furnishings. It was brought out that if leaks and unsuitable equipment were given more attention, and more care exercised, the discomfort and annoyance would not be felt. The same gas is used elsewhere without similar complaint.

Witnesses complained at all hearings of the increase of gas bills when gas supply was lowest. This was shown to be due largely to improper adjustment of

air mixer and larger amount of gas required during cold weather.

Transmission

The towns on the Southern Ontario Pipe Line receive their gas supply according to their relative distance from the gas field. Those nearest the fields get the better supply when shortage occurs. The transmission of large volumes of gas under reduced pressures through long pipe-lines is greatly retarded owing to the friction created. This is a serious factor when the field is supplying to its limit and a sudden increase in consumption takes place, reducing the pressure in the lines, so that the gas has to flow faster through the line. Duplicate delivery pipe-lines for conveying the products of different gas fields to market are a great and useless expense.

It was brought out that it is clearly in the interest of the consuming public that independent exploration work be encouraged and that where small fields are opened (at considerable distance from market but within reach of existing pipe-lines), some method should be found so that present pipe-lines become the carriers of such gas under circumstances encouraging to the smaller operators.

Field Conditions

The decline of the Tilbury gas field was first indicated when gas compressor stations were first erected in 1913 and 1914. In the case of the Tilbury field the presence of salt water underlying the gas is found to be a great menace to the life of the field because, as the field pressures decline, the water invades and seals up the porous rock containing the gas. There was a general decline in rock pressures in the Union Natural Gas Company's field from 540 pounds in 1912 to 318 pounds at the present time. In 1915 the open-flow measurement of the Union wells was 90,000,000 cubic feet. In 1919 it was 33,000,000 cubic feet. Pumping outfits have to be maintained on the Tilbury wells for keeping the water down. These outfits consist of a separate gas engine unit for each well. The Union National Gas Company has 171 producing wells and 14 non-producers.

A former field with conditions somewhat similar to those of the Tilbury field was known as the Essex gas field. This field supplied the city of Windsor and large quantities of gas were exported to Detroit and Toledo. The field was drawn on for about ten years and ceased suddenly, causing great inconvenience. Every gas field begins to decline as soon as it is tapped.

In the drilling of wells in the Tilbury field the gas is encountered just above the big water, consequently pockets cannot be drilled down so as to form a gathering basin for the water at the foot of the well; this is a serious inconvenience because it makes constant and frequent pumping necessary. Wells are tested daily and weekly for shut-in pressures. This is a necessary part of the field work to determine what gas the well is making. Only three wells were frozen during the past winter in the Union Natural Gas Company's field. No producing wells were shut in during the winter.

The evidence goes to show that the Union Company's wells and those of the Glenwood and Beaver Companies, situated in the same field, were given the very best attention.

The open-flow measurements of all the wells in the Tilbury gas field show a decline of about one-third according to measurements taken in 1919. There is a strong possibility of the Tilbury field being drowned out if the output is not materially reduced; water is gaining in the field as pressures are lowered. The gas

is being withdrawn at about one-third of the open-flow, which is much too fast for the safety of the field.

Water conditions in the eastern field are not nearly so serious and wells will produce down to a very low pressure. Tilbury field is a "tank" field; one part of the field communicates with another through the porous rock. In the Welland-Haldimand field there are wells where the rock pressures have declined from 500 pounds to 300.

The open-flow measurement of a well is not the amount of gas which the well will deliver into the lines; the actual delivery of the well is about one-third of the open-flow.

Large companies look after the field conditions more systematically than small companies or individuals, therefore the larger companies obtain the better results.

Recent drilling shows smaller results than formerly; this is true of all the Ontario established gas fields. Early drilling in the eastern field brought wells of from 200,000 cubic feet to 500,000 cubic feet open-flow per day. The Port Colborne-Welland Gas Company drilled five wells last year and kept three of them. Deep drilling has been tried in the eastern field and twelve wells failed. One witness claims that he could double his capacity by drilling on his reserve territory in the eastern field. In Rainham and Canboro townships the rock pressure has declined from 200 pounds to 120. The Chippewa Oil and Gas Company drilled eighteen wells in the eastern field at a cost of \$21,600 and had five dry holes. It does not take the full output of all the wells to supply the summer demand.

The wet wells in the Tilbury field vary as to the time required to operate pumps. In some wells the water can be removed in a few hours; in others a whole day is required. All wells are operated to full capacity in all the fields to supply the winter demand. Some wells in the Tilbury field are being pumped at considerable expense although not producing gas, as it is found that this method keeps the water off the adjacent producing wells.

In Dover township the six deep producing wells which were drilled within the last two years by the Union Natural Gas Company, and which were connected to the Sarnia pipe line, have declined in production over one-half since they were drilled in. This is a far more rapid decline than that shown by the Tilbury wells. It is estimated that the gas field in Tilbury controlled by the Union Natural Gas Company will yield 58,859,510,000 cubic feet of gas when pressures drop to fifty pounds.

Total gas from the Dover wells drilled by the Union Natural Gas Company was in December, 1919, 5,961,524 cu. ft. per day, and in February, 1920, 3,439,858 cu. ft. per day, a reduction of about two and one-half million cubic feet.

Producing companies endeavour to maintain a reserve acreage in order to drill for increased supply and to protect their producing wells.

In the Glenwood Company's Tilbury wells the pressure is kept back to about 100 pounds to retard the flow of water into the wells. If the compressor plants were operated, the back pressure against the water would be lowered and there would be no gas. The Glenwood Company drilled nine wells in 1919, and the Beaver Company three, in the Tilbury field. More wells drilled in the Tilbury field would deliver the gas more quickly but would not increase the supply. The pressures would decline so much faster. The Glen-

wood Company would not keep a new well unless it measured over 20,000 cubic feet when brought in.

Twice as many pump-men are required to tend the wells in winter as in summer in the Tilbury field. The Union Company has sixty-five pumps out of one hundred and sixty-six wells; siphons are being replaced with power pumps as quickly as equipment can be obtained and installed. The expense in handling the water in Tilbury field is increasing. Water is being pumped from wells drilled as recently as 1918 in Tilbury field, but the greatest amount of water is found in the older wells.

The Glenwood Natural Gas Company has spent seven years in constructing a plant for removing the sulphur content from the Tilbury field. This plant is the only one of its kind in existence and is located in the heart of the Tilbury gas field. Crude ammonia in 17 per cent. solution is reduced to 9 per cent. and the gas passed through the liquid. The ammonia absorbs H₂S out of the gas and ammonium sulphide is the product. The difficulty is in freeing the ammonia from the sulphur. This purifier cannot be operated continuously because of constant corrosion, which necessitates repairs. The only practical purifying plant is the oxide system, but this system develops water vapour which condenses and gives trouble. The life of a gas pipe varies, depending upon the kind of soil in which it is laid, the attack from electrolysis, and the corrosive elements in the gas. Some pipes last forty years and other only one year.

The Dominion Natural Gas Company operating in the eastern fields carries 55,000 acres of operated leases and 64,000 acres of unoperated leases. Some companies hold ten times as much unoperated as operated acreage. The largest area held by the Dominion Company is where the limits are not yet developed; the smaller area is where the district is tested out as in the older fields.

The Dominion Company at the beginning of the year 1919 had 773 wells, and at the end of 1919 had 796 wells (having drilled 38 producing and abandoned 22 wells). Seven dry holes were drilled in 1919. More wells were drilled by them in 1916 than in 1919, but more money was spent on the drilling in 1919. The open-flow of the Dominion Company's wells showed a decline between 1906 and 1919 of about 90 per cent., between 1907 and 1919 of about 95 per cent., between 1908 and 1919 of about 50 per cent.

Increased costs of materials and labour prevent development work. Shallow drilling has been almost abandoned. Deep drilling costs have increased from 100 to 120 per cent. The Union Natural Gas Company has stopped drilling operations entirely. Companies cannot get funds invested in the natural gas business sufficient to continue exploration work and the opening up of new producing territory. The cost of drilling a deep well at the present time is from \$20,000.00 to \$25,000.00, while wells in the Tilbury field cost approximately \$2,000.00.

In Dover township, where new gas and oil production has been opened up within the last two years by deep drilling, there are seven producing wells out of twenty, while in Tilbury the Union Natural Gas Company has 166 producing out of 179. The Union Company drilled eight wells in 1919 (four in Dover and four in Tilbury), not all producers, but got more gas in 1919 than in 1918. The Union Company has drilled thirteen deep wells. The Tilbury gas field is now thoroughly drilled. The drilling of twenty wells in

the township of Dover was an effort to recover production. One deep well drilled on Rondeau Provincial Park, Kent county, cost \$125,000.00 and was a dry hole.

There are large areas of gas producing formation underlying vast districts in the province of Ontario. The large area held by the National Gas Company, consisting of 30,000 acres in the eastern field, admits of great development. After operating for six years ten additional wells were drilled; one of them came in with an output of two million and another of one and a half million cubic feet per day. This company have only eighty-five wells on the 30,000 acres and ten of these have been pulled. The territory is good for 200 wells and the output could be trebled if funds were procurable. There are many dry wells scattered over the eastern gas territory. One opinion claims that there is not enough productive area tributary to the city of Hamilton to furnish that city with a full supply of gas.

Many wells are abandoned in both the eastern and western gas fields, which are not replaced by new drilling; this is a strong factor in decreased production. The Union Natural Gas Company spent \$250,000 trying to locate more gas when abnormal conditions caused by the war created a shortage.

Waste

Lack of efficient equipment in the consumption of gas is responsible for a large percentage of waste. There is approximately forty per cent. of waste between transmission of gas and the consumer's burner.

Average Waste Percentage.

	1918	1919
Sarnia	24.8	14.5
Petrolia	41.5	34.0

The decrease is caused by the improvements made in the distributing plants.

