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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 2

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Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

THE CANADIAN MINING JOURNAL

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The Canadian Mining Journal

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REGINALD E. HORE

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CONTENTS.

THE NICKEL QUESTION

Having started an agitation in favor of the prohibition of the export of nickel matte, some of the newspapers seem very unwilling to believe that the nickel industry does not exist simply for the purposes of our enemies. The Toronto World claims that nickel matte should not be shipped to the United States because only in that way can we be assured that it shall not reach Germany. As there is no refinery within the Empire that is available for the Canadian Copper Co. the World virtually demands that the company's mines and smelters in the Sudbury district be closed down and the Mond Nickel Co. be given complete control of the Canadian nickel industry until another market is found for the matte turned out by the Canadian Copper Company's smelter.

The Mond company is getting along very nicely and needs no such assistance. Indeed, it is unlikely that the directors would take, during the war, undue advantage of the monopoly which the World proposes to give to it unrequested.

But even if the Canadian Copper Company's business was temporarily taken away the Mond Company could not meet the requirements. While the newspapers seem to be of the opinion that nickel is a metal used only in Germany, nickel is in fact being used much more largely by the Allies and friendly neutrals. Before the war Germany was one of our best customers for nickel, but by no means our only one nor our largest one. Since the declaration of war no known shipment of Canadian nickel has been made to Germany while the consumption in the United States, England, France, Russia, Japan and Italy has been undoubtedly large. These countries the Mond company would be quite unable to supply with sufficient quantities of nickel during the war.

And under these circumstances the Toronto World, with the best of intentions we believe, asks that the export of nickel matte be prohibited. The World wishes above all things to help Britain and to handicap Germany in the present war. So do we. So do all good citizens of the British Empire. But should we allow our patriotism to make us blind to the Allies' interests while we are endeavoring to keep our nickel from Germany? Would it be wise to adopt such measures to do away with a traffic concerning the existence of which we have no evidence of any kind?

The World contends that Canadian nickel must not be shipped to Germany for the construction of armament with which to destroy British ships and the armies of our Empire and our Allies in the field. To

this we heartily subscribe. But the World goes further and asks that without any evidence that nickel is being shipped from the United States to Germany we should forbid the export to the United States. To this we dissent.

The United States is by far the largest consumer of Canadian nickel. During 1912 we exported to Great Britain matte containing 5,164,512 pounds nickel and to the United States matte containing 44,224,119 pounds nickel. To other countries we sent 70,386 pounds nickel in matte. The total matte imported by the United States in 1913 contained 47,446,520 pounds nickel. New Caledonia, therefore, sent to the United States not more than 2,885,811 pounds nickel in matte.

During 1912 the United States imported matte containing 46,317,078 pounds nickel and in 1913 matte containing 47,446,520 pounds. The exports of nickel and nickel oxide during these two years amounted to 25,815,016 and 29,173,088 pounds. No matte is known to have been exported during the period. Nearly one-half of the nickel, therefore, remained in the United States.

The United States is using in its industries and its armament about 20,000,000 pounds of nickel per year, or about four times the amount which we exported directly to Great Britain during 1913. Obviously, therefore, the United States is almost as much interested as we are in the regular operation of our mines and smelters.

Of the nickel exported by the United States during the past few years Germany undoubtedly received a large share. We have no authoritative figures, but, from various published statements which we have seen, it is evident that Germany has bought large quantities, especially in the past few years. Other European countries were also large buyers, however, and will doubtless continue to be if nickel is available.

The World states that if the nickel is once adrift in the United States it can and will leave that country in a thousand ways, and that it can and will find its way to the highest market, Germany. That efforts will be made to take advantage of the high price Germany is willing to pay for nickel is to be expected. There lies danger and it must be guarded against. That it is being guarded against is, however, well known.

REFINING NICKEL IN CANADA

The Toronto World favors immediate legislation to compel the Mond Nickel Company and the International Nickel Company to refine their nickel matte in Canada. The World would settle difficult problems very simply if it had its way.

We would like to see nickel refineries established in Canada. It has long been hoped that we would soon be able to export nickel, nickel oxide and copper, instead of nickel-copper matte. The operating companies so far have been content to smelt the Sudbury district ores in Canada and refine the matte abroad.

The practice of the Canadian Copper Company at Copper Cliff is to roast the ore, then smelt the roasted ore in blast furnaces and then re-treat the blast furnace product in large rotary converters. In the process of roasting, the sulphur content is reduced from about 25 per cent. to 12 or 13 per cent., and iron is oxidized. The roasted ore consists therefore of a mixture of sulphide minerals and iron oxide. The roasted ore is smelted with coke, quartz being used as a flux, in a strongly oxidizing atmosphere. Copper and nickel combine with sulphur in the furnace to form what is known as matte. The iron oxide combines with the quartz, forming a slag. The company's six furnaces have a total capacity of over 2,000 tons of ore in 24 hours.

The furnace matte, as it is called, contains about 6 per cent. copper, 16 per cent. nickel, 47 per cent. iron and 27 per cent. sulphur. This furnace matte is treated in converters by blowing air through it. The air oxidizes the iron and the iron oxide forms with quartz or other silicious matter in the furnace a slag. The removal of this slag leaves a final product containing about 25 per cent. copper, 55 per cent. nickel, 19 per cent. sulphur and a little iron.

This product, known as Bessemer matte, is shipped to New Jersey to be refined. Why? Mr. Monell's answer to this question is not very enlightening. He states clearly that his company is not influenced by Germans, nor shipping nickel to Germany. But regarding the refining of nickel matte he says, "While recognizing that refining at the point of production, i.e., the mines, is the ideal condition, economic conditions, seriously affecting cost of production, have dictated the present location of nickel refining, and with the present state of the art, any material change in such economic conditions would react in a manner most detrimental to the Canadian nickel industry." We expected something more definite than this statement from Mr. Monell. It is generally understood that the present location of the refinery has many advantages. But we can hardly subscribe to Mr. Monell's statement that a change would be so disastrous to the Canadian nickel industry.

We are willing to agree that a change might seriously affect the profits of the International Nickel Company, and that the men who have built up the industry deserve some consideration. In a letter published in our last issue Mr. R. W. Leonard argues that the refining could be economically done in Canada, and he seems to be of the opinion that present investments in plants abroad should therefore be sacrificed and plants established here. We would like to see the change made; but we are not convinced that men who build up an industry in Canada should be penalized because they also built up an industry in the United States which might have been built up, though at greater cost, in Canada.

Before the formation of the International Nickel Company the product of the Canadian Copper Com-

pany was sold to the Orford Copper Company of New Jersey. The latter company owned a very satisfactory process for refining the matte. The Canadian company owned the ore deposits. Each had a good thing. If the Orford company had failed to recognize the value of the process the Canadian Copper Co. might have obtained control and established its own refinery, but the Orford company knew it had a good thing and held on. The International Nickel Co. took over both Canadian Copper and Orford Copper Companies.

It would evidently have been unwise to close down the New Jersey plant at that time, and so the shipment of matte from Copper Cliff was not discontinued. From the company's standpoint we imagine that economy still says that the refining be done in New Jersey. But that the Canadian nickel industry would suffer a serious reaction if the company established a plant in Canada passes our comprehension.

We cannot agree with the World nor with all of Mr. Leonard's views; but neither can we accept Mr. Monell's statement regarding refining of nickel matte in Canada.

COPPER SMELTING IN CANADA

Professor G. A. Guess' article in this issue will serve to show that Canada can claim the credit for some of the most marked recent advances made in copper smelting. The work of Mr. D. H. Browne and his associates at Copper Cliff in connection with coal dust firing of reverberatory furnaces is of first importance to copper metallurgists. Mr. Browne's description of the furnace now in operation at Copper Cliff has just been published in the bulletin of the American Institute of Mining Engineers and we reprint it along with extracts from Mr. L. V. Bender's paper on the same subject. Perusal of these three articles will give some idea of the value of the process worked out by the metallurgists of the Canadian Copper Co.

Another distinct success in copper smelting has been achieved by the Granby company. The new smelter at Observatory Inlet, B.C., is to be the largest pyritic smelter in America, and it is being operated very successfully. The cost per pound of copper is very low, exceeding all expectation. During the summer the furnaces were not running satisfactorily. Professor Guess, who was called in to advise the company, spent a few months at the property in the fall and made changes which have greatly improved the practice.

It has often been remarked that most of the American copper smelting plants are in charge of Canadians. According to Dr. Peters about sixty per cent. of the United States copper is made by Canadians. And it is also worthy of note that the greatest advances made in smelting in the past decade have been in copper smelting. Canadians have had much to do with the success of copper smelters in the United States. The plants at Copper Cliff, Grand Forks, and Observatory Inlet compare favorably with any others in America.

CANADIAN MINING INSTITUTE

Representation on the Council of the Canadian Mining Institute is all out of proportion to the importance of the several mining districts. Reference to the membership list shows some glaring discrepancies. It is time that some revision was made.

It is expected that at the annual meeting in March some measures will be taken to provide for a more fair representation of the several Provinces. A change of this nature would doubtless appeal to the majority of the members of the Institute.

In this issue we publish reviews of mining in Nova Scotia, Quebec, Ontario, Alberta and British Columbia in 1914. In all cases the war has left its mark on the records. It is satisfactory to note, however, that the year closed with the industry in much better condition than in August. The prospects for an active year are fairly good, though of course not as bright as a year ago.

In his excellent resume of the Nova Scotia Coal Trade for 1914 Mr. F. W. Gray again calls attention to the necessity of taking good care of rescue apparatus. Too often apparatus is given little attention and then at the critical moment fails. There have been occasions during 1914 when carelessness of this sort came near to claiming lives.

At the annual meeting of the Canadian Mining Institute, March 3rd, 4th, and 5th, there is to be a discussion on "How can prospecting be stimulated." This is a subject on which nearly every mining man has formed some opinion. We may, therefore, expect to hear many interesting plans suggested. The discussion is to be opened by Professor Haultain.

CORRESPONDENCE

MOND NICKEL BOND ISSUE

To the Editor of the Canadian Mining Journal:—

Sir,—In a recent issue of your Journal, the statement regarding the success of the recent bond issue of the Mond Nickel Company referred to their former bond issue as amounting to ten times what it actually was. The actual amount of the first debenture bonds was £375,000 not £3,750,000 as stated.

The total amount of the two bond issues is, therefore, £875,000, or a trifle over one-fifth of the amount which was given out by the press.

As all the press notices had the same error, the mistake was probably in the original cable. Will you kindly correct this statement in your next issue, giving the same prominence to the correction that you gave the original notice.

Yours truly,
THE MOND NICKEL CO., LTD.,
C. V. Corless, Manager.

Coniston, Jan. 5, 1915.

WORKMEN'S COMPENSATION

The rates which the Ontario Workmen's Compensation Board has assessed upon the mining industry for 1915 are given below. The rates levied in New York, Washington and Ohio are given for comparison.