The unrestricted consumption of gas without charge under freehold agreements is a very great source of wastage. In January, 1919, 100 free users consumed 46,400 cu. ft., while 100 pay users in Sarnia consumed 24,400 cu. ft. a difference of nearly 100 per cent. Considerable waste was encountered in defective lines in the town of Petrolia, but repairs to these lines resulted in reducing the leakage. Some meters were found to be running slow and these are being repaired and tested. The readjustment of all conditions from the gas field is required to reduce the waste of gas to a minimum.

An excellent idea of Canada's great mineral wealth is given in the Ontario Government's display at the Canadian National Exposition, a feature of which is an exact reproduction of the underworkings of a mine—a drift in which the latest type of drill is set up ready for operation and manned by a typical miner. That Ontario is one of the richest provinces in mineral resources to be found in the world is apparent from a cursory glance at the minerals and metalics and a study of the figures that are set forth of the total value of the chief minerals produced in Ontario during 1919. These include silver, \$198,000,000; nickel, \$150,000,000; iron, \$80,000,000; gold, \$61,000,000; copper, \$54,000,000; cobalt, \$7,000,000. These figures indicate that Ontario produces 45 per cent of the total mineral output of Canada, and tell a vivid story of the vast natural resources of this province. The exhibit is well arranged and has attracted a great deal of attention.

Northern Ontario Letter

Owing to the high price of silver during the last half of August having induced some of the heavy holders to release large quantities, quotations commenced to recede again during the opening week of September. It is not believed, however, that the price will long remain at a point near the 90 cents mark, but may be expected to again gradually work up to not far under \$1.00 an ounce.

The leading Cobalt producers, in common with other large holders of silver in other parts of the world, took advantage of the recent high quotations and released a large amount of their hoarded stock of bullion. It is still believed, however, that close to \$2,000,000 worth of the metal is contained in local vaults.

On Labor Day, September 6th, the members of the Imperial Press Conference visited the mining districts of this part of Northern Ontario. The magnitude of mining operations together with the other industries including agriculture and paper manufacture appeared to be somewhat of a revelation. The thought that all this wealth lies adjacent to the railway and that in the vast stretches lying beyond, no roads have yet penetrated, seemed to impress the visitors with the importance of the future which is unfolding before this country.

Arrangements are to be made to enlarge the milling equipment of the Beaver Consolidated mines, according to unofficial reports. This is said to have been made advisable owing to the large quantity of low and medium grade ore opened up during the past six or eight months. The plan to virtually work the Beaver mine over again promises to have been well advised and, in addition to encountering quite important shoots of high-grade ore, the life of the mine has been considerably lengthened by blocking out a large tonnage of low-grade ore. It is a quite general belief that the Beaver Company, in addition to its own earnings, may commence to receive revenue from the operation of the Kirkland Lake Gold Mines during the coming year. Should such prove to be the case, substantial dividends appear to be indicated for the Beaver stockholders.

A rock crusher together with an automatic shovel and loader is being installed at the Kerr Lake mine for the purpose of handling the large tonnage of low-grade ore lying in the dumps. It is intended to crush the ore to about 2½ inch ring, after which it will be conveyed by aerial tramway to the customs mill of the Dominion Reduction Company. In the meantime, this low grade material is being shipped at the rate of about 4,000 tons monthly, and constitutes at least half of the total current output from the operation of the Kerr Lake. Production from all sources is being maintained at upwards of 50,000 ounces monthly.

Ore shoots, quite rich in places, but more or less limited in extent, have been encountered on the old Lumsden mine. Work has been under way for several months, and it is understood an endeavor will be made to send out a shipment of ore at a reasonably early date.

Leaseholders of the old Ruby Silver property, situated in the south-eastern part of the township of Bucke, close to the old Green Meehan mine, have taken out a small pocket of high-grade ore and will make a shipment this month. The shoot is said to have con-

tained about \$5,000. Further work is planned with a view to opening up low or medium-grade mill-ore as well as possible shoots of high-grade ore.

Plans are being arranged to commence sinking to deeper levels on the Oxford-Cobalt property, situated in Gillies Limit. Lateral work at the first level has not opened up commercial ore but has offered encouragement to continue the work to a lower horizon and to a point where lateral work may be carried on in closer proximity to the contact.

The Gowganda District.

Advice from Gowganda indicates that another shipment of high-grade ore will be made this month, and may amount to about ten tons. It is intimated in semi-official circles that current output is about equal to expenditure, and that in addition a substantial quantity of low and medium-grade ore is being blocked out. It is also understood the question of installing a small mill is under contemplation. Should this course be adopted, it is quite reasonable to suppose that the winter roads would be taken advantage of to haul the heavier parts to the property.

The policy of temporarily patching up the Gowganda road has been adopted by the present Ontario Government. This method has already cost the country between \$300,000 and \$400,000 for work on this 27-mile road, and still leaves the field without satisfactory transportation. Last year, the defeated government recognized the folly of the policy and decided to construct a macadam road, but with the rise to power of the U.F.O.-I.L.P. party, this work was discontinued and the old game still goes on with the mines of the Gowganda field paying the piper.

The first unit of the power plant of the South Bay Power Company, at Gowganda, is said to be nearing completion and current may be turned on within a short time.

Everywhere throughout the active silver-mining districts, including Cobalt, Gowganda, South Lorrain and Elk Lake there is a tendency to look to the coming year as one likely to be marked by continued high quotations for commercial bar silver, and with this belief in mind arrangements are being made to carry on work at the fullest possible capacity.

THE GOLD MINES.

The Porcupine Field.

The trend of the price of commodities during the past month or six weeks has given rise to the hope that a definite turn has taken place in the downward motion of the price of material. If this is actually the case, net earnings at the gold mines will increase accordingly, because with them the gold will always command the standard price, while cheaper material will reduce the cost of production.

An interesting report originated in Porcupine this week in which it is said the Moneta mine which adjoins the Hollinger on the immediate west may figure in a deal with English interests and may be worked in a big way. This property is regarded as one of the most favorable of the undeveloped pieces of ground lying in close proximity to the producing area. With its neighbor the Hollinger Consolidated having actually mined close to \$38,000,000 and with more than \$40,000,000 more blocked out, and with indications of these bodies continuing to enormous depth, the prospect of the Moneta ultimately developing in a satisfactory manner appear to be extremely good. The

strike of the Hollinger ore bodies is directly into the Moneta.

Concerning this property, it will be recalled that a report was in circulation last spring that interests identified with the Hollinger had offered 25 cents a share for the Moneta, but publicity given to the matter caused the report to subside.

In connection with opening the Porcupine V.N.T. Mines, it is believed the balance of this year may be occupied in de-watering the underground workings, etc., but that by early in the new year the property will be in full operation. The \$30,000 provided in the sale of the first block of treasury stock at 15 cents a share is to cover this preparatory work, while the sale of the next block of 200,000 shares at 30 cents each, as per the underwriting arrangement, is expected to place \$60,000 in treasury with which the mine can be brought to the producing stage and probably pay its own way. It is just possible the mill may also be overhauled and enlarged so as to treat about 150 tons daily, in which case the operation would become an important one.

Considerable criticism continues to centre around the McIntyre-Porcupine's purchase of a coal property in Alberta. Full details are not available, but a good many stockholders, particularly those resident in Northern Ontario and familiar with the situation, are expressing open resentment of this attitude of the President of the McIntyre Co. employing funds of the company on a venture of that kind when the McIntyre is itself but getting away to a fair start.

The Davidson Company is also under fire. The company recently made the proposal that the stockholders option at least fifty per cent of their shares "until nine months after the completion of a 500-ton mill," but some of the shareholders see in this a situation amounting to the same thing as though they joined the pool. With their shares tied up, they would not be in a position to take advantage of a favorable market to sell, nor would they be able to get out provided things failed to go well. The company is said to have arranged with English interests to underwrite a large amount of treasury stock, provided they are given an option on 50 per cent of the outstanding stock. Sailing may not be altogether too smooth, judging from the attitude of stockholders who know there is no law to compel them to either option their shares or to place them in a pool.

Reports are current that the Big Dyke property in the township of Deloro may resume operations this fall. The plan is said to be an endeavor to carry work to deeper levels with a view to finding whether or not the gold content increases at depth. Values from surface to a depth of 100 feet, as shown in work done a year or so ago are comparatively low.

A diamond drill is being transported to the Clifton-Porcupine property and will be used for the purpose of ascertaining the extent of the continuation of ore-bodies opened up as a result of the large amount of underground work formerly done. This is expected to serve as a guide in determining the future development policy.

The Kirkland Lake District.

The proposed consolidation of the Kirkland Lake, Teck-Hughes and Orr Gold Mines is one of the chief topics of discussion in the Kirkland Lake district. It is believed, however, to be altogether too soon to esti-

mate the possibilities of this being brought about. Proposals and counter-proposals will probably be made, and no doubt the balance of the year may be occupied in an endeavor to arrange terms mutually satisfactory.

The Ontario Government has placed a force of men at work of building a road from the Tough-Oakes mine, east through Lebel township to Mud Lake for the benefit of the property owners in that district. The large amount of activity and the favorable results being achieved on such properties as the Bidgood, Wood-Kirkland, Moffat-Hall and others tends to indicate that another gold mining camp of importance may be in the making. It is believed advantage will be taken of the winter roads to transport a good deal of machinery this winter, and a number of properties will likely be equipped with mining plants by next spring.

Advices from the Argonaut Gold Mines at Beaverhouse Lake continues favorable, and the decision to carry work to a depth of perhaps 500 feet has aroused more than ordinary interest. The proving of a mine some twelve miles east from the present producing part of the Kirkland Lake gold area is regarded as being of the utmost significance—especially so on account of the mine being on an unbroken belt of rock formation extending all the way from Kirkland Lake, which makes the intervening territory highly promising from a mining standpoint.

T. J. Flynn has secured an option on the Patricia mine at Boston Creek. The price is said to be in six figures, and the option of quite short duration. This property was formerly equipped with a small mill, but the entire plant was destroyed by fire in 1919, and the property has remained idle since that time. Dr. Flynn is associated with the Matachewan Gold Mines, but whether or not he is in any way acting on behalf of that company in the present instance is not stated.

On all sides in the gold mining districts of this part of the province, everything points to increasing activity with the approach of winter and a better labor supply.

Mr. P. E. Hopkins, geologist of the Provincial Department of Mines, returned to Toronto this week after spending about three months in survey and geological work in the vicinity of Schreiber, from which localities come reports of a gold strike. According to Mr. Hopkins' report, however, it would appear as if the prospects of any big output of gold from the district are small. The Jackson claim, which was the original strike, is about three miles east of Schreiber. Mr. Hopkins states that it is a high-grade gold prospect with considerable galena also showing. The quartz vein is situated in Keewatin, close to the granite. "It is a very narrow high-grade gold vein," said Mr. Hopkins, speaking of the discovery, "it is likely that more little veins will be found, but whether they will amount to anything I could not say." He was of the opinion that the veins would prove too small to be worked. The prospect looked promising, however, and formations in the district might promise further discoveries. Mr. Hopkins is getting out a map of the whole district showing the territory fifteen by ten miles which should prove of value in further prospecting work.

TORONTO MINING STOCKS.

Following are the average quotations for gold, silver and miscellaneous stocks on the Standard Stock Exchange, Toronto, for week ending September 4th, 1920.

Silver.	High	Low	Last
Adanac Silver Mines, Ltd.	2½	2	2¼
Bailey	5	4¾	4¾
Beaver Consolidated	42½	39	42
Chambers-Ferland	7	7	7
Cobalt Provincial	45	43	44
Gifford	1½	1⅛	1⅜
Hargraves	1¾	1½	1⅞
La Rose	33½	33½	33½
McKin.-Dar.-Savage	58	55	55
Mining Corp. of Canada	1.80	1.60	1.65
Nipissing	11.05	10.25	11.00
Ophir	2½	2	2½
Peterson Lake	13½	13¼	13½
Temiskaming	33	33	33
Trethewey	27	25	25¼
Gold.			
Apex	1⅞	1½	1⅞
Atlas	13	13	13
Boston Creek Mines	17	17	17
Dome Extension	38½	36½	38½
Dome Lake	4		
Dome Mines	12.50	12.25	12.25
Gold Reef	3⅛	2¾	3⅛
Hollinger Consolidated	5.80	5.70	5.80
Keora	16½	15	15¼
Kirkland Lake	53½	52½	52½
Lake Shore M. Ltd.	1.15	1.13	1.15
McIntyre	1.98	1.93	1.93
Moneta	10	10	10
Newray Mines, Ltd.	6	6	6
Porcupine Crown	25	25	25
Porcupine V.N.T.	24¾	24	24¾
Preston East Dome	2⅞	2⅞	2⅞
Schumacher	18½	18½	18½
Teck-Hughes	10	10	10
Thompson Krist	8¼	8	8
West Dome	6½	6¼	6¼
West Tree Mines Ltd.	5½	5½	5½
Miscellaneous.			
Rockwood Oil, Gas	3½	3⅞	3⅞
Vacuum G.	25	24	24½

TORONTO COAL PRICES.

Toronto, September 9.—Toronto coal dealers report that hard coal is particularly tight and that there is practically no production. Last week's prices remain unchanged, mine run still being quoted at \$14.25 to \$14.50 f.o.b. Toronto: Smokeless coal \$14.50 to \$15.00; hard coal \$8.00 to \$11.50 gross tons at mines, American funds.

METAL QUOTATIONS.

Fair prices for Ingot Metals in Montreal Sept. 9th 1920. (In less than carload lots).

	Cents per lb.
Copper, electro	23¾
Copper castings	23½
Tin	53
Lead	9½
Zinc	10½
Aluminum	35
Antimony	8¾

NOTES FROM THE NOVA SCOTIA COLLIERIES**Production of Cape Breton Collieries of Dominion Coal Co.**

The total coal output for the month of August was about 9,000 tons less than the total output for July. The total output last month reached 260,667 tons, while the output for July was 269,116 tons. The output for August, 1919 totalled some 242,495 tons. Several one day strikes and accidents to machinery is responsible for the low output last month. The following are the individual outputs of each colliery.

No.	Tons.
No. 1	28,693
No. 2	44,564
No. 4	25,537
No. 6	19,980
No. 9	19,541
No. 10	10,317
No. 11	14,634
No. 12	14,520
No. 14	15,939
No. 15	9,066
No. 16	13,078
No. 17	2,540
No. 21	13,442
No. 22	16,898
No. 24	3,979

Total 260,667

The interesting features of the individual production of the collieries is the high percentage of Emery Seam coal, which exceeded eleven per cent of the total; the recovery of output rate in the Waterford District, and the appearance of No. 17 as a substantial producer, and the comparatively small quantity of coal coming from the older mines in the Glace Bay District, from Nos. 2 and 9 in particular.

The shaft of the hoisting engine at No. 12 Colliery broke recently, and repairs may necessitate the idleness of this colliery for several weeks. In the meantime every effort is being made to place the men at the neighboring collieries.

Labor Matters

The Royal Commission is holding final sessions in Sydney, and its Report is shortly anticipated. The miners' leaders are endeavoring to affect the findings of the Commission in their favor by giving out interviews to the newspapers threatening serious trouble unless their demands are granted in full. The judicial status of the Commission, and the etiquette of the judicial procedure is meeting with scant recognition.

In view of the undertaking of the U. M. W. representatives in Montreal in January 1918, which was that wage rates and conditions in the United States were not to be made the basis of comparisons with wage rates and conditions in Nova Scotia, it is revealing to note the statement of the President of the U. M. W. in Nova Scotia, recently given out, as follows: "One thing is certain, if the United States branches succeed in obtaining their demands for increased rates, which they have made, we, of the Canadian United Mine Workers, will make the same demands here, and we will press to have them granted. In this we shall have the support of the American miners without doubt." The President of the Nova Scotia District also expressed his opinion that "nationalization of mines will prove to be the only cure for the miners' troubles, which exist over the world today."

Miners' Relief Societies.

A disappointingly retrograde step was recently taken by the miners and steel-workers at Sydney Mines, who voted for the dissolution of the Benefit Society which, since the full operation of the Workmen's Compensation Act, has afforded relief payments in disability to work arising from sickness. This action is the more surprising, as the Glace Bay miners have decided to increase the extent of their payments and the scope of the benefits. It has been established by careful recording of statistics over many years in the Cape Breton coal-mining districts that two-thirds of the disability to which the miner is subject arises from sickness, and only one-third from occupational accident and disease. Where the sick benefit societies have not been in existence, the miners have usually been frequently requested to contribute to pithead collections for relief of the victims of sickness, and while this system has not of course proved satisfactory or equitable in practice, it has also made greater demands than the regular dues of the sick societies upon men who are thoughtful towards their neighbors' misfortune.

New Bankhead for Nova Scotia Steel & Coal Co.

The Nova Scotia Steel & Coal Company will shortly erect a concrete and steel bankhead at the Jubilee Colliery, Sydney Mines. The existing bankhead was not intended to serve as a permanent erection, and it possesses some inconvenient features. A bankhead capable for handling an immediate tonnage of 1,200 tons, and an ultimate tonnage of 2,500 tons daily is projected. Two electric winding engines are proposed, one to handle the coal from the lower seam, and one to deal with the upper seam output. Modern screening arrangements, including picking belts and shaking screens of the "Marcus" type will be employed. Box-car loaders are also to be provided. The bankhead and its equipment will be electrically operated and will include the labor-saving arrangements for tub-handling that are usual in modern bankheads.

The underground equipment of the Jubilee Colliery is of modern type, including electric storage-battery locomotives. The longwall method has been used with success, the thickness of the seams and the roof cover being, both in the upper and lower seams, well adapted to the longwall system of mining.

JUDGMENT AGAINST GRANBY COMPANY IN DISPUTE OVER TITLE TO CASSIDY COLLIERY SITE.

In giving judgment in favor of the Esquimalt and Nanaimo Railway Company, of Vancouver Island, in a very important settlers' rights suit, entitled E. & N. Railway vs. Wilson & McKenzie, Mr. Justice Gregory finds that the Granby Mining Company loses its title to the property on which it built the fine town of Cassidy a few years ago. The Granby Company has an investment there of close on a million and a half dollars.

It is quite certain—the fact is even mentioned by His Lordship in giving his judgment—that the case will be carried finally to the Privy Council in London. The Granby people are carrying on mining operations at Cassidy, which is a prosperous and growing mining centre, and work will it is understood, go ahead in any event until the disposal of the case by the highest court.

First, the appeal will be taken to the highest court in British Columbia at the sittings in October in Van-

couver, and it may be possible to secure final judgment in London some time next year.

The Granby Company purchased the property from Messrs. Wilson & McKenzie, who were executors of the estate of the late Joseph Ganner and Mrs. Dunlop. The property involved is in the Cranberry district, a few miles south of Nanaimo. The parties named had received the coal lands under the Settlers' Right Act, having been in possession of the surface rights prior to the building of the E. & N. Railway. Upon application a crown grant was issued to the Granby Company by the Government about three years ago. On February 18, 1918, the E. & N. Railway brought suit for a declaration that the crown grant is null and void, and that the plaintiff railway company is the proper owner of the coal under the old grant made by the Dominion Government in consideration of the building of the railway.

The trial was held at Victoria in January and February of this year.

"It seems to me to be abundantly established," said Mr. Justice Gregory, in giving a written decision of considerable length, "that the legal estate in the disputed lands is in the plaintiff company, and that it is the proper party to bring the action." His Lordship adds that he agrees with the ground set up by Mr. Davis in his argument that there was no proper hearing of all parties concerned as provided by the statensively into the six other questions raised by Mr. Davis in his argument.