Rates of Assessment Per $100 of Pay Roll.

Class 5—

	New York	Ohio	Washington	Ontario
Mining	$6.61	$1.35	$1.60	$3.00
Iron smelting	5.96	1.80	....	2.00
Concentrating, stamping, or other preparation of metals or minerals (without heat)	3.89	.70	1.60	.80
Reduction of ores (with heat), smelting or refining of other metals or minerals	5.96	.70	1.60	1.50
Manufacture of Calcium Carbide, Carborundum, or Alundum	2.13	.99	....	1.50
Boring or drilling except when done by an employer coming under another classification) sinking artesian wells	2.85	1.49	....	1.50

In connection with the matter of rates the Board has issued the following circular::

Some mention has recently been made in the public press of interviews with certain manufacturers regarding the rates for the first provisional assessment levied by the Workmen's Compensation Board upon employers in Schedule 1 of the Act.

If it were practicable, the members of the Board would have been pleased to discuss with each employer the situation which the new law has brought about. This, of course, could not be done. In the large number of interviews that have taken place, however, a better understanding of the law has invariably been brought about, and it has occurred to the Board that in the circumstances a few general statements regarding the matter of rating might advantageously be placed before you.

First, it should be clearly recognized that the Board can have no interest in collecting more money than is required to pay the compensation for which the Act provides. A large part of the cost of administering the new law is being borne by the Government out of the Consolidated Revenue Fund of the Province, so that, except as to a very small percentage, all moneys paid in by employers will be applied for the sole purpose of providing the compensation which the law requires to be paid to injured workmen. The intention is to provide a system of mutual protection on the basis of actual cost, and the cost is reduced by the amount so borne by the Province.

As an illustration of the manner in which matters will work out, take for example, the white goods industry, which has been spoken of (Class 27). The rate named is 40 cents. Supposing there is a pay roll in this class of $2,000,000 in the year 1915, this would realize for the accident fund the sum of $8,000. If, after the accidents of the year have been provided for, it should be found that only $6,000 has been needed, the balance of $2,000 will be carried forward into the next year to the credit of this class, the proper proportion of this surplus being credited to the members of the class, and the rate for the following year would be reduced accordingly to such figure as would seem sufficient. Upon the other hand, should the amount realized from the rate named prove insufficient, the class and the employers in it would be debited with the deficiency and a higher rate would have to be levied for the following year.

In every case each individual employer, no matter what figure the estimate of his pay roll has been put down at, will, as stated in the assessment notice, have his assessment adjusted according to his actual pay roll at the end of the year. Thus an employer, for example, with an actual pay roll of $10,000 for the year will pay just half what an employer with a $20,000 pay roll would pay.

As to the question of the rates which have actually been fixed by the Board for 1915. This, naturally is the most important question of the moment. Most employers, we think, who have considered the situation will have expected that these rates would be considerably higher than the old employer's liability rates. The basis of compensation and the maximum sum which may have to be paid are substantially higher under the new law and the right to compensation, except in minor cases, no longer depends upon the employer having been at fault or the workman not at fault for the happening of the accident, and these circumstances must necessarily cause material increase in rates, though the exact extent of such increase cannot, until actual experience has been had, be definitely determined. Fortunately the Board has had the benefit of the experience of the industrial commissions of several States across the border (Michigan, Ohio and Washington) as an aid in considering the proposed rates for Ontario. In very many cases the rates named here are less than the experience rates in any of these States, and in most cases they are less than half the rates charged for the year 1915 under the New York State law. None of the rates for these States, of course, can in any sense be regarded as an infallible guide, for in none of the places mentioned is the scale, nor are the conditions, of compensation, the same as in Ontario.

These general observations are made with confidence that employers generally will recognize that the Board is endeavoring to deal as fairly as it can with an admittedly difficult problem. We would have been more than pleased could we have seen our way clear, particularly in these difficult times, to name rates lower than those proposed, but everyone will recognize the necessity of putting the Accident Fund on a sound basis at the outset, and if in doing this it should happen that some few employers have this first year been charged more than may turn out to be actually needed, the Board will be more than ready, as knowledge is gained by experience in the actual working out of the law, to credit back the surplus in levying the following year's assessment and to place all employers, as nearly as possible, in a position of equality, having regard to the relative hazard of their various industries.

The Board, in these matters, recognizes its responsibility as trustee of the Accident Fund for the employers and employees of the province, and once this is generally understood, we hope, with the explanation we have given, that any misconception of the law or of the methods of carrying it out will be cleared away.

The Board will welcome any inquiries as to any specific matters not covered in this circular.

THE SMELTING INDUSTRY IN CANADA IN 1914

By Geo. A. Guess.

During the year 1914 there have been some very interesting developments in the smelting industry of Canada, despite the low metal prices which have prevailed.

Improvements in Reverberatory Furnaces.

The various experiments in reverberatory furnace operations which the Canadian Copper Co. has been carrying on for some time have resulted in revolutionizing reverberatory furnace smelting throughout America. The success of this work at Copper Cliff has attracted universal attention. Many of the features of the practice developed by the Canadian Copper Company have been introduced at other American smelters, at some of which, notably at El Paso and at Anaconda, the new idea has been carried much farther. The success attending the work particularly at Anaconda has been so great that one of the New York heads of the Anaconda Company prophesied that inside of two years not a pound of ore would be smelted in that company's blast furnaces.

Readers of this journal are well aware of the success at Copper Cliff attending the introduction there of pulverized coal as reverberatory furnace fuel. Experiments on charging gradually developed the idea of fettling with calcines, until finally the whole reverberatory charge was placed along the side walls of the furnace, through openings in the roof. The result of this is, to use a phrase of Mr. David H. Browne, that smelting is now done in a "tunnel of calcines." The calcines protect the side walls so that little heat is lost there and radiation losses are confined mainly to the roof.

The calcines on the walls cut down the cross sectional area of the furnace, and wider ones are likely to be built in future. El Paso has built a furnace 24 ft. wide, and Anaconda has one 25 ft. wide. Instead of what has been the standard reverberatory furnace, 19 x 110 ft., the furnace of the year 1915 is likely to be at least 25 ft. wide inside, from back to front throughout, without side doors, and with greatly increased length. The furnace will be fired with oil or pulverized coal, will be charged through openings on the roof along the side walls for nearly its entire length, and the charging will be practically continuous.

The economy of heat will be a big item. The continuity of heat will cut furnace repairs to a minimum. The fact that nearly any kind of coal can be used for fuel when pulverized will make the fuel bill in many cases very small. It is quite possible that the percentage of coal necessary to smelt a ton of reverberatory furnace charge may not exceed the percentage of coke necessary to smelt a similar charge in the blast furnace. It is no wonder then that reverberatory furnace men are enthusiastic.

The Knudsen Furnace Trials.

Another interesting piece of work has been the trying out of the Knudsen furnace at the Canadian Copper Co.'s smeltery. This furnace is somewhat like a big basic converter. The ore smelting operation is started with a mixture of coal and coke. Sulphide ore is used and the blowing continued until smelting is completed, when the furnace is tilted and the slag removed. The matte may be removed after blowing high.

This furnace, which was much larger than had ever before been used, gave a very good account of itself, and showed conditions under which it would have distinct advantages over blast furnaces.

Treatment of Fines at Coniston.

The Mond Nickel Company, in the new plant at Coniston, has in the treatment of fine ore followed other than reverberatory furnace lines. It takes a considerable amount of fines to keep a reverberatory furnace in commission, and in a small plant these are not always forthcoming. The sintering methods adopted by the Mond Company must be considered a makeshift. Sintering of copper ore fines has been tried out and abandoned in so many plants that the outlook for it in copper-nickel ore is not very bright. At the best, it furnishes at very high cost for preparation material to be smelted in a blast furnace.

Recovery of Dust and Fume at Trail.

The striking developments at the plant of the Consolidated Mining & Smelting Co. of Canada at Trail during the year has been the installation of the Cottrell precipitating device for recovering dust and fume from the lead furnaces. The plant at Trail makes use of 384 12-inch pipes, 16 ft. long, which stand vertically and which have a capacity of 100,000 cu. ft. of gas per minute. The inner wall of each tube is an electrode, and a wire passing centrally down the tube is the other electrode. Between them there passes a rectified current at 75,000 volts. The dust recovered carries 70 per cent. lead. This is, the writer believes, the first Cottrell installation anywhere to treat lead smelter dust and fume.

The installation at Garfield of 5 in. diameter pipes to handle converter gases has been very successful, and the Anaconda experiments with 36-in. pipes with arsenic bearing gases have been reported successful.

There is no doubt of the success of the Cottrell system, and the cost of installation is very much less than that of the bag house and the operating expenses very low.

Granby Smelters.

In the Boundary Country the last of the smelters was shut down in August. In December, due to pressure brought to bear by the Government, the plant at Grand Forks resumed operations. There had been both at Phoenix and at Grand Forks great suffering among the people due to the closing of the mines and smelter.

In March there was started the new smelter of the Granby Consolidated Mining, Smelting & Power Co. This plant is on Observatory Inlet, not far from Prince Rupert, the Pacific Coast terminus of the Grand Trunk Pacific. The smelter has three furnaces, 52 in. wide and 30 ft. long. A fourth furnace will be built by spring. The plant will then have a daily capacity in excess of any other pyritic smelter in the world.

The ores treated at the new smelter are pyrites, with a small amount of pyrrhotite and copper pyrites and a schistose gangue matter in part replaced by quartz. Pyritic smelting is practised. Five per cent. of coke to ore is used, and the matte, though low grade, goes direct to the converters. The ore from the two ore

bodies may be so mixed that very little barren quartz is necessary in the charge.

Power is furnished to the mine, the smelter and the railroad from Falls Creek. Because of the cheap power and the character of the ores, the Granby Company will be able to smelt at a lower cost per ton of ore than is done elsewhere.

When the fourth furnace is built there will be three furnaces steadily in blast, with a fourth in reserve. The daily ore tonnage will be from 2,000 to 2,500 tons per day.

This plant has been converting, in basics of the Great Falls type, mattes that average, by the month, between 16 and 17 per cent. copper. These are lower mattes than have been continuously handled elsewhere.

COAL MINING INDUSTRY IN ALBERTA IN 1914*

By John T. Stirling.

During the year 1914 the coal mining industry in Alberta, particularly in the southern portion of the province, has not been so satisfactory as it was during the year 1913. There were 4,306,346 tons of coal produced during the year 1913; the output for the year 1914 will probably not exceed 3½ or 3¾ million tons. This decrease is due to a large extent to the reduced amount of coal used by the railway companies and also to the extremely mild weather which has been experienced throughout the year. At the end of the year 1913 there were 217 mines in operation, while at present there are only 208. Thirty-seven mines have been abandoned during the present year, four re-opened and twenty-four new mines commenced.

For the last few months, the mines in the Crowsnest Pass district have been producing about 30 per cent. of their available output only, while the mines in the Lethbridge district have been producing about 50 per cent. The mines in the northern part of the province have been working fairly steadily, and at the present time are all practically operating to full capacity. A considerable improvement has also taken place in the Lethbridge field during the last week or two and it is expected that henceforward during the next few months the mines in this district will be in steady operation.

The most important developments in the province during the year have been in the Drumheller and Brazeau districts. In the Drumheller district, where the coal mined is of a high grade, there are now eight mines in operation. The output in this district for the year 1913 was 52,894 tons, while for the year 1914 it is estimated that it will be at least double that quantity. Most of this coal is shipped to Manitoba and Saskatchewan. In the Brazeau district, the mines operated by the Brazeau Collieries, Ltd., have been so far developed that an output of 1,000 tons per day is now being obtained.

The mines situated on the main transcontinental lines of the Canadian Northern and Grand Trunk Pacific railways about 200 miles west of Edmonton are being developed very slowly owing to the difficulty in marketing the output.

Practically all the mines which have been commenced during the year have been opened with the intention of operating on a small scale for the purpose of supplying a merely local demand. There have been no new mines opened up in the district north of Edmonton.

In all the bituminous and anthracite mines in the province as well as in the more important lignite mines, safety lamps are now in use. This is also the case of all the mines in the Drumheller district. The lamps most commonly employed are of the Wolfe type, while some lamps of the Koehler type and also electric safety lamps are in use. The No. 6 mine operated by the Department of Natural Resources of the Canadian Pacific Railway Co. is equipped with electric safety lamps of the Wico and Ceag types, while a number of lamps of the Edison type are used by the Pembina Coal Co., Ltd. Both these lamps are giving satisfaction.

During the past year the Pembina Coal Co., Ltd., have installed two storage battery locomotives of the Edison type.

There has been a considerable increase in the number of tons of coal produced per pound of explosive used particularly in the bituminous and anthracite mines, and only "permitted explosives" are now allowed to be used in these mines.

Up to the present time there have been 87 non-fatal accidents and 19 fatal accidents in the province during the year 1914. This number is exclusive of the catastrophe which occurred on June 19th, in the mine operated by the Hillcrest Collieries, Limited, at Hillcrest, whereby 189 men lost their lives. The catastrophe was caused by an explosion of gas and coal dust. It has been impossible, however, to ascertain the cause of the explosion.

An order-in-Council was passed during the year putting into effect certain regulations under the Mines Act. These regulations, among other things, prohibit any person, other than an authorized person, relighting a safety lamp underground and also make provision for the better regulating of the amount of coal dust in a mine.

During the year, further training in Mine Rescue Work has been carried on to such an extent that there are now 142 men holding certificates in the province for efficiency in this regard. A second railway car has been provided and equipped for the purpose of carrying on this work in the Bankhead and Canmore districts. In addition to this, there is a mine rescue car in the Crow's Nest Pass district which operates between Lundbreck and Coleman. A mine rescue station is also being operated at Hardieville, near Lethbridge, and substations at Commerce, Coalhurst and Taber.

The Provincial Government has organized classes in technical education at the different mining camps in the province, and while only a commencement in this direction has been made, there is reason to expect that a very large number will avail themselves of the opportunities thus afforded by this provision.

*From the Canadian Mining Institute Bulletin, Jan., 1915.

DOMINION COAL AND STEEL OUTPUT 1914.

The annual production statement of the Dominion Coal Company, Limited, issued recently, shows an output of 4,287,150 tons for the year 1914. The output for 1913 was 4,741,391 tons. The output of the Dominion Iron and Steel Company was as follows:

	Tons.
Iron ore mined	335,000
Limestone quarried	295,000
Pig iron made	181,000
Steel ingots made	237,500
Rails made	120,000
Blooms and billets for sale	23,500
Wire rods made	37,700
Wire and wire products	26,000
Steel bars	15,000

MINING IN ONTARIO IN 1914

Ontario mines made a good showing in 1914. Production was not quite as large as in the preceding year; but results of development work were, on the whole, very satisfactory. The mines of the province are capable of making a large output in 1915 if the markets warrant it.

Especially noteworthy in the record for 1914 is the improved condition of the gold mining industry in Ontario. The silver mining industry, while showing a falling off in production and profits, is in a fairly satisfactory condition. In spite of a large output during the year, there has been a large addition made to the known nickel ore reserves in the Sudbury district. The iron ore mining companies have experienced a bad year, owing to the general depression in the iron and steel industry. There was little change in the output of non-metallic minerals.

Gold.

A considerable increase in production of gold in Ontario during 1914 was expected. The development of ore bodies and the erection of plants in the Porcupine district has been proceeding during the past few years in the face of many difficulties. Those who had faith in the camp are now beginning to see their hopes realized. In 1913 Porcupine produced 207,583 oz. of gold. In 1914 the production was about 270,000 oz. A larger production in 1915 is to be expected. War should not retard operations at the gold mines that have reached a self sustaining position. The demand for gold is increased, not decreased, by present conditions.

Silver.

A decrease in production of silver in Ontario during 1914 was expected. But the decrease was larger than expected. The output in 1913 was 29,724,931 oz. The ouput in 1914 was less by between 4,500,000 and 5,000,000 oz. In August the market for silver practically disappeared and several mines were closed down. After a few weeks, however, the companies were able to resume operations. The price of silver has been lower than usual and there is little inclination to push production at present. The leading mines have large reserves of silver and facilities for production. The 1915 output depends to an unusual degree on the price of the metal. And the price cannot safely be predicted. We hope for an advance.

Nickel and Copper.

In the Sudbury district important additions have been made to nickel-copper ore resources during the past two years. Explorations carried on by the Canadian Copper Co., Mond Nickel Co. and British American Nickel Corporation have resulted in the discovery of large bodies of ore.

The production of nickel during 1914 would probably have been larger than in 1913 had conditions been normal. At the outbreak of hostilities, however, the working force was greatly cut down and for several weeks production was small. Later several of the furnaces were started up again. The matte output for the year contained about 22,000 tons nickel. In 1913 there was smelted in the Sudbury district 823,403 tons of ore which produced 47,150 tons of matte. The nickel contents amounted to 24,388 tons, valued in the matte at $5,237,477. The decrease for 1914 was therefore about 12 per cent.

Only three companies, Canadian Copper, Mond Nickel and Alexo Mines, Ltd., produced matte in 1914. The British American Nickel Corporation earned on operations at the Murray mine, but did not build the smelter which has been in contemplation for some time.

Iron.

The Canadian iron mines made small outputs in 1914. The Helen and Magpie mines were operated by the Lake Superior Corporation; but that company brings much of its ore from the United States. The Moose Mountain company has improved its briquetting process and is able to produce a good product for the smelters; but the market in Canada has been almost negligible. Blast furnaces in Ontario produced about 650,000 tons of pig iron in 1914.

Of 1,228,269 tons of ore smelted into pig iron in Ontario in 1913 only 132,708 tons was of domestic origin. This is partly due to the character of the Ontario ore deposits.

Dividends.

Dividends paid by Ontario gold and silver mining companies in 1914 and previously are as follows:

Company.	Total to End 1913.	1914.
Beaver.	410,000	.....
Buffalo.	2,507,000	280,000
City of Cobalt	139,321	.....
Cobalt Central	192,845	.....
Cobalt Silver Queen ..	315,000	.....
Coniagas.	5,920,000	1,320,000
Crown Reserve	5,536,378	424,479
Cobalt Townsite	842,259	200,000
Casey-Cobalt.	109,499	93,750
Cobalt Lake	315,000	150,000
Caribou-Cobalt.	25,000	50,000
Foster.	45,774	.....
Kerr Lake	4,920,000	600,000
La Rose	4,074,821	899,176
La Rose shared privately prior to May, 1908	1,204,862	.....
McKinley-Darragh. . . .	3,865,012	472,015
Nipissing.	10,890,000	1,350,000
Mining Corporation of Canada.	.....	259,375
Right of Way	526,903	16,850
Peterson Lake	.....	129,096
Seneca Superior	310,774	335,218
T. & H. B.	1,870,401	69,849
Timiskaming.	1,384,156	.....
Trethewey.	1,011,998	50,000
Wettlaufer.	637,465	.....
Hollinger.	1,440,000	1,170,000
Porcupine Crown	.....	180,000
Private Corporations (estimated).	3,500,000	300,000
	$52,015,475	$8,349,809

The Mining Corporation of Canada which figures on the dividend list in 1914 for the first time is a company formed to take over the properties of the Cobalt Townsite, Cobalt Lake and City of Cobalt companies, and the Cobalt properties of the Townsite Extension. These properties were taken over in April, 1914, and the companies wound up.

Peterson Lake and Porcupine Crown appear on the dividend list for the first time.

MINERAL PRODUCTION IN THE PROVINCE OF QUEBEC IN 1914

By Theo. C. Denis, Superintendent of Mines, Quebec.

Had industrial conditions during the second six months of the year just passed been as favorable as forecast by the first half of the year, the mineral production of the Province of Quebec for 1914 would undoubtedly have shown a marked increase over 1913.

But the European war has had a very marked effect on mining activities, and, except for a very few special cases, decreases will probably be recorded in most of the substances mined in the Province.

Asbestos.—Our production of asbestos, which last year amounted to $3,830,504, will show a decrease; for during the last five months, operations at the Thetford, Danville and Black Lake mines have had to be considerably curtailed. But during the early part of the year, shipping had been very active, and it is thought that the decrease in 1914, as compared with 1913, will not exceed 15 per cent.

Copper and Sulphur Ore.—The market for copper and sulphur ore has been very satisfactory on the whole. The production of cupriferous iron pyrites from the Sherbrooke district will probably exceed the previous year's. As in past years, some of this ore was shipped to Capelton, to the sulphuric acid works, but the great majority is exported to the United States.

These ores are low in copper contents, ranging from 2 to 5 or 6 per cent., and high in sulphur, 40 to 48 per cent. Therefore, it is imperative that the sulphur contents should be utilized, as it constitutes a large proportion of the value of the ore. The manufacture of chemical fertilizers accounts for nearly 90 per cent. of the consumption of sulphuric acid. Therefore, on account of the restricted market in the Province, all our pyritous ores can not be used locally, and the larger market of the United States has to be sought. But, on the other hand, there is no doubt that the Eastern Townships should offer a much greater outlet for chemical fertilizers than they at present do. This would allow of a much larger proportion of our pyrite being used in the Province in the manufacture of superphosphates. Such conditions, however, are not improvised, and can only be reached by an educative campaign among the farming community concerning the rational uses of chemical fertilizers.