Mr. Taylor, for the Granby Company, had urged quite vigorously that no hearing before the Lieutenant-Governor-in-Council, of which the plaintiff was entitled to notice, was necessary. He urged that the hearing was an act of the executive, that it was secret and could not be inquired into, and that in any case the executive probably had complete information before it before giving the crown grant to the Granby Company.

THE LATE MR. BEN COOKE.

Mr. Ben Cooke, who for fourteen years acted as drill demonstrator, and service man for the Canadian Ingersoll-Rand Co., died at his home, Garson Quarries, near Winnipeg, Manitoba, on August 26th, after a short illness.

Mr. Cooke was a mining man of wide experience, having started his mining career some thirty five years ago in the old Phosphate Mine near Buckingham, Quebec. Working from there through the various mining camps of the east and middle west through to British Columbia. He also spent considerable time in the Sudbury district, working at the Canadian Copper Co. as foreman of the rock house at the old Copper Cliff Mine. He also had an extensive experience in the contracting field, having for some time been in charge of the Kenora Office of the Canadian Ingersoll-Rand Co., Limited, during the time they were double tracking the C. P. R. between Fort William and Winnipeg. He was also for some time in charge of drilling for the Cooke Construction Co. on their work at the Halifax Terminals, in Halifax, N. S. and with the Norman McLeod Construction Co. when they excavated the rock for the Spanish Aero Car installation at Niagara Falls, Ontario.

He leaves a widow and three children.

Ontario's Metalliferous Production, First Half Year--1920

Returns received by the Ontario Department of Mines for the six months ending June 30th, 1920, are tabulated below, and for purposes of comparison the quantities and values are given for the corresponding period in 1919. Tons throughout are short tons of 2000 lbs.

General Remarks.

The aggregate output from metalliferous mines, smelters and refining works of the Province of Ontario for the six months ending June 30th shows a considerable increase in value over the 1919 figures. For the first time since 1903, when the Cobalt silver camp was discovered, the output of gold exceeds that of silver in valuation. The new electrolytic refinery of the British American Nickel Corporation is now in operation at Deschenes, near Ottawa.

Product.	
Gold	(ounces)
Silver	"
Platinum metals	"
Cobalt (metallic)	lbs.
Nickel (metallic)	"
Nickel Oxide	"
Cobalt Oxide	"
Other Cobalt Compounds	"
Nickel Sulphate and Carbonate	"
Lead, pig	"
Copper Sulphate	"
Copper, blister	"
Nickel in matte exported*	tons
Copper in matte exported*	"
Iron Ore, exported x	"
Iron, pig !	"
Total	

Gold.

Ontario's position as a producer of gold is becoming increasingly important. For the first half of 1920 the output was nearly 22 per cent. greater than the 1919 production. Production of gold by individual mines is presented herewith:

Porcupine.

Hollinger	\$2,928,079
McIntyre	1,085,298
Dome	989,566
Porcupine Crown	70,017
Dome Lake	46,809
Northerown	31,019
Davidson	13,489
Total	\$5,164,277

*Copper in matte was valued at 13 cents and nickel at 25 cents per pound in 1919. For 1920 the values have been placed at 14 and 28 cents per pound respectively. The total matte produced contained 15,030 tons of nickel and 7,705 tons of copper. See heading "Nickel-Copper" for explanation.

xTotal shipments of iron ore were 13,962 short tons worth \$74,073.

!Total output of pig iron was 321,826 tons valued at \$8,255,916. Figures in the table represent proportional product from Ontario ore.

Kirkland Lake.

Lake Shore	243,977
Kirkland Lake	137,676
Teck-Hughes	125,137
Total	\$506,790

From miscellaneous mines the output was \$17,138, of which the Argonaut in Gauthier township contributed \$16,938. There was also a recovery of gold worth \$2,498 from nickel-copper refining operations. In addition gold mines produced 49,156 ounces of silver worth \$56,364. During the period 673,694 tons of ore were milled — the milling capacity at Porcupine at the end of June was 5,296 tons and at Kirkland Lake 330 tons daily. The 150-ton mill of the Wright-Hargreaves mine at Kirkland Lake is nearing completion.

	Quantity		Value \$	
	1920	1919	1920	1919
Gold	277,656	231,729	5,690,504	4,666,759
Silver	4,474,322	5,744,172	5,077,028	5,951,362
Platinum metals	184. 45	30. 08	12,433	1,805
Cobalt (metallic)	113,239	59,337	266,045	93,157
Nickel (metallic)	4,854,979	5,147,745	1,696,087	1,825,347
Nickel Oxide	3,491,544	5,503	814,070	1,567
Cobalt Oxide	388,318	202,912	645,873	301,791
Other Cobalt Compounds	1,417	26,289	1,029	16,164
Nickel Sulphate and Carbonate	159,183	133,732	15,308	15,531
Lead, pig	749,820	1,481,204	71,006	54,802
Copper Sulphate	89,939	4,497
Copper, blister	2,918,153	3,080,492	470,949	452,055
Nickel in matte exported*	9,527	7,072	5,338,120	3,535,915
Copper in matte exported*	4,434	4,341	1,241,520	1,128,753
Iron Ore, exported x	2,189	5,804	18,512	44,309
Iron, pig !	28,771	24,095	738,079	670,512
Total	22,101,580	18,759,829

Silver.

The quantity of silver marketed during the period was considerably less than the output. An average price of \$1.30 per fine ounce obtained for the first quarter of 1920, while for the half year the average New York price was \$1.17 for silver in the open market as distinguished from the fixed price, retroactive to May 13th, of \$1.00 per ounce (1000 fine) under the Pittman Act for metal produced, smelted and refined exclusively within the United States. For the month of June the average open market price in New York was 90.84 cents. This disadvantage to the Ontario producer, however, was more than offset by the exchange rate. Since June the export price of silver has risen gradually until it approaches the quotation for domestic silver.

During the period a total of 4,474,322 ozs. worth \$5,077,028 were marketed. Of this total 225,513 ounces came from the Miller Lake O'Brien and Castle properties at Gowganda, 23,414 ounces from nickel-copper refining operations and 49,156 ounces from gold ores. Some producers of silver were paid for the cobalt content of ores, concentrates and residues marketed. In all \$138,317 was received for 296,116 pounds.

Refineries.

During the half year 1,445 tons of ore, 581 of con-

centrates and 1,185 tons of residues were treated in the southern Ontario refineries located at Thorold, Doloro and Welland for a recovery of 1,477,490 ounces of silver in addition to arsenic, metallic nickel, metallic cobalt and compounds of these last mentioned metals. The companies operating were the Coniagas Reduction Co., Deloro Smelting and Refining Co., and Metals Chemical Ltd., respectively. The last mentioned operated for the first three months of the year only, after which the plant was taken over by Ontario Smelters and Refiners Limited. Alterations in plant and process were made, which prevented production during the second quarter of the year. This new company also owns the plant at Chippawa formerly operated by the Standard Smelting and Refining Company. Copper sulphate was recovered from residues by one of the companies. It should be pointed out that the output of metallic nickel oxide from silver ores is small compared with that from nickel-copper refining. Only 203,713 lbs. of metallic nickel and 15,384 lbs. of oxide were marketed. In the table under the heading "Other Cobalt Compounds" are included cobalt carbonate, hydroxide, sulphate and acetate.

Nickel-Copper.

During the half year 627,681 tons of ore were raised and 520,705 tons smelted, the total output of nickel-copper matte being 28,365 tons containing 15,030 tons of nickel and 7,705 tons of copper. The British America Nickel Corporation and the International Nickel Company of Canada worked the Murray and Creighton mines respectively, while the Mond Nickel Company raised ore from the Garson, Levaek, Bruce, Worthington and Victoria No.1.

Refineries.

As regards shipments of matte, 7,944 tons went to Canadian refineries at Port Colborne, Ont., and Deschenes, Que., 16,323 tons to the United States, and 1,123 tons to Wales. During the period the new electrolytic refinery at Deschenes commenced operations and had 1,185 tons of matte in process on June 30th although no refined metals were ready for market at that date. The new plant which permits recovery of metals of the platinum group in pure form is reported to be working very satisfactorily as is also the smelter at Nickelton, one mile from the Murray mine, where the ore is smelted direct without preliminary roasting. In addition to metallic nickel, nickel oxide and blister copper, there was a by-product recovery at Port Colborne of the precious metals, gold, silver, platinum, palladium, rhodium, ruthenium, osmium and iridium. There was also a small recovery of copper in the United States from Ontario silver ores.

Iron Ore and Pig Iron.

Shipments of siderite ore from the Magpie mine by the Algoma Steel Corporation and of briquettes produced from magnetite ore by Moose Mountain, Ltd., Hutton township, totalled 13,962 short tons valued at \$74,073. The first mentioned used its entire output in the blast furnaces of the Corporation at Sault Ste. Marie, while the latter shipped its product to Quebec and the United States. The new Helen mine of the Algoma Steel Corporation has been diamond drilled and it is estimated that over 100 million tons of siderite are available for mining.

The pig iron output by the Algoma Steel Corporation at Sault Ste. Marie, Steel Co. of Canada at Hamilton and Canadian Furnace Company at Port Colborne

was 321,826 short tons valued at \$8,255,916. Only 58,387 tons or 8.94 per cent. of the total of 653,137 tons or ore charged to the 7 furnaces in blast was of domestic origin, the balance being imported from the United States. Furnaces of the Midland Iron and Steel Co., Parry Sound Iron Co., and Standard Iron Co., were not operated during the period. The output of steel from pig iron was 337,048 tons valued at \$1,661,570. These figures do not include any secondary steel produced in the electric furnace from scrap iron and turnings.

Lead.

The entire output of pig lead came from the mine and smelter near Galetta on the Ottawa River operated by the Kingdon Mining, Smelting and Manufacturing Company. The product was consigned to the Jas. Robertson Company, Limited, of Montreal, manufacturers of plumbing supplies. There is a small recovery of lead from the silver ores of Cobalt treated in the United States refineries, returns of which are received at the end of the calendar year.

PRODUCTS OF THE MINES USED IN PAINT AND VARNISH INDUSTRY.

A statistical review of the paint and varnish industry in 1918 in Canada, issued by the Dominion Bureau of Statistics, shows a varied use of the products of the mine in use as solvents, pigments and fillers.

Of interest to the coke oven industry is the use during 1918 of the following thinners and solvents, which are, or can be, the product of coal distillation:

	Quantity	Value
		\$
Creosote (gals.)	53,073	13,747
Naptha (gals.)	904,673	286,053
Benzine etc. (lbs.)	2,863,110	166,711
Benzol (lbs.)	338,639	16,133

Among the pigments and driers, is noted the use of 7,198,248 pounds of zinc oxides and lithopone, valued at \$721,527, and 1,462,636 pounds of white lead, valued at \$168,255.

As a filler, there was used the following:

	Quantity	Value
	pounds	\$
Asbestos	3,738,230	24,325
Barytes	4,326,670	76,278
Whiting	8,422,276	116,817
Pig Lead	10,593,351	874,638

Among the exports from Canada during 1918 is included 588,229 pounds of cobalt oxide and cobalt salts, valued at \$853,737, together with mineral pigments, oxides and ochres totalling 15,389 hundredweight and valued at \$18,377.

Among the exports into Canada are included considerable quantities of various preparations of lead, ochres and umbers, metallic oxides, zinc and coal tar bases.

It is evident from the statistics of the Bureau that the paint and varnish industry is an important customer of our mines, and that notwithstanding that over \$17,000,000 of paints and varnishes were manufactured in Canada during 1918, there still remains further room for expansion in the business, seeing that imports totalled \$6,309,836 worth in the same period. Of course, much of this import value was made up of primary products which enter into the finished article, and are not the product of Canada.

Stench Warnings in Metal Mines

By A. C. Fieldner (Chemist Bureau of Mines) and
S. H. KATZ (Assistant Physical Chemist,
Bureau of Mines).

Signals and warnings are necessarily of such a nature as to be perceived through one of the five senses. Most signalling devices appeal to the eye or the ear, and the principal means of sending a warning from the surface down to the miners in a metal mine has been by messengers, electric gongs or lamps, telephones, interrupting the flow of compressed air or introducing water in the compressed air lines.

Recent investigations (Katz, S. H., Allison, V.C., and Egy, W. L., Use of Stenches as a Warning in Mines, Technical Paper 244, 28 pp., 1920) of the Bureau of Mines in co-operation with several large metal-miners through the sense of smell are exceedingly simple to install and are on the whole as effective as any other system heretofore used.

Briefly, the door or stench system of warning consists of injecting one-half to one pint of a very strong smelling liquid (preferably one with a vile odor) into the main compressed air line at the surface. The air current quickly vaporizes the stench liquid and carries it to all parts of the mine where compressed air is used. Thus miners in working places operating air drills receive a positive warning to come to the surface within a few minutes after the stench has been introduced at the surface.

Nature of Stench Liquid:

Obviously a stench liquid must not produce a poisonous or injurious vapor. The warning must be harmless under all possible conditions. The odor preferably should be disagreeable rather than pleasant in order to be most effective as a warning, and should be distinctive so that there would be no danger of mistaking it.

Of the large number of substances investigated, ethyl mercaptan (C_2H_5SH) has proven most suitable from the standpoint of cost, availability and effectiveness. Ethyl mercaptan is a volatile liquid boiling at 98 deg. F. and freezing at 228 deg. F. below zero. It has a disagreeable and characteristic skunk-like odor which will not be mistaken for any odors commonly found in mines. Less than 0.01 per cent by volume of ethyl mercaptan vapor in air will give a strong odor.

Ethyl mercaptan may be obtained from certain chemical manufacturers at a cost of approximately \$2.25 a pound. It is not usually kept in stock by drug and chemical dealers. For this reason, experiments have also been made with amyl acetate, artificial "banana oil," which may be purchased from any chemical supply house or dealer in paints and lacquers.

Amyl acetate does not evaporate as quickly as ethyl mercaptan and requires a somewhat larger quantity to give a strong odor; however, in actual mine tests it proved quite effective and may be used as a second choice when ethyl mercaptan is not available. The odor is distinctive but rather pleasant to most people, and therefore is not so suitable a warning as the stench.

Practical Tests in Metal Mines:

Practical tests of stench warnings have been made with excellent results in the following mines:

North Butte Mine (copper), North Butte Mining Co., Butte, Mont.
Central Mine (gold), North Star Mining Co., Grass Valley, California.
Empire Mine (gold), Empire Mining Co., Grass Valley, California.
Bennett Mine (iron), Bennett Mining Co., Keewatin, Minnesota.
Caspian Mine (iron), Pickands, Mather and Co., Caspian, Mich.

The test at the Caspian mine with ethyl mercaptan was especially successful. A. H. Trestrail, range safety inspector, stated on coming to the surface after this test was made, that "the entire fourth level was completely saturated in about 2½ minutes and that there could be no mistake in detecting the odor." As a result of this test Pickands, Mather and Co. plan to install stench injectors on the air lines of all their underground ore mines.

Amyl acetate was used in the test at the Central mine, at Grass Valley, California. The time required for the warning to traverse various distances in the mine are given in the following table:

Observer No.	Distance by pipe, Feet.	Time in minutes.
1	4000	3
2	4800	10
3	3600	7
4	3800	4
5	7800	8

The warning was positive in all cases.

Quantity of stench liquid required for test:

One and three-fourths pints of ethyl mercaptan or three and one-half pints of amyl acetate are required for each 100,000 cubic feet of free air (compressed air and ventilating current) entering the mine per minute.

The injector is easily constructed from a stout glass cylinder, or an air-tight metal cylinder with a sight glass, and capable of withstanding the pressure in the line. It is connected both above and below the liquid to the air line with short one-half inch pipes. The stench liquid is put in through a removable plug, a valve is placed in the pipe below the liquid and one in the pipe above, the latter to allow air at the line pressure to fill the space emptied when liquid flows into the air line. Satisfactory results have been obtained by simply running the stench into the air line with no baffle for holding the liquid up to the passing air. Such an installation need not cost more than \$20 to \$30. Complete instructions for making stench warning tests and details of apparatus required are given in Bureau of Mines Technical Paper 244, which may be obtained by writing to the Director of the Bureau of Mines, Washington, D.C.

Stench warnings are not considered suitable for use in coal mines, as the stench must be introduced into the ventilating current which travels at a much slower velocity than the compressed air used in operating drills in metal mines.—U.S. Bureau of Mines, Reports of Investigations.

CYANIDE IN CANADA.

(By J. A. McRAE, Cobalt, Ont.)

A peculiar situation is developing in connection with the use of cyanide at the precious metal mines of Canada, particular in the silver and gold mining districts of Northern Ontario, including the Cobalt, Porcupine and Kirkland Lake fields.

Up until quite recently, the Cassel Cyanide Company, of Glasgow, Scotland, supplied the great majority of the mines with cyanide, the price of the chemical ranging from around 16c a pound before the war up to about 24c a pound at the present time. Although the increase has amounted to about fifty per cent above pre-war prices, yet it is interesting to note that the manufacturers of similar grade cyanide in the United States are charging the American consumer about 35c a pound. In fact at one time during the war, the price of the chemical in the United States soared to over a dollar a pound. As to this, it has always been more or less a mystery why the Cassel Cyanide Company of Glasgow did not take advantage of this opportunity to enter the remunerative United States market. This is a condition which has given rise to wonder as to whether or not the manufacturers may have some understanding among themselves as to what field they are to bid for business.

The New Competitor.

Recently, however, a new competitor has entered both the Canadian and United States field, even extending its activities to Mexico. This is the American Cyanimid Company, of Niagara Falls. Moreover, it has become quite evident that its bid for trade is one to be reckoned with quite seriously. Already the mines of the great silver mining camp of Cobalt are procuring the greater part of their cyanide from this new source, and although the inconvenience caused by using this low grade article is considerable, yet the saving in cost is said to more than compensate for this added inconvenience.

It is now interesting to learn that the leading gold mines of Canada are turning their attention to the possibility of effecting a saving by using the low grade cyanide, toward which end the Hollinger Consolidated and the Dome Mines have each ordered a carload and will conduct exhaustive experiments. Should the tests prove to be satisfactory, it conveys the threat of possibly eliminating the Cassel Cyanide as a serious competitor.

The truth appears to be that although the product of the American Cyanimid Company is low grade as compared with the Cassel cyanide, yet by using large quantities of the low grade material the same result is obtained, and that about 19 or 20 cents worth of the low grade material goes as far as about 24 cents worth of the high grade article.

It seems to be quite obvious, therefore, that in order to continue to do business in this country the Cassel Cyanide Company will be obliged to do some close figuring and possibly reduce its price to around 19 cents a pound. In event of this, the mines would probably be found giving the high grade article the preference.

An Expression of Fear.

Among certain representative mining men the fear is expressed that the precious metal mines are beset with danger on account of the present situation. They point to the fact that in the chemical industry in various countries a careful study reveals the fact that

when one competitor begins to find business unprofitable it is very often found ready to retire entirely from the field, its successful rival paying a fair amount as compensation. This gives rise to the thought that were the American Cyanimid Company to offer the Cassel Cyanide Company a lump sum to retire from the Canadian field, just what would be the result? In event of this it is asked, would the successful competitor be willing to continue to sell cyanide at the present extremely low margin of net profit, or would advantage be taken of the opportunity to increase net earnings.

The mining men anticipating the possibility of such a result as that outlined are in the minority, and the majority seem to believe the Cassel Cyanide Company will never retire from the field. It is due to this that close observers scent the smoke of a possible battle, in a contest waged on the one hand by the Cassel Cyanide Company and on the other by the American Cyanimid Company. It is intimated that interests closely associated with the Dupont Powder Company are vitally interested in the affairs of the American Cyanimid Company. This being so a lively contest may develop provided the Cassel Cyanide Company decides to remain in the field.