Lead and Zinc Ores, in much greater quantities than in 1913, have been mined in Montauban township, Portneuf county. Three operators are now working there, and an increase in activity is expected in 1915. The mineralized zone, which appears to be in a belt of carbonate rocks in a pyroxenite zone, contains pockets and lenses of ore, some of which are considerable. Although these lenticular deposits lack continuity, they are numerous and important enough for a very successful local industry, for the mineralized zone appears to be considerable.

Gas.—Very earnest efforts are being made in the vicinity of St. Hyacinthe to "bring in" a field of natural gas. Gas was struck in 1910 at St. Barnabe at a depth of 1,860 ft., and two more wells are now being put down in the vicinity. One of these has now reached 2,800 ft. and the other 1,400 ft.

Structural materials usually represent over 60 per cent. of the mineral production of the province of Quebec. It is thought that this year will show a comparatively large falling off in building stone, lime, clay products and cement. Owing to an active movement in road construction throughout the province, there must have been a large increase in the production of stone for road metal,; but it is very difficult to keep track of all the small quarries which are opened temporarily for local usage.

Summary.—To sum up, if we consider the unfortunate industrial and financial conditions which have been ruling for the last five months, the mining industry of the Province of Quebec does not seem to have been unduly affected, and it is thought that by the time our returns from producers are all in, some time in the early part of February, our total production for 1914 will be found to at least equal our production for 1912, when it was $11,187,110, that is 17 per cent. less than in 1913, which was our banner year.

During the year, there were nine deaths of workmen due to accidents in mines and mills. Of serious accidents, entailing loss of 10 days or more, there were 108. In 1913, these figures were respectively, 16 and 181. We cannot yet work out the proportions as regards men employed in mines, quarries and clay-pits, as these figures are collected at the same time as the figures of production. From all appearances the ratio of fatal accidents to number of days labor will be smaller than last year, when the proportion was 1.86 killed per 1,000 men employed.

GERMANY'S POTASH REFUND.

The German Kali syndicate has at last paid over to American potash consumers the $1,000,000 refund which was authorized last June by the Reichstag. This refund represented the return to American consumers of surtaxes paid under protest by American buyers during 1910 and 1911, during the operation of the German potash law, enacted in May, 1910, for the purpose of eliminating the favorable American contracts.

This $1,000,000 had been paid by the German government to the syndicate at about the time the war broke out. But the syndicate has dilly-dallied about letting go of the money and has only within a few weeks made actual settlement.

The joke of the matter is that the syndicate has not paid over any actual cash, but is paying in potash. And there is another joke on top of this. The potash with which it is paying has been advanced arbitrarily $4 per ton over the former contract prices, on the basis of the excuse that the war and the difficulties of shipping through neutral ports are costing $4 per ton more. This is probably a true claim, but considering the fact that the Kali syndicate sells to American buyers at $27 per ton potash which actually cost to produce only $8 per ton, a profit of $19, or 240 per cent. per ton, the claim of needing this extra $4 is not calculated to stir any deep feeling of sympathy in the hearts of American purchasers.

The query is raised, why if the Kali syndicate can ship this potash to pay its refund, it cannot continue some regular shipments under its contracts, which it has notified the trade it has been obliged to rescind. The trade does not take this notice of abrogation of contracts by the syndicate at all seriously. After the war is over, if the syndicate attempts to do business with American potash buyers, it is likely to find some suits on its hands.—Boston News Bureau.

THE COAL TRADE IN NOVA SCOTIA IN 1914

A Resume.

By F. W. Gray.

Production.—The production of the coal mines of Nova Scotia during 1914 was approximately 6,660,000 tons, a decrease from the tonnage raised in 1913 of 600,000 tons, and one million tons below the maximum capacity of the collieries had trade conditions been favorable and permitted their full operation.

In the resume for 1913 the writer remarked:

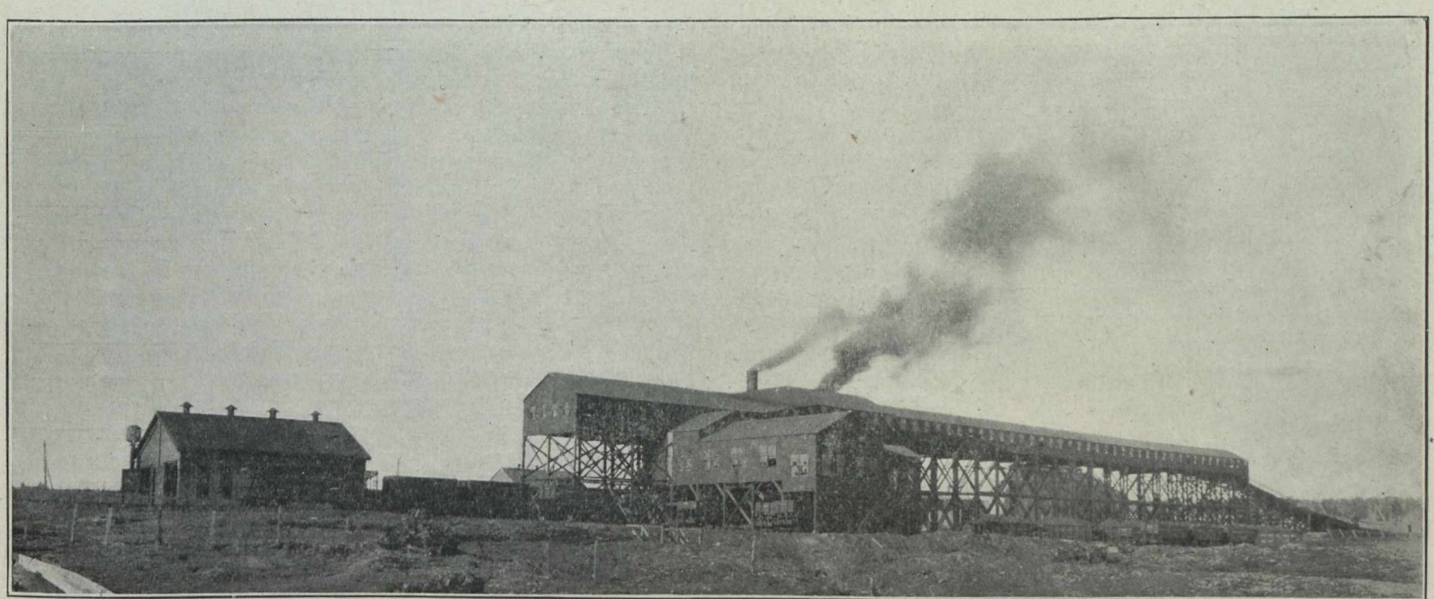
"If history repeats itself, and the financial stringency of 1913 is followed by a recession in trade such as followed in 1908, after the decline in securities in 1907, it may be that the outputs of 1913 will not be exceeded."

Unfortunately, a recession in trade did follow the decline of values in 1913, and then, just as sapient financial editors were commencing to talk of a restoration of confidence, were heard the first audible mutterings of the coming storm. How much of the drastic readjustment of financial values in 1913 was brought about by the same sinister brains that schemed the events of August, 1914, may some day be known, but at the present time we can only dimly surmise they were not unconnected. Be that as it may, the combined effect of the trade depression in the spring, and the subsequent outbreak of war, is responsible for the decrease in coal production in Nova Scotia.

What 1915 has in store for the coal-trade, and the other industries, depends on the march of events in Europe. Viewed purely from a commercial and local standpoint, apart from the greater issues at stake, there is no great reason for optimism. Hilaire Belloc is probably correct when he forecasts 1915 as a year of great economic distress, and it is difficult to see why it should be otherwise, so far as Europe is concerned. Canada, however, because of proximity to the United States, is a little differently situated to the remainder of the Empire. For good or evil our financial affairs are inextricably mixed with those of our southern neighbors, and there is just a faint ray of hope that if the United States should profit commercially by the troubles in Europe, Canada may be sympathetically affected. At the present time, however, the coal production of the United States is greatly in excess of the demand. Generally speaking, the outlook for the coal trade is not rosy, and if the collieries of Nova Scotia maintain in 1915 the same level of production as in 1914, matters will have to progress better than there seems at the moment good reason to anticipate.

The year 1913 marked the peak in Nova Scotian coal production by outputs aggregating seven and a quarter million tons. For a number of reasons it would appear that several years must elapse before the provincial production again exceeds seven million tons. In 1913 there were numbered among the producing collieries several mines which have since been permanently abandoned, and in the same year a number of new collieries for the first time reached practically their maximum output. The development of new collieries to replace the exhausted mines has been halted by the prevailing trade conditions, and by the time it has become possible to bring them into full operation still others amongst the older mines will either have been closed or have suffered serious permanent diminution in output capacity.

The development of Nova Scotian collieries proceeded very rapidly from 1911 to 1913, the production for 1913 having increased a million tons over 1911. At the present time there is not one of the operating coal companies in Nova Scotia that is in a position to very materially increase its production over the figures of 1913.



No. 12 Colliery, Dominion Coal Co.

A tabulation of the production of the various coal companies, compared for four years, is as follows:

Production of Nova Scotian Coal Mines.

(Ton of 2,240 lbs.)	1911	1912	1913	1914
Dominion Coal Co.—				
Glace Bay Mines	3,895,000	4,513,269	4,739,149	4,300,000
Springhill Mines	266,000	419,096	381,414	418,000
Nova Scotia Steel & Coal Co.	780,000	841,528	813,877	750,000
Acadia Coal Co.	370,000	435,654	536,000	397,000
Inverness Coal & Railway Co.	281,000	279,318	293,847	263,500
Intercolonial Coal Co.	263,000	235,859	189,550	213,000
Maritime Coal & Railway Co.	160,000	140,000	158,847	142,000
Colonial Coal Co.	30,000	36,897	65,844	52,500
Minudie Coal Co.	105,000	60,000	65,500	69,000
Cape Breton Coal, Iron & Railway Co.	.....	.....	8,424	49,000
	6,250,000	6,961,619	7,252,452	6,654,000
Cape Breton Island	5,000,000	5,671,012	5,921,141	5,415,000
	80%	81%	81%	81%
Nova Scotia	1,250,000	1,290,607	1,331,311	1,239,000
	20%	19%	19%	19%

It will be noticed the percentage of production as between the Mainland collieries and the Cape Breton collieries has continued curiously constant for the four year period given above.

The percentage borne by the production of the collieries of the Dominion Coal Company to the whole provincial output rose from 66% in 1911 to 71% in 1912, and has remained constant at this figure throughout 1913 and 1914.

The only increases in production are at the Springhill Mines and the Drummond Colliery—both increases being due to the overcoming of difficulties arising from underground fires in 1913—and from the new colliery of the Cape Breton Coal, Iron & Railway Co at Broughton, near Glace Bay, the last-named increase being the most important.

Accidents.—The accident rate showed a diminution from the high figures of 1913, in which year there were a large number of single fatalities, caused chiefly from falls of roof and side. As was hoped, the increase seems to have been sporadic, and apparently not indicative of a permanent increase in the fatality rate.

In the closing weeks of the year two of the most experienced and capable mining officials of Pictou County, Deputy Inspector Blackwood and Superintendent Brown, were the victims of after-damp, following a slight explosion in the Allan Shaft Mine of the Acadia Coal Company. At the time of writing full particulars are not available, but the loss of these two well-known and honored officials is deeply felt in Pictou County.

Underground Fires—Mine fires again were the cause of much trouble and loss of production in the Mainland collieries. The areas affected by fires which occurred in 1913 in the Drummond Mine and the Springhill Mines have been partially recovered during the year.

The most important underground fire was one which was first noticed on July 9 in the McGregor Seam of the Albion Mine of the Acadia Coal Company. After a great deal of hard and dangerous work the fire area was sealed off. The part of the mine unaffected by the fire is now being worked; but the fire area has not been re-opened. A full account of the interesting operations in connection with the subjugation of this dangerous fire is to be found in an article which appeared in the Canadian Mining Journal of December 1, 1914. Effective use was made of oxygen apparatus, and as a proof of their utility the following excerpt may be quoted from the article in question, referring to the construction of an important stopping:

"The stopping at the foot of the fan-shaft could not have been built at all without the oxygen helmets, and consequently the re-opening of this mine could not have been done until the fire had absolutely killed itself."

Experience in the Pictou and Cumberland fields is that mine fires are not easily "killed" by sealing-off, and the usefulness of the oxygen apparatus in hastening the recovery of the mine is therefore apparent.

Following the slight explosion which was the cause leading to the death of the two officials at the Allan Shaft, previously referred to, use was made of oxygen apparatus for the recovery of the bodies.

There are very few places where greater use has been made of oxygen apparatus than in Pictou County, and experience with these devices, under conditions of the most difficult and dangerous character, has proved their undoubted utility, but has nevertheless been accompanied by several significant and untoward happenings. The incidents of the year connected with the use of breathing apparatus but serve to strengthen the opinions expressed by the writer in the January 1, 1914, issue of the Canadian Mining Journal,* as follows:

"If it is not considered possible to have a competent man to take charge of breathing apparatus, it is far better to be without them.

"Breathing apparatus are an essential part of the equipment of every modern colliery, and have in many instances proved themselves to be of great utility, but, like every other part of mine equipment, they must receive proper care and inspection, must be taken seriously, and not regarded as a *raree* show or a fad, and must be used under the same discipline, and with the same sense of responsibility as, say, the ventilating-fan, or the man-hoisting shaft."

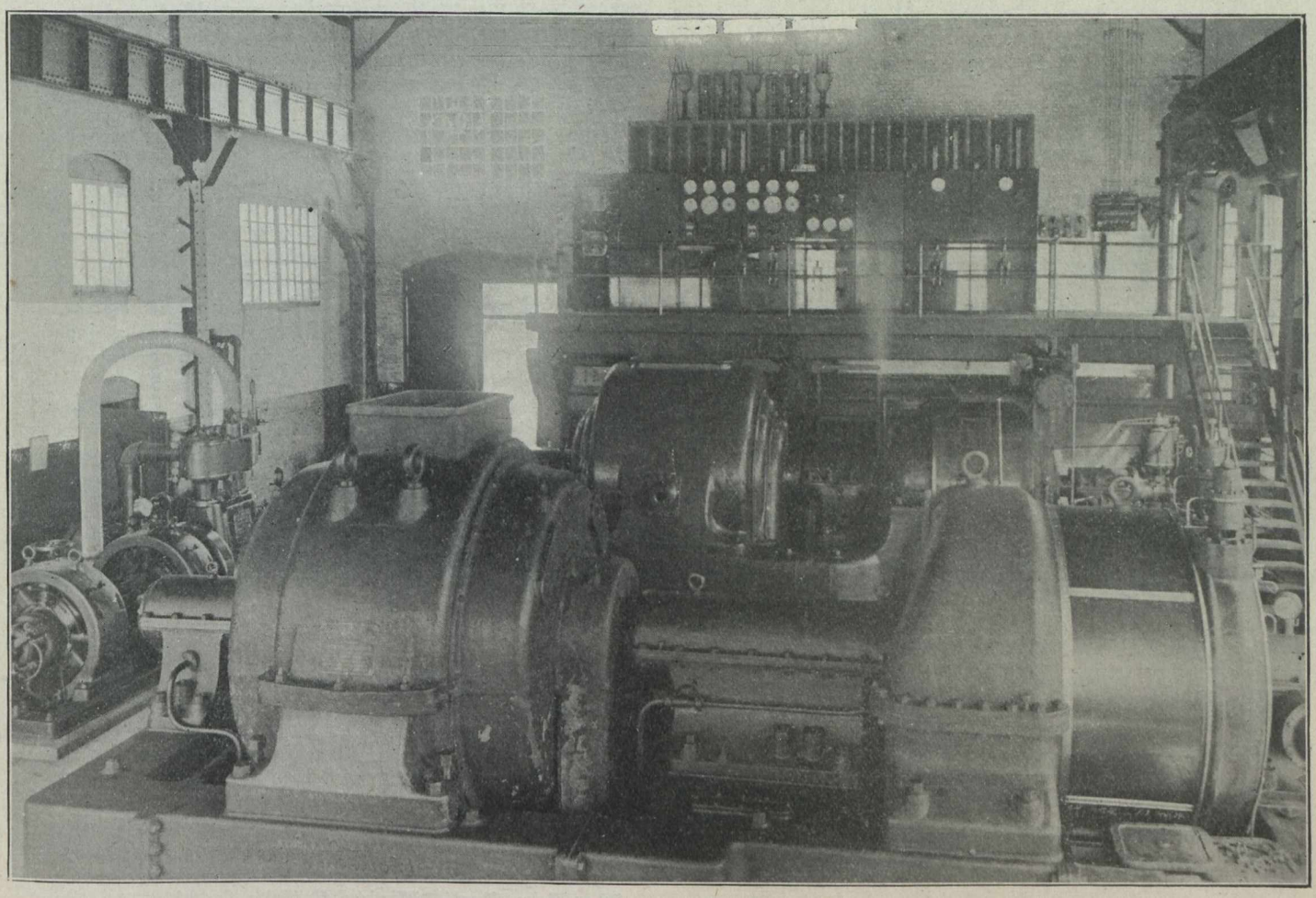
The Acadia Coal Company had a decrease in production of 140,000 tons, attributable to the trade conditions, and the fire trouble mentioned. The Vale Colliery was closed down in March. The date of its re-opening is very indefinite, and it may not be re-opened. The underground development of the Allan Shaft Colliery has gone forward steadily during the year, and a great deal of rock-work has been done to prove the very trou-

*Oxygen Breathing Apparatus. The Controversy of the Injector vs. the Non-Injector Types. Canadian Mining Journal, Jan. 1, 1914.

bled and difficult territory in which this colliery is situated. A brick and steel house, containing two electrically-driven air-compressors is being added to the Allan Shaft plant.

The new plant installed at the various mines of the Acadia Coal Company during 1912 and 1913 has enabled noteworthy economies in coal consumption, and although the conditions under which the mines have been worked during 1914 were not such as to render possible the most economical showing in power production, the actual saving effected may be gauged from the following table:

	1912	1913	1914
Output.	435,654	536,000	397,000
Colliery Consumption	75,812	56,512	41,348
Percentage of Colliery Consumption to Output.	17%	10%	9%



Waterford Lake Power Plant, Dominion Coal Co. Two 2,500 Kilowatt Live Steam Turbo-Generators

The full economy has not yet been realized. Although the percentage of colliery consumption to output for the whole year was nine per cent.; for the month of September, when the trade conditions permitted normal outputs, the figure was seven per cent only.

In the McGregor Mine coal is now being worked from an area on the east side of the slope, which has been closed for ten years on account of an old fire. The section was flooded at that time, but has recently been drained, and is now being worked, as previously stated.

The Springhill Mines had a most successful year, and were probably the only collieries in Nova Scotia that worked uninterruptedly throughout the whole year. Outputs of from 1,700 to 1,800 tons daily have latterly been obtained, and the mine has practically overcome the difficulties caused by the fire which broke out at Christmas, 1912. No additions were made to the equipment during the year.

The Maritime Coal, Railway & Power Company had a slight falling-off in output, but this was due entirely to the slackness in trade. The capacity of the mines has been so improved that an output of 200,000 tons could have been obtained under normal trade conditions.

The Minudie Coal Company showed a small increase in production. Had trade permitted, the output would have been much larger. In the year 1913, to produce 65,500 tons, the mine worked 287 days, but the output of 69,000 tons for 1914 represents only 205 working days, approximately. The expectation of the management to double the 1913 output would doubtless have been fulfilled had bad trade not intervened.

The Intercolonial Coal Mining Company passed through a period of reconstruction during 1914, and it is understood that the new financial arrangements, together with the acquisition of some coal adjoining the Drummond Mine barrier, will revivify this old-established company. The production for 1914 already shows an increase over 1913.

The Inverness Coal & Railway Company record a decrease in output of 30,000 tons compared with 1913. The reduction in production, as elsewhere, is attributable

to the trade conditions. The Inverness Coal & Railway Company is now the only operating coal company in Inverness County which has in 1914 the smallest coal production for very many years.

The Nova Scotia Steel & Coal Company had a decrease of about 60,000 tons as compared with 1913. This may be regarded as a good showing under the circumstances, because, like the Dominion Coal Company, a large portion of the Scotia output is used in steel-making. As the falling-off in coal requirements for steel-making purposes was much greater than the actual decrease recorded, it is evident that general business must have been well maintained. The Sydney Mines blast furnace has been damped down for some time past.

The new Baum washer is nearing completion. Apart from this, very little construction work has been undertaken during the year.

Dominion Coal Company; Cape Breton Collieries.

The combined outputs of this company, including the Springhill Mines, shows a decrease in production of 400,000 tons. The decrease was caused entirely by a reduced demand for coal for steel-making purposes. Other business was well maintained, and the water shipments made by this company were the largest to date. Shipments to St Lawrence ports were, in round numbers, two million tons, being 300,000 tons in advance of 1913, itself the best year to that date.

A comparison of output by collieries over the past four years, for the Cape Breton mines, is as follows:

Dominion Coal Company Outputs.