Those who have followed the trend of developments in every phase, are free to admit that the fears expressed have some little foundation, and that the present is the time for mine operators to give the matter careful study.

First of all, the body best suited to take up the question is the Ontario Mining Association, representing as it does the great majority of precious metal mines in this country. It does not seem to be too much to expect that this association might find it advisable to encourage the Cassel Cyanide Company to remain in the field as a serious competitor for Canadian business.

Cassel Cyanide of Canada, Ltd.

This view is strengthened by the fact that only a few months ago, the Cassel Cyanide Company of Canada, Ltd., was incorporated as a subsidiary of the parent company in Glasgow. While the functions of this new organization have never been officially outlined, there are many reasons for believing that it may prove to be the nucleus of a powerful company on this continent, with a large plant to be erected along the border of the two countries, Canada and the United States, and bidding for the trade of the entire continent.

Competition of this kind would likely be beneficial to the mines, as it would tend to reduce the price of cyanide to a minimum.

To sum up the situation: On the one hand is the possibility of competition being eliminated with results not beneficial to the mines, while on the other may be seen the possibility of competition being ultimately intensified. The question is: Which will it be?

QUICK LOADING OF COAL FREIGHTER.

What is claimed to be a world's record in the loading of a coal freighter was established by the Baltimore and Ohio Railway at its Curtis Bay coal piers on May 10th. A cargo of 6,967 tons of coal was placed in the S. S. "Malden", belonging to the New England Gas Company, in 2 hours 44 minutes, an average of 2,548 tons an hour. The "Malden" is well known in Cape Breton ports from whence she has freighted coal for the Everett Gasworks.

Contribution of Oil Geology to Success in Drilling

(Bulletin of Associated Petroleum Engineers). FREDERICK G. CLAPP, Chief Geologist.

The question is frequently raised as to what proportion of geological work has resulted in successful wells or what proportion of favorable structures have ultimately been found productive. In the early days of applied geology the percentage of success was not so high as now. Since then geology has attained a high degree of efficiency and accuracy and has become a recognized branch of engineering applied to the oil business. During the first few years of this century oil was supposed to be found mainly in anticlines, or rather, geologists were supposed to credit oil as existing only in anticlines, as anticlines constituted the most important type of geological structure that geologists then knew to be productive. During the past fifteen years the situation has changed to such an extent that a considerable number of other types of structure are known to be petroliferous in regions where other conditions are satisfactory. Every particular type of structure is given a technical name and studied from the standpoint of the habit of oil when associated with that particular type.

When we realize that fully ten different classes and twenty sub-classes of geological structures are favorable for oil, we understand the complexities of the petroleum geologist's work. His difficulties are doubled when it is necessary also to consider the degree of metamorphism or natural alteration in character of the strata, their hardness and porosity, the number and character of the "sands" that are expected to be productive, their known or calculated depth, whether certain beds are persistent or lenticular, their geological age, water conditions, etc. Although some persons expect a geologist or petroleum engineer to be infallible in his advice, it is generally understood, after a realization of the difficulties encountered in making predictions, that infallibility may not reasonably be expected and that the percentage of successful wells depends not only on the accuracy and quality of the geological work and the abundance of geological outcroppings but also on the variability of unknown underground conditions, such as porosity, metamorphism, water problems, levels, etc., which frequently have no evidence on the surface.

Consequently the success of drilling based on geological advice can be represented by a different factor in practically every oil producing country, state or county in the World. For instance, in nine townships in Northern Oklahoma, Frederick G. Clapp has calculated that success in drilling increased from about 60 per cent. previous to 1913 (during which time no geological advice existed in the region) to 87 per cent. throughout the years 1913-1916 in the wells drilled entirely on locations made by the geologist.

Dorsey Hagar shows, in a paper presented before the American Institute of Mining Engineer, (Vol. 57, 1917, page 892), that 70 per cent of the pools located in Oklahoma, during the four years immediately preceding October, 1917, were opened on geological ad-

vice. He has also calculated that whereas only one well in 150 had opened a new pool in ordinary haphazard drilling in Oklahoma, on the other hand under geological advice one well in three had opened new pools. Hence, he states, an oil operator who prospects on the basis of geology has 50 times as much chance of striking a pool as one who does not.

Similar results have been found by other writers on the same region, more recently. Oklahoma stands at the head of oil-producing states respecting appreciation of geology, and is fourth from the bottom in the proportion of dry holes. Out of a total of 8,196 wells in 1919, Oklahoma had 62.4 per cent. of oil wells and 10 per cent. of gas, while but 27.6 per cent were dry.

In this connection it is interesting to note that Dorsey Hagar in another paper (Trans. Am. Inst. Min. Engrs. February, 1917, pp. 195-8) finds that out of the 75 most important oil pools of Oklahoma and Kansas located during the same year, all but four are on well defined structures such as domes, anticlines or terraces.

It should not be supposed that such a high degree of geological success as in Oklahoma can be attained everywhere. Nevertheless, The Associated Petroleum Engineers had only one failure in Wyoming from 1915-1917; the only wildcat well recommended in Canada was a success; and in Southern Oklahoma three new domes, deciphered in detail and recommended for testing, have all resulted in new pools. Whereas these illustrations perhaps show the extremes of success, the other extreme may be found where a geologist is asked to make a location in a region where he must tell his clients frankly that the chance is not good. Accordingly, all that he can do is to select the least unfavorable location: that is, the location where oil will be found if it exists at all in the territory in point.

In drilling without the aid of geology, there is, of course, complete failure in certain states which have been considerably prospected but where oil does not exist. Among oil producing states, on the contrary, the highest percentage of failure without geological advice has been 45.4 per cent. in the Gulf Coast fields of Texas and Louisiana. This applies where all the fields lie on saline domes, seldom more than one or two miles in diameter, many of them not apparent topographically, and hence with a chance not greater than 1 in 1000 of striking oil by an ordinary "wildcat" well.

The statistics tell us that out of the 1,236 wells drilled in the Gulf Coast fields in 1919, 52.6 per cent. were oil wells, 2. per cent. gas wells, while, as above stated, 45.4 per cent. were dry holes. Inasmuch as the figures include both wells located inside or in extension of fields and also "wildcat" it is evident that a consideration of "wildcat" alone would result in an extremely small percentage of success. Although many persons suppose a geologist to be of no great value in the Gulf Coast fields, this is far from being true. Geology has in many cases discovered

* 120 Broadway, New York City, July 28, 1920.

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saline domes and is furthermore of great value in properly locating new tests on domes which have been inadequately tested. The domes are so peculiar in type and results that after as many as fifteen wells have been drilled on a dome without success, yet later a field has been located on the very same dome. Every well that is drilled on a dome furnishes evidence for the geologist in making recommendations for the drilling of a well that will ultimately find production. The utility of geology in the Gulf Coast dome locations is properly attested by the fact that the Spindletop dome, the first one opened up, was drilled by Capt. A. F. Lucas, a mining engineer, who had given years of study to the subject.

Next to the Gulf Coast fields in proportion of dry holes, considering both those drilled on geological advice and those without, are the Illinois fields, which in 1919, out of total of 370 wells drilled, yielded 68.4 per cent. of oil wells, 1.3 per cent. gas wells and 30.3 dry holes. This is probably a lower percentage of success than would have attained in Illinois during the height of drilling in that state some years earlier. While the original drilling in Illinois may have been done largely without geological information, it is a fact that in recent years geology has been of tremendous assistance in Illinois, particularly in warning prospective investors away from unfavorable territory. Undiscovered potentially productive domes do exist in Illinois, yet nearly all structures and supposed structures which the Associated Petroleum Engineers have been called to examine in that state have for one reason or another been decidedly unfavorable. Notwithstanding the general flatness of the surface of northern and western Illinois and its deep covering of glacial drift, there are many portions of the state where detailed geological studies can be made and where results are of great value.

One who understands the high degree of success attained in Wyoming may be surprised to learn that 7 per cent. of the 303 wells drilled in that state in 1919 were dry, 8.9 were gas wells, while only 62.4 per cent. resulted in oil wells. It must be realized that a large proportion of drilling in Wyoming has been of a "wildcat" nature, that not all of the formations outcrop at the surface as prominently as in the Salt Creek, Big Muddy and other well known fields, and that in many cases little data are available to guide the geologist. However, as stated above, the results of at least one geologist as to Wyoming have been 80 per cent. successful.

The Central Ohio fields in 1919, out of a total of 940 wells, had 23.6 per cent. of dry holes as compared with 47.8 per cent. oil wells and 28.6 gas wells. Since Ohio has great gas fields, it is a fair assumption that a large proportion of the gas wells were actually drilled for gas and hence successful. The market is such that gas has sometimes as great value as oil. In the Central Ohio oil fields conditions are more difficult in some respects than in any part of the United States, because in the northern portion the formations are buried deeply by glacial drift, while throughout the fields the general structure is that of an eastwardly dipping monocline or homocline in which oil has accumulated at localities of slight interruption of the dip or of change in texture of the sand. Such localities are found by careful fieldwork south of the drift border and where the drift covering is slight.

Although the value of geology might be supposed to be slight in the Central Ohio fields, yet as the result of extended explorations made in those fields by The Associated Petroleum Engineers and other geologists, several good pools have been opened up. While the proportion of successes there is lower than in many other states, it is, nevertheless, so considerable that, because of the great value of Ohio oil, the geological work has been eminently desirable. In Central Ohio, as in the Gulf Coast, one must not depend on finding the pool by a single test. The proper plan is to drill first on what is apparently the most favorable part of the structure. This generally results in a "showing" of some sort and it is then desirable to work up or down dip towards the center of the structure, according to whether a showing of oil or of gas or of both be found. Companies that have proceeded on the assumption that a pool could be located by a single test have in some cases failed of success, while other companies later entered the very same fields and "proved up" the pool by making two or more tests.