	1911.	1912.	1913.	1914 (Est.)
Mine 1.	577,405	584.834	533.599	464.000
Mine 2.	755,879	817.447	810.627	709.000
Mine 3.	171,431	131.459	118.206	71.000
Mine 4.	392,727	423.798	393.650	333 000
Mine 5.	324.511	266.966	220.719	161 000
Mine 6.	254.975	274.942	260.990	226.000
Mine 7.	194.529	202.189	221.816	183.000
Mine 8.	176.824	155.228	80 033	32.000
Mine 9.	408.869	430.670	393.591	388 000
Mine 10.	183.992	216.467	198.115	155.000
Mine 11.	.....	.....	44.425	81.000
Mine 12.	281.407	329.586	352 590	384 000
Mine 14.	184.544	321.946	415.927	385.000
Mine 15.	40.292	148.186	221.250	225.000
Mine 16.	17,963	130.862	259.173	257.000
Mine 17.	.....	.....	25	6.500
Mine 21.	17,391	57.891	153 054	116.000
Mine 22.	.....	20,798	61.359	123,500
	3,984,749	4,513.269	4.739.149	4.300.000

During the year No 8 Colliery, usually known as the International Mine, was permanently closed down owing to the exhaustion of the coal. The mine was probably the oldest operating mine in Canada.

No. 17 Colliery, which had been unwatered and developed to a point where an output of several hundred tons daily was possible, was temporarily closed, but will be opened whenever trade conditions warrant.

Many new records in production were made during the year. No. 2 Colliery raised 3,962 tons in one ordinary shift, and No. 9 Colliery, which adjoins No. 2, has to its credit 2,119 tons in one shift. The largest single day's output during the year was 20,634 tons, this being also the largest day's output in the company's history. Except in June the mines did not work to their full capacity, which is now around 450,000 tons per month. The output in June was 452,270 tons, and if it had been necessary 490,000 tons could have been produced in this month.

There is a temporary lull in new construction work. Two new electrically-driven coal-hoists were completed and put into operation at Nos. 15 and 18 Collieries. Four B. & W. boilers and an additional Bettington boiler (making four Bettingtons in all), were added to the Waterford Lake power plant, and two complete electrical generating units of 5,000 kilowatts each are now in daily operation there. No. 16 Bankhead was completed and put into operation. This bankhead, which is entirely electrically operated, is constructed of steel and concrete, and is fitted with Marcus shaking screens. It is a fine example of a modern bankhead and screening-plant, and is an evolution of the experience gained in the construction and operation of not less than eight new bankheads which the Coal Company have built within the past six years.

The Baum washer dealt with about 175,000 tons of washed slack during the year. It is probable that during the winter a considerable amount of slack will be washed and stored for shipment in the summer. The experiment of washing and stocking washed-slack during the winter will be an interesting one.

The coal stock-piles accumulated by the Dominion Coal Company during the winter of 1913-1914 were unusually large, aggregating as they did 640,000 tons. This huge accumulation was loaded and shipped within a period of five months, in addition to the regular output from the mines. On several occasions during the shipping season the piers at Sydney dealt with over 30,000 tons of coal within the twenty-four hours of one day and from 25,000 to 28,000 tons per day was a usual quantity for the piers to handle during the past summer.

At the beginning of the year the Dominion Coal Company granted an increase of six per cent. on the wages of certain classes of day-wage men earning under $2.00 per day, and concluded a renewal of the agreement with the Provincial Workmen's Association for three years, or until the end of 1916.

The Colonial Coal Company shows a decrease of 13,000 tons, due to trade conditions. The briquetting plants were in operation, and the demand for briquettes is said to be well maintained.

The Cape Breton Coal, Iron & Railway Company show the most important increase in production in Nova Scotia, although various causes combined to prevent the obtaining of a much larger output, which had been anticipated. The output of this company is being shipped over the Sydney & Louisburg Railway, owned by the Dominion Coal Company, and into vessels at the Louisburg piers of this company. Nothing was done during the year on the proposed loading pier on Mira Bay, or on the construction of the railway branch to connect this proposed pier with the mine at Broughton.

The Nova Scotia Mining Society for the first time held its annual meeting in Sydney, and from both a professional and a social viewpoint the meeting was an unqualified success. The papers read were, if anything, too numerous, and they were successful in provoking useful and illuminating discussions. The society was honored by the presence of distinguished visitors from the Geological Survey and the Mines Department at Ottawa, and the interest evoked by the discussions was heightened by the presence of a visiting deputation from the Canadian Mining Institute. Prospects for closer union between the two societies are very promising.

Owing to the depressed condition of trade and the general disinclination to social and festive functions

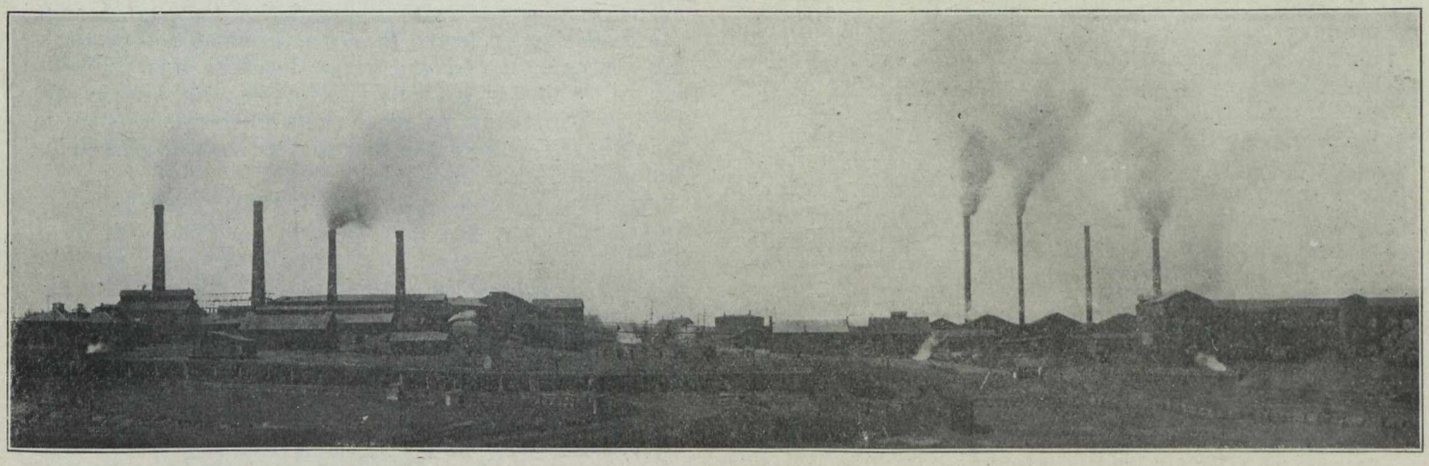
during war time, it is not unlikely that the annual meeting during 1915 will be omitted. Such action, if it is taken, will not be significant of any weakness in the society, or inability to arrange a successful meeting; but would merely indicate a desire not to incur unnecessary expense during a period of more or less pronounced economic distress.

Technical Education—Nothing further was done with reference to the mooted technical school in Sydney, and no tangible action has as yet been taken by any Governmental department towards carrying into effect the recommendations of the Royal Commission on Technical Education. Under prevailing conditions it is, of course, to be expected that the recommendations of the commission, and many other laudable matters, will be shelved until the Kaiser's education has been completed. The mining and other technical classes of the Nova Scotia Government continue their excellent work, and yearly improve in popularity and efficiency of training.

Shipping Matters.—The fact that it was a collier which collided with the Empress of Ireland, and brought about the death of over a thousand persons, has given an undeserved odium to coal-freighting in the minds of the unthinking public. In view of the overwhelming predominance of coal cargoes in the freighting trade of the St Lawrence it is not surprising that a number of the accidents which take place will be connected with coal-freighters. An examination into the facts will show, however, that in proportion to the tonnage employed in coal-freighting, the proportion of accidents with which colliers are connected is a relatively small one, and will bear comparison with any other traffic on the river.

A feature of the year was the increase in water-borne shipments. Approximately, 3,040,000 tons of coal have been freighted out of Sydney harbor during the year, the greater portion of this large quantity being handled after the outbreak of the war, without interruption of any consequence resulting from the hostilities.

Beyond the coaling of a few light cruisers in Sydney, which came and went unheralded and unannounced, the residents of the coal districts have seen no visible evidence of the waging of the sternest maritime struggle of history. Although our collieries overlook the open Atlantic, and form the most conspicuous landmarks of the eastern extremity of Canada, and although the presence of the Sydney Steel Works is betrayed far out to sea by "a pillar of cloud by day, and a pillar of fire by night," our industrial districts have been unmolested, in spite of the relentless fight that is daily proceeding between Britain and the second greatest naval power of the world. To the thinking man, it is something more than remarkable that the populous and important trade route of the St. Lawrence, and the undefended gulf and Nova Scotian coast should have up to now remained free from hostile craft. In the early days of the war, when men looked daily for a naval Armageddon, and before we had settled down to the nerve-trying grind of a conflict that is still young, there were wild tales in the west of the bombardment of Glace Bay and the wireless stations, and many persons anxiously scanned the sunlit expanse of the August sea for the enemy. But, thanks to the navy, the enemy has not yet been sighted, and while little is seen and less heard of the ceaseless activity of the "sure shield," the continued peaceful existence of our industries is in itself evidence of the navy's ubiquitous and powerful pressure. The case of the Sydneys is not unique, but it would be less than just if an article which purports to be descriptive of the coal trade of Nova Scotia in 1914 did not express in some way our pride in the navy, and gratitude for its protection. Nova Scotia shared with the Empire a heartfelt sorrow in the loss of the Good Hope and the Monmouth, and its people slept a little more soundly at nights after they read of Admiral Sturdee's swift and complete revenge.



Springhill Mines, Nova Scotia

Legislation.—The commission appointed by the Provincial Government to formulate regulations governing the use of electricity in mines completed its labors, and reported to the Government, but as yet no legislation in this connection has been mooted.

The Provincial Government announced its intention to appoint a commission to enquire into the status of the colliery relief societies, but so far this commission has not been named.

The Dominion Coal Company Employees' Benefit Society has now 10,200 members, compared with 11,000 in 1913.

The income for 1914 was approximately $150,000, derived as follows: Company and employees, in equal proportion, $128,000; Government of Nova Scotia, $13,000, and interest on investments, $9,000.

There was disbursed in weekly relief payments the sum of $98,000, or $11,000 more than in 1913; for death claims $95,000, against $96,000 in 1913, and for the widows and children of deceased members, $27,500,

compared with $22,000 in 1913, making a total disbursement of $135,000.

At the end of the year there were dependent on the funds 171 widows and 384 children, an increase during the year of 49 widows and 55 children.

The cost of administration was $5,800, or less than four per cent. of the gross income, which is not unreasonable.

It will be noticed that the disbursements came very close to the income for the year, and if the liabilities assumed during the year on account of dependents of deceased members are added, the year's operations really show a deficit. It is evidence that in the near future this society will have to make some changes either in the schedule of relief payments or in the rate of members' contributions if the large reserve now accumulated is to remain intact, or be added to.

Local Effect of the War.—Apart from the world-wide influence which the war has had on trade, some local effect has been occasioned by the fact that all the warring nationalities are represented among the workmen employed at the mines. The colliery districts have contributed a large percentage of the Nova Scotian recruits to the First and Second Contingents, Cape Breton Island and Springhill being particularly well represented. The French and Belgian workmen of military fitness quickly responded to the call, and already several have fallen on the field. The number of alien enemies among the mining companies is very small, and practically all of these men have remained peaceably at their work. The Russian workmen have so far not been called upon by their Government. There is a popular misapprehension as to the number of foreign nationalities employed in the Nova Scotian coal mines. There are more foreign workmen in the Sydney coalfield than in any of the other coalfields in the Province, and in the Sydney coalfield the non-British nationalities comprise only between seven and ten per cent. of the workmen employed. In recent years the percentage of foreign workmen has decreased rather than increased, and the newcomers attracted by the expansion of the coal industry have been very largely from Great Britain and Newfoundland, or native Nova Scotians returning from the Canadian west. If the war involves Italy, as seems probable, the effect on the labor supply will be more marked than it has been up to the present, as a great proportion of the most dependable labor in Canada and the United States is recruited from Italian sources.

EXPLOSIONS OF COAL DUST.

In his annual report just made to the Secretary of the Interior, Director Joseph A. Holmes, of the United States Bureau of Mines, states that excellent progress has been made during the past fiscal year in the investigation of the explosibility of coal dust at the experimental mine near Bruceton, Pa. These investigations included a careful examination into the inflammability of coal dust collected from hundreds of mines in different coal fields and a systematic study of the possibility of coal mine explosions starting from the improper use of explosives or the use of improper explosives, or from electric sparks, miners' lamps, mine fires, or other agencies.

Probably the most important feature of the year's work was the development of four types of explosion-stopping devices in which rock dust is used, as follows: Box barriers, concentrated barriers, ventilating door barriers and ventilation stopping barriers. The barriers were tested in strong and in weak explosions, and were effective in preventing propagation of flame beyond them. After being placed in a mine they are easily inspected and require little attention. Demonstrations before mining men led to inquiries from a number of companies, with a view to the erection of the devices in mines.

The results of the tests at the experimental mine have shown the value of watering and of steam humidifying systems, and the peculiar merits of rock dust, both when distributed throughout the mine and when used as barriers for limiting explosions. The supplementary use of shale dust or limestone dust was found to greatly increase the efficiency of watering.

Four great explosions occurred in the United States during the year, as follows: One in the Stag Canyon mine, at Dawson, N. Mex., October 22, 1913, resulting in the death of 263 men; one at Acton, Ala., on November 18, 1913, in which 24 men were killed; one at the Vulcan mine, New Castle, Colo., December 16, 1913, in which 37 men were killed; and one at Eccles, W. Va., April 28, 1914, in which 181 lives were lost. The general ventilation in most of the mines involved in explosions was good, but the defect in certain mines was in permitting the local accumulation of gas through not bratticing up to the face of gaseous entries or working places. One of the great disasters was probably caused by the use of dynamite for blasting, and by disobedience in firing a shot or shots when miners were in the mine, in spite of the fact that an outside shot-firing system had been installed.

Other lesser disasters occurred during the year. Many shot firers lost their lives in the Pittsburg, Kan., district, and in Oklahoma, Indiana and Iowa. Although the system of employing shot firers to fire the shots when all others are out of the mine lessens the number of deaths, yet in many districts the methods of shot firing employed are still so extremely hazardous that only the most reckless men are willing to act as shot firers. In any mine in which this system is used, there seems to be no good reason why shot firing from without the mine by electrical means should not be employed, at least if permissible explosives are not used.

Director Holmes strongly urges the purchase by the U. S. Government of the grounds on which the experimental mine is situated. He declares that the Bureau of Mines should own these grounds, now merely leased, in order to safeguard the large expenditure already made in developing the mine thereon and equipping it with expensive appliances.

Looking to the future, the director observes that, despite the progress made in ascertaining the nature of mine explosions and in devising methods of prevention, they still continue to occur, and it is to be feared that complete prevention will be difficult, owing to the inherent difficulty of eliminating errors of observation, judgment or understanding from among miners or mine officials. Thus, one of the shocking disasters of the past year was brought about because of one man's willingness to risk the sacrificing of not only his own life, but the lives of many others, in order to gain a few tons of coal. It is difficult to meet such a case, and yet with the progress that is being made in the methods of preventing or limiting explosions, it is certain that hereafter in a well protected mine, properly cared for, there will be much less danger of a widespread explosion.

COAL-DUST FIRED REVERBERATORY FURNACES OF CANADIAN COPPER CO., COPPER CLIFF, ONT.*

By David H. Browne.

Historical.

The use of coal-dust fired reverberatory furnaces, or indeed of reverberatory furnaces of any description, was for the Canadian Copper Co. a matter of necessity, and not of choice. For twenty years smelting had been done in blast furnaces alone, and with the Herreshoff furnaces used prior to 1904 there was no trouble in treating fine ores. But little fine dust was produced, and this, following the time-honored custom, was wetted down and put back with the charge. Whether the flue dust really smelted, or whether it was worn out by being chased around in a circle, was a problem that troubled no one.

With the installation of modern blast furnaces and high-pressure blowing engines, in 1904, fine dust commenced to assert itself. Evidently more dust was made than could be smelted, but so many vital problems engaged our attention at that time that this minor question was pushed to one side.

In 1906, the details of blast-furnace smelting and the conversion of matte had been worked out to a satisfactory conclusion, and the ever-increasing piles of flue dust and fine ore on the stock yard demanded serious consideration. Numerous experiments in sintering, briquetting, mixing with converter slag, forming blocks of flue dust with green-ore fines and cement, and so on, were undertaken. None of these showed much promise. Our problem was still further complicated by the question of treating converter slag. The ore was basic, the slag was not needed as a furnace flux, and it was felt that under these conditions the old method of pouring slag in molds and resmelting in the blast furnace was an unnecessary expense. If the converter slag could be settled in basic-lined reverberatory furnaces, in which at the same time flue dust and green-ore fines could be smelted, two problems might thus be solved.

Reverberatory practice with our ores was, however, an unknown factor. As carried on in the West, on siliceous ores and concentrates, at least 25 per cent. of fuel was required, and even this ratio depended greatly upon the skill of the firemen. The lack of skilled labor; the difficulty of recovering unburned coal from the ash by water concentration in our Northern winters, and the difficulty of utilizing it, if recovered, in a plant using no steam power; the uncertainty of the effect of highly basic charges on the hearth and walls, and our entire unfamiliarity with reverberatory practice, caused us to defer our decision.

In the Engineering and Mining Journal of Feb. 10, 1906, S. S. Sorensen, describing certain experiments at the Highland Boy smelter, called the attention of the metallurgical world to the possibilities of pulverized coal as a reverberatory fuel. While Mr. Sorensen's experiments did not lead to the adoption of this method of using coal at the Highland Boy, they showed very clearly that increased tonnage, with decreased fuel consumption, could be attained and that such difficulties as he encountered were largely mechanical and presumably removable. Mr. Sorensen was, as far as I know, the pioneer in the use of pulverized coal in reverberatory furnaces.

His experiences were confirmed by Charles Shelby, who in an able article in the Engineering and Mining Journal of March 14, 1908, described his experiences in the use of pulverized coal in the reverberatory furnace at Cananea. Mr. Shelby experienced much trouble by the sticking of ash in the flues and the formation of a siliceous blanket over his charge, but until blocked by these conditions he attained better results, both in tonnage and fuel ratio, than had been obtained by grate firing. A profitable contract for the purchase of fuel oil led to the discontinuance of these experiments, but enough had been done to show that the subject was worthy of further investigation.

In October, 1909, I visited Mr. Sorensen at the Steptoe Valley smelter, of which he was then superintendent. We went over the details of the Highland Boy experiments together and agreed that with proper attention to structural and mechanical details the troubles there experienced could be avoided. In the same month I visited Mr. Shelby and discussed the difficulties encountered at Cananea. These also seemed avoidable. It was evident that if the problem could be worked to a successful issue the fuel ratio, then usually about 4:1, might be raised to 6½ or 7:1. This warranted considerable expenditure in working out the details of practice.

In visiting all the prominent Western smelters in that year, 1909, I found that the proposal to use pulverized fuel on a large scale was received with more interest than enthusiasm. As a rule, the profession was skeptical as to the expediency of starting a new plant on a practically unproved method.

During the fall of 1909, our Chief Engineer, George E. Silvester, visited the cement factories in the Eastern States in order to study the proper method of grinding and burning coal. His report confirmed our opinion, that the process was practical, and during the winter plans were drawn for a reverberatory plant to use pulverized coal as fuel.

The mechanical difficulties encountered at Highland Boy and at Cananea consisted chiefly of two things, viz.: the stoppage of flues with accumulations of ash, and interruptions and irregularities in the coal-dust feed. It had been demonstrated in cement plans that the operations of feeding and burning pulverized coal could be made quite as continuous, as uniform, and as easily regulated as feeding oil, provided only that proper methods were used in the preparation of the coal.

A plant equipped with the latest appliances for drying and pulverizing coal was therefore designed, in a fireproof building entirely separated from the reverberatory-furnace building. Especial care was taken to specify that all bins, conveyors, etc., for the pulverized coal be made as nearly dust-proof as possible by the use of rubber gaskets, to eliminate the danger of dust explosions.. To circumvent, if possible, the trouble from accumulations of coal ash, an entirely new arrangement of furnace flue was designed, the idea being to eliminate the several right-angled bends in common use, and provide, as far as possible, a straightaway course for the gases. In following out

*A paper to be presented at the New York meeting of the American Institute of Mining Engineers, Feb. 1915.

this idea, the skimming door was taken from its traditional position at the end of the furnace and placed on the side, entailing the sacrifice, apparently, of nothing but the tradition.

As the furnishing of steam power from the waste gases was not an essential feature of the installation, hydro-electric power being used exclusively in the plant, the waste-heat boiler was made entirely a secondary consideration, and was situated so as not to interfere in any way with the straightaway idea when not in use.

In February, 1910, Mr. Silvester and I visited the Western smelters to obtain information on reverberatory practice. Mr. Sorensen was keenly interested in Mr. Silvester's plans, in which he advised a few modifications of minor details, while approving the ideas as a whole.

through a door near the fire end, as scrap is charged in an open-hearth steel furnace.

The introduction of so much cold air and cold material prevented any satisfactory fuel ratio. During the first five months 21,406 tons of cold charge and 43,463 tons of converter slag were smelted with 9,609 tons of coal. This shows a ratio of 6.7 tons of total charge per ton of coal, but only 2.2 tons of cold charge per ton of coal. However, as the cold charge was wet and often frozen, better results probably could not be expected.