In Kansas, out of the total of 3,432 wells drilled in 1919, 75.8 per cent. were oil wells, 5.5 per cent. were gas wells, while only 7 per cent. were dry holes. A large proportion of the latter were "wildcats" drilled in the extreme eastern part of the state or in outlying unproductive counties in hunting a repetition of the known big pools. The Augusta-Eldorado fields were discovered largely owing to geological fieldwork, and it has seemed reasonable to suppose that similar fields would be found on similar anticlines in central Kansas. This has been tried, and some cases of failure may be due perhaps to the fact that granite comes within drilling distance of the surface under a wide area in central Kansas. These factors bring down the percentage of geological successes in that state, but they do not affect the percentage in non-granite parts of the state or in other states where granite does not approach the surface.

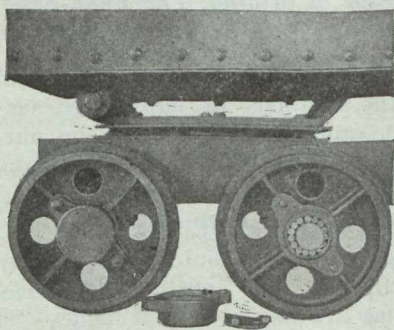
Among the oil-producing districts of the United States, that one with the highest degree of success in 1919 from all classes of wells, including "wildcats" and those geologically located, was Kentucky. There 3,716 wells were drilled of which 85. per cent. achieved success as oil wells, while 3.7 were "gassers" and only 11.3 were failures. This is a remarkable record and refutes the remark sometimes made that geology is of little value in Kentucky. In Kentucky fields geologists have been active as in no other part of the United States, except Oklahoma and Texas, and a large proportion of the pools are in favorable geological structure.

In a general way, the use of geology has kept pace with the oil industry. Although there were no petroleum geologists for about 20 years after the discovery of petroleum in this country and although in 1908, when the consulting office of Frederick G. Clapp was opened in Pittsburgh, only one other oil geologist in the United States had a consulting office, yet by November, 1918, the columns of The Oil and Gas Journal carried 19 professional cards of petroleum geologists and engineers. By June, 1920, this number had increased to 43, most of these cards representing more than one individual. This depicts only the private practice phase of the profession. In addition, a number of the larger oil companies now maintain

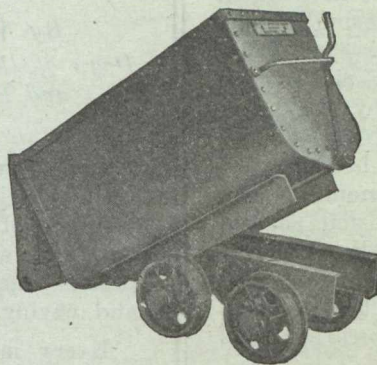
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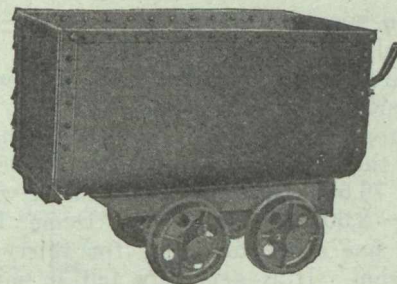
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geological staffs of considerable size. Thus the petroleum geologist or engineer has taken his place in the business as an essential factor.

Many persons believe that geological activities are directed mainly to the discovery of new pools or new producing regions. This, however, applies to but one part of the profession and that the oldest one. At the present time, fully as important a group consists of the resident geologists in large fields and the research men on the large staff whose business it is to study all factors of importance that may affect the production of known fields or be otherwise of interest to the business.

Another new province is that of appraisal. If proficient in the appraisal field the geologist becomes fully entitled to be known as a petroleum engineer. He is called into consultation by companies desirous of making purchases in order to evaluate producing and potential properties. By means of decline curves, character, thickness and oil content of sands, spacing of wells, water and gas conditions and other factors, the petroleum engineer is enabled to estimate closely what a property will produce in future.

THE POLITICAL EMBARRASMENTS OF CANADA'S FUEL WEAKNESS

Canada's important function in foreign affairs is frankly stated by Sir Auckland Geddes, British Ambassador to the United States. He calls upon Canada to play a large part in the building of a "golden bridge of sympathy and understanding" between the British Empire and the United States. "On the basis of such a friendship the peace of Europe could be es-

tablished," says the Ambassador. "I doubt if for many years it could exist in any other form."

It follows that the role this country is called upon to play is an essential one. Upon Canada's service to the cause of world peace the highest considerations depend. The opportunity and the responsibility are both impressive.

In this connection, it is most unfortunate that Canada should depend upon the United States for coal. Canada's fuel weakness is a fertile source of misunderstanding and trouble. It remains an invitation to the worst elements in American politics to involve Canada in their anti-British crusade, and it causes our best friends across the border endless embarrassment. Industrial quarrels, now so prevalent, aggravate the condition.

Sir Auckland Geddes has devoted himself passionately to the cause of Anglo-American goodwill. For the tricks and arts of diplomacy he substitutes a frank and open appeal to the good sense of the people. His is a momentous duty, in which he has the sympathy of all Canadians. He deserves practical assistance as well. Whatever Canadians can do to silence the voices of mischief-makers should be done resolutely and without delay. And let us take steps to wipe out this lingering coal disgrace by developing the huge coal resources of our own country to the end that the American people may have in Canada, a self-respecting, self-sustaining neighbor.—"Montreal Star."

PERSONAL

Mr. Samuel W. Cohen of Montreal, is now in Newfoundland on examination work.

TORONTO NOTES

At a special meeting of the Dome Mines Company, Limited, held in Toronto this week the proposals of the directors to purchase the property of the Dome Extension Company were ratified. The shareholders were represented by proxies exceeding 360,000 shares. With the taking over of the Dome Extension property, 76,667 shares of Dome stock will be distributed among 2,300,000 shares of Dome Extension, which means one share of Dome for thirty shares of Dome Extension. It is generally felt in mining circles that the taking over of the Dome Extension by the Dome Mines will add considerably to the wealth of the Dome if the recent exploration work can be depended upon. It was recently reported that diamond-drilling operations by the Dome on Dome Extension showed important ore bodies. The negotiations between the two mines have been going on for some time, and last March, owing to the incompleteness of the explorations, an extension of the option was secured until September.

The English Electric Company, Ltd., in addition to their four plants in England has purchased the Siemens Works at Stafford and has taken over the business of the Siemens Company of Canada Ltd. The English Electric Co., Ltd., will handle a complete line of electrical equipment. Offices will still be at Transportation Building, Montreal and Mr. C. W. Stokes remains as manager.

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Hendrick Manufacturing Co.

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Pennsylvania Smelting Co.
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Mine and Smelter Supply Co.

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

Ball Mill Linings:

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

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

Belting:

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

Belting—Silent Chain:

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Hans Renold of Canada, Limited, Montreal, Que.
Jones & Glasco (Regd.)

Belting (Transmission):

Goodyear Tire & Rubber Co.

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Bluestone:

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Northern Electric Co., Ltd.

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Diamond Drill Carbon Co.

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Hendrick Manufacturing Co.

Brazilian Ballas:

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Diamond Drill Carbon Co.

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Mussens, Ltd.
The Wabi Iron Works
R. T. Gilman & Co.

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

MINING OPPORTUNITIES IN MANITOBA

Mineral Areas

Approximately three-fifths of the total area of Manitoba is Pre-Cambrian. In the Pre-Cambrian of Ontario, the well-known camps of Sudbury, Cobalt and Porcupine have been developed. In Manitoba, there was but little prospecting before 1912, when the Rice Lake Camp was opened up, and the Hudson Bay Railway gave access to the mineral areas in Northern Manitoba. Attention is being directed particularly to the Pas Mineral Belt and the Rice Lake Area, but prospecting is being carried on in the Cross and Pipestone Lake Area, the Oxford Lake, Knee Lake, God's Lake and Island Lake Area, and the West Hawk Lake, Falcon Lake, Star Lake Area.

Development

Since 1915, development has been rapid in the Pas Mineral Belt. Twenty million tons of low-grade copper ore have been explored by diamond drilling at Flin Flon Lake and are now being actively developed under option. High grade copper is exported from Schist Lake to the smelter at Trail, B.C.; over seven million pounds of copper have already been realized. Other copper prospects are under development and the building of a smelter at the Flin Flon property will lead to the establishing of a large copper industry. Gold is now produced at Wekusko (Herb) Lake, and active underground development work is being carried on at Wekusko Lake, Copper Lake and in the Rice Lake District east of Lake Winnipeg.

Transportation

Transportation is available to the Rice Lake Area by steamboat from Winnipeg to the Hole River, and thence by launch and Provincial wagon road. The Copper Belt is reached from The Pas by the Ross Navigation Co's. steamboats to Sturgeon Landing, thence by wagon road and canoe. Herb Lake is reached from Mile 82 on the Hudson Bay Railway (less than one day from The Pas.)

Mining Regulations

The mineral resources are under Federal control and the Federal mining regulations apply to Manitoba. No mining license is required. Work to the value of \$100.00 a year must be performed for a period of five years on claims filed under the quartz mining regulations. The office of the Mining Recorder for the Rice Lake district is in Winnipeg, and for The Pas Mineral Belt at the Pas.

Opportunities

The districts are comparatively new, and on the eve of substantial development. There are good opportunities at the present time for prospectors, mining companies, and particularly for development companies.

For maps, reports and general information, apply to—

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THE PAS, MANITOBA.

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Osborn, Sam'l (Canada) Limited.
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The Wabi Iron Works

Conical Mills:

Hardinge Conical Mill Co.

Copper:

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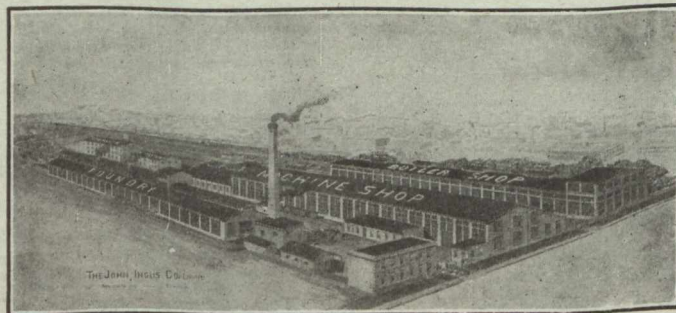
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- Cyanide:**
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R. T. Gilman & Co.
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Diamond Drill Contracting Co.
E. J. Longyear Company
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Sullivan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

Canadian Miners' Buying Directory.—(Continued)

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

Canadian Miners' Buying Directory.—(Continued)

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

Nails:
Canada Metal Co.

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

Nickel Anodes:
The Mond Nickel Co., Ltd.

Nickel Salts:
The Mond Nickel Co., Ltd.

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

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

Oil Analysts:
Constant, C. L. Co.

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

Ore Sacks:
Northern Canada Supply Co.

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

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

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

Paints—Special:
Spielman Agencies, Regd.

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

Permissible Explosives:
Giant Powder Company of Canada, Ltd.

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

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

Pillow Blocks:
Canadian Link-Belt Company

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

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

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

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

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

Platinum Refiners:
Goldsmith Bros.

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

Powder:
Giant Powder Company of Canada, Ltd.

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

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

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

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

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

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

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

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

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

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

Pumps—Diaphragm
The Dorr Company

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

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

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

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

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

Refiners:
Goldsmith Bros.

Elddles:
Hendrick Mfg. Co.

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

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

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

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

Canadian Miners' Buying Directory.—(Continued)

Rope—Wire:

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

Rolls—Crushing

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

Samplers:

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

Scales—(all kinds):

Canadian Fairbanks-Morse Co., Ltd.

Screens:

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

Screens—Cross Patent Flanged Lip:

Hendrick Mfg. Co.

Screens—Perforated Metal:

Hendrick Mfg. Co.

Screens—Shaking:

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

Screens—Revolving:

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

Scheelite:

Everitt & Co.

Separators:

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

Shaft Contractors:

Hendrick Mfg. Co.

Sheet Metal Work:

Hendrick Mfg. Co.

Sheets—Genuine Manganese Bronze:

Hendrick Mfg. Co.

Shoes and Dies:

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

Shovels—Steam:

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

Ship Bunkering Equipment:

Canadian Mead-Morrison Co., Limited.

Silent Chain:

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

Silent and Steel Roller:

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

Silice:

Coniagas Reduction Co.

Saline Refiners:

Goldsmith Bros.

Smelters:

Goldsmith Bros.

Sledges:

Canada Foundries & Forgings, Ltd.

Smoke Stacks:

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

Solder—Bar and Wire:

Hoyt Metal Company.

Special Machinery:

John Inglis Co., Ltd.

Spelter:

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

Sprockets:

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

Spring Coil and Clips Electrico:

Canadian Steel Foundries, Ltd.

Steel Barrels:

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

Swamp Forgings:

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

Steel Castings:

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

Steel Drills:

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

Steel Drums:

Smart-Turner Machine Co.

Steel—Tool:

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

Structural Steel Work (Light):

Hendrick Mfg. Co.

Stone Breakers:

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

Sulphate of Copper:

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

Sulphate of Nickel:

The Mond Nickel Co., Ltd.

Surveying Instruments:

C. L. Berger

Switches and Switch Stand:

Canadian Steel Foundries, Ltd.
Mussens, Limited.

Switches and Turntables:

John J. Gartshore

Tables—Concentrating:

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

Tanks:

R. T. Gilman & Co.

Tanks—Acid:

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

Tanks (Wooden):

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

Tanks—Cyanide, Etc.:

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

Tanks—Steel:

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

Tanks—Oil Storage:

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

Tanks (water) and Steel Towers:

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

Tires—Auto, Truck and Bicycle:

Gutta Percha & Rubber, Ltd.

Canadian Miners' Buying Directory.—(Continued)

- Tramway Points and Crossings:**
Canadian Steel Foundries, Ltd.
Hadfields, Limited
- Transits:**
C. L. Berger & Sons
- Transformers:**
Canadian Fairbanks-Morse Co., Ltd.
R. T. Gilman & Co.
Northern Electric Co., Ltd.
- Transmission Apparatus:**
Jones & Glassco (Regd.)
- Transmission Machinery:**
Canadian Link-Belt Co., Ltd.
Hans Renold of Canada, Limited, Montreal, Que.
Jones & Glassco (Regd.)
- Troughs (Conveyor):**
Hendrick Manufacturing Co.
- Trucks—Electric:**
Canadian Fairbanks-Morse Co., Ltd.
- Trucks—Hand:**
Canadian Fairbanks-Morse Co., Ltd.
- 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.
- Twinoxes:**
Canada Foundries & Forgings, Ltd.
- Uranium:**
Everitt & Co.
- Weighing Larries:**
Canadian Mead-Morrison Co., Limited.
- Welding—Rod and Flux:**
Prest-O-Lite Co. of Canada, Ltd.
Imperial Brass Mfg. Co.
- Welding and Cutting—Oxy-Acetylene:**
Prest-O-Lite Co. of Canada, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Imperial Brass Mfg. Co.
- Wheels and Axles:**
Canadian Steel Foundries, Ltd.
Hadfields, Limited
The Electric Steel & Metals Co.
The Wabi Iron Works
- Winches—Power Driven:**
Canadian Mead-Morrison Co., Limited.
- Winding Engines—Steam and Electric:**
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—Bare and Insulated:**
Canada Wire & Cable Co.
- Wire Rope:**
R. T. Gilman & Co.
Canada Wire and Iron Goods Company.
Canada Wire & Cable Co.
Dominion Wire Rope Co., Ltd.
- Wire Rope Fittings:**
Canada Wire and Iron Goods Company.
Canada Wire & Cable Co.
- Wire Cloth:**
Northern Canada Supply Co.
Greening, B. Wire Co.
Canada Wire & Iron Goods Company
- Wire (Bars and Insulated):**
Standard Underground Cable Co. of Canada, Ltd.
Northern Electric Co., Ltd.
- Wolfram Ore:**
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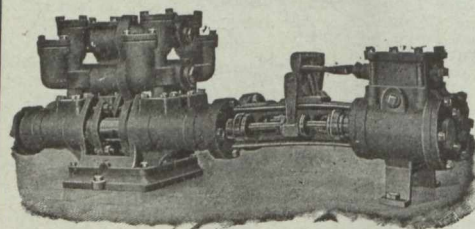
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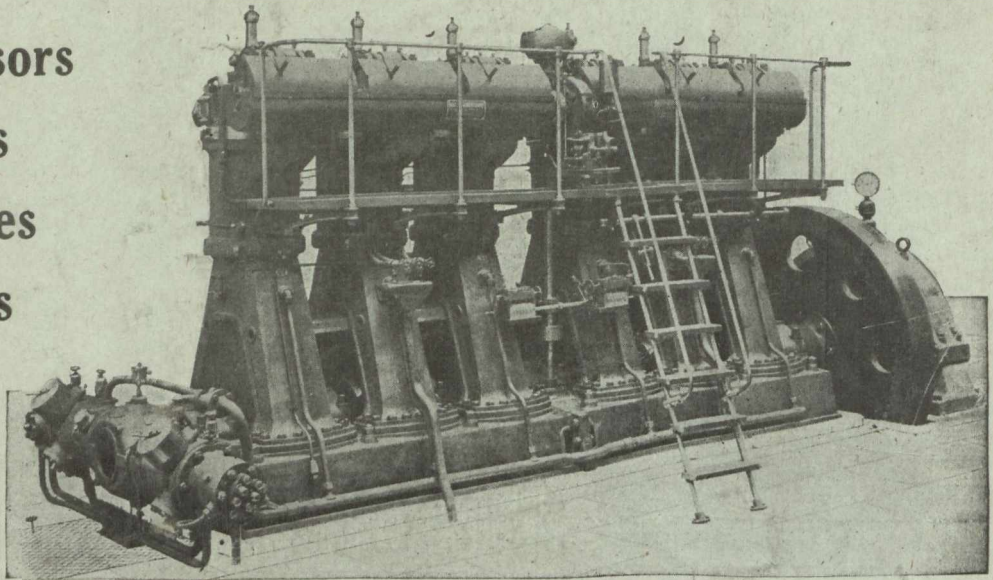
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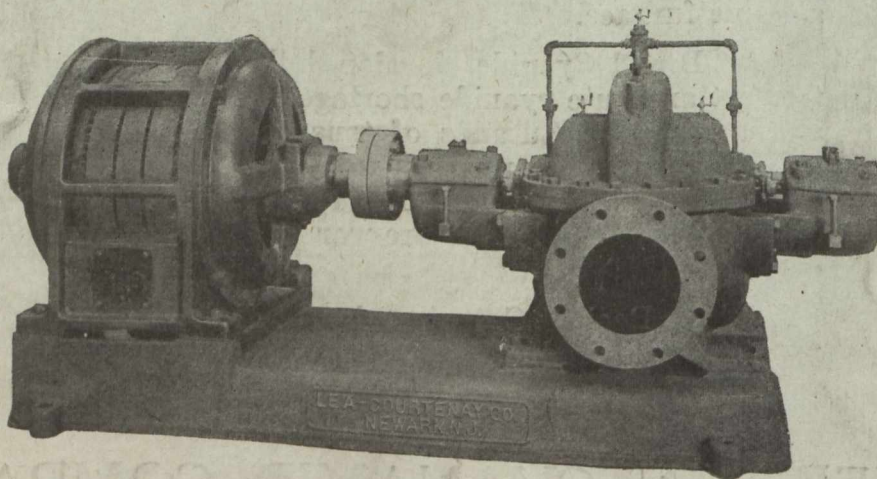
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