The combustion of fuel was satisfactory from the start, no trouble being experienced either in grinding or burning the coal. The ash, while working on cold charges, choked and clogged the flue at the throat. This difficulty was not eliminated until later, when hot calcines were used and a larger tonnage was smelted.

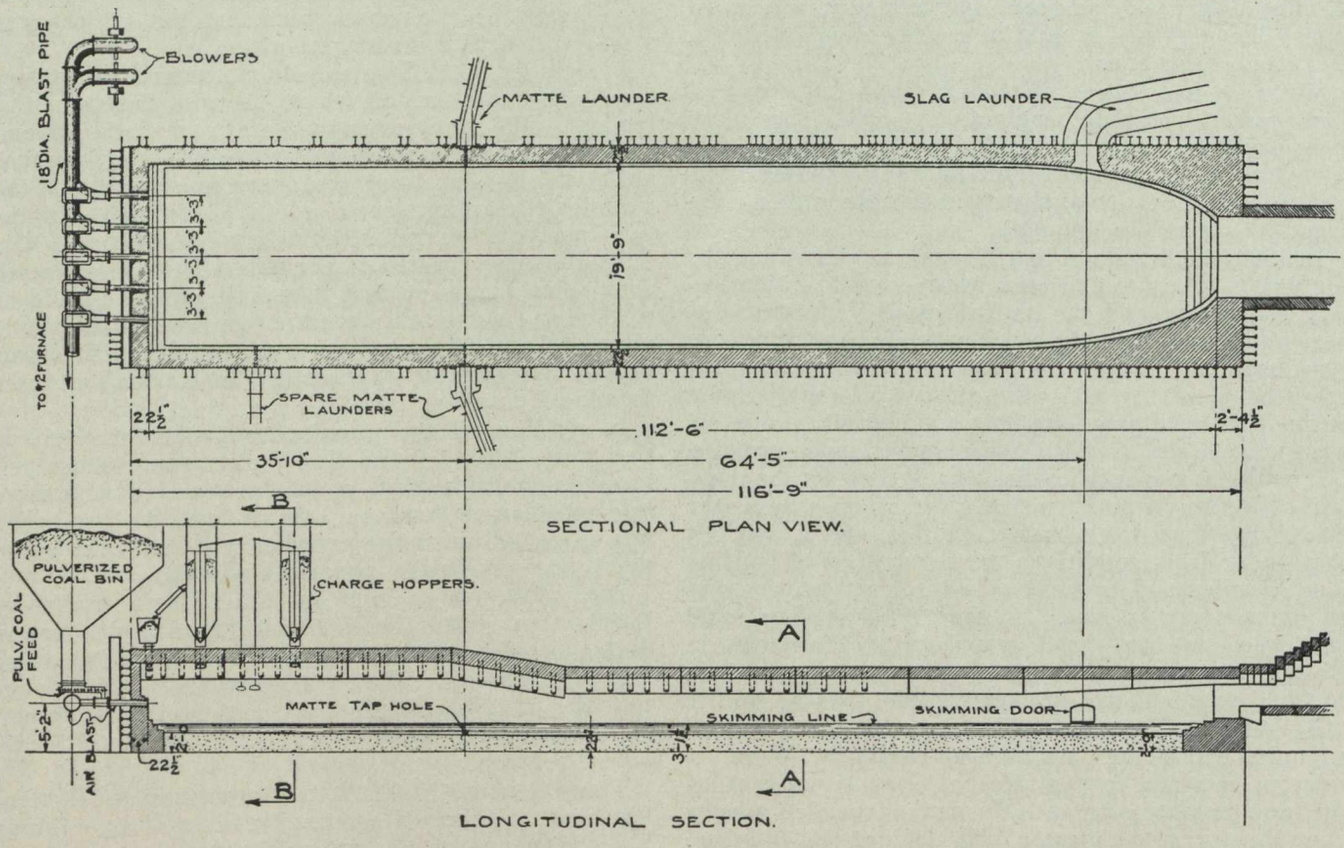


Fig. No. 1. Reverberatory Furnace of the Canadian Copper Co., Copper Cliff, Ont.

In April, 1910, the Canadian Copper Co. authorized construction, and work was begun at once. As the entire site of the proposed plant had to be raised 11 ft. above the yard level, and a large amount of rock cutting and filling was necessary on the hillside where the bins and approaches were planned, active construction of the reverberatory proper was slow, and operations did not commence until Dec. 23, 1911.

As built, the original furnaces were lined with basic brick, and the hearth was an inverted arch of magnesite. The furnaces went into operation before any proper means of drying flue dust was provided, and during the winter of 1911-12 a large amount of the charge, wet and frozen as it came from the piles, was shoveled in through the doors of the furnace. All the converter slag was poured in, at first through an opening in the roof, later by means of an iron chute

In general, the slower the furnace is worked the colder is the ash and the more it sticks and accumulates, while the faster it is driven the less does the ash hang back in the furnace. Under present conditions, with rapid smelting, the ash is a negligible factor.

In the summer of 1912, the roof and side walls were repaired and some facilities provided for drying the charge. In the winter of 1912, four Wedge furnaces were built to roast green-ore fires. These went into operation in March, 1913. At this date we ceased to send converter slag to the reverberatory furnaces, since with the opening of No. 3 mine the blast-furnace charge became more siliceous and slag could be used economically as a flux.

During this year very pronounced improvements were made by Mr. Agnew, then superintendent of the smelter, who with his foremen, Messrs. Kent, McAskill, and Mason, worked out and adapted to our use a modi-

fication of the Cananea system of side fettling. Long and shallow pockets were provided along the side walls, and through holes in the roof green-ore fines were fed to protect the sides. This naturally led to bricking up all the doors on the furnace, and the marked improvement which resulted from the exclusion of cold air and the insulation of the walls by a non-conducting and continuously-renewed blanket of fines brought about the extension of this side-fettling system to take in almost the entire charge of calcines.

As the walls were thoroughly protected by the charge thus introduced, the use of basic brick in the walls and hearth was no longer necessary, and the next change, in October, 1913, was to the siliceous bottom and silica brick walls customary in Western smelters.

In 1914, the fuel ratio and furnace practice were steadily improving. The figures or the first three months in 1914, one reverberatory being in use, are given tabular below.

	January.	February.	March.
Furnace days	31	28	31
Calcines, tons	10,020	9,460	10,860
Blast-furnace, fine tons.	906	922	847
Wedge-furnace, fine dust, tons	171	193	180
Converter slag	69	248	0
Green-ore fines and samples	1,731	1,326	2,308
Total charge	12,897	12,149	14,195
Coal	2,575	2,150	2,094
Charge per day	416	434	458
Coal per day	83	77	67
Ratio charge in fuel	5.0	5.65	6.77

Construction of the Furnaces.

The following notes on construction are given in explanation of the accompanying drawings. Figs. 1

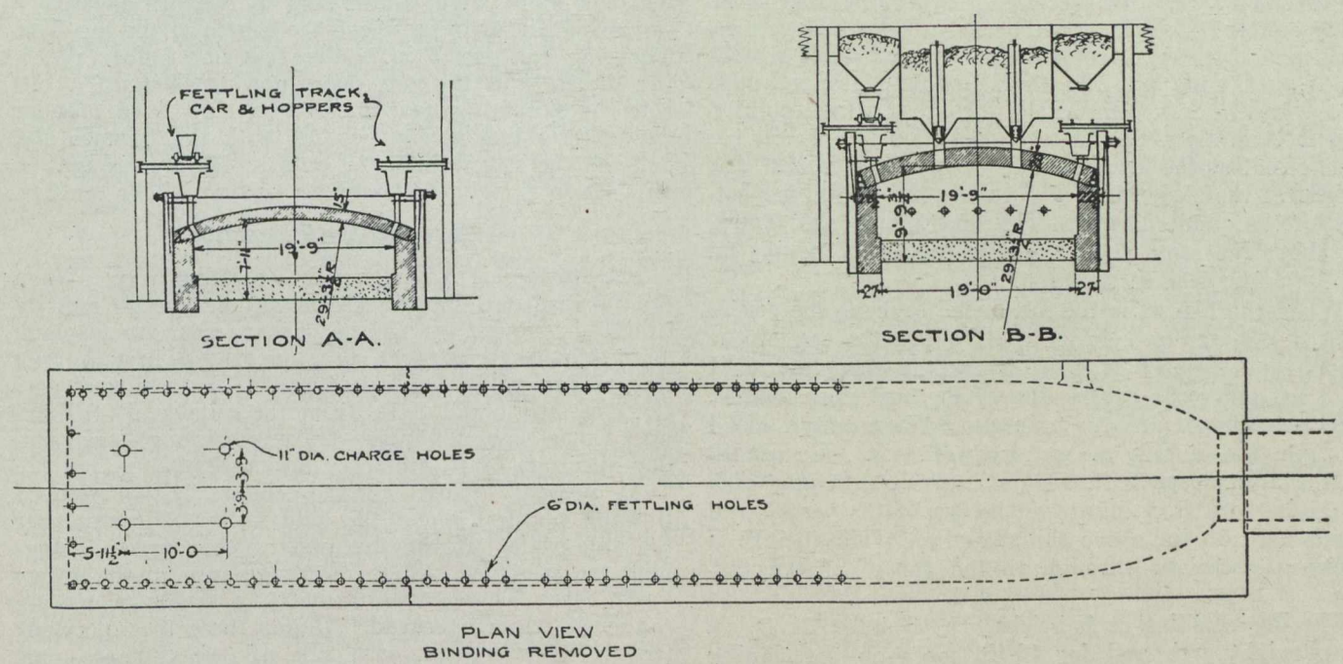


Fig. 2. Details of the Furnace Shown in Fig. 1.

In the summer of 1914, a change was made in grinding the ore fines for the Wedge furnace. The ore, which was previously too coarse to make a good calcination, was treated in ball mills, and screened, so that only about 14 per cent. remained on a 20-mesh screen, instead of the former 40 per cent. This finer-crushed ore cannot be produced in sufficient quantity to keep the furnace up to its full capacity. Furthermore, when the calcines dropped, on account of this finer grinding of the ore, from 13 per cent. sulphur to 7 or 8 per cent., the production of slag increased and the production of matte fell off. These conditions, with shortage of calcines, militated against the high ratio of charge to fuel and in June, 1914, the fuel ratio was 5.35.

This historical narrative is introduced to show the gradual development of the process and the conditions which have brought about changes in the original plans.

and 2, which, reduced in size as they must be, are not always clear.

The area occupied by the reverberatory-furnace building was raised about 11 ft. above the level of the surrounding yard, by pouring furnace slag between concrete retaining walls, which were protected as the filling progressed by clay against the concrete. At distances of 56 ft. apart, on the centre lines between furnaces, tunnels 12 ft. wide were provided in this slag foundation. These tunnels were to carry tracks so that the reverberatory furnaces built on this poured-slag area could be tapped into pots at the yard level. The furnaces are skimmed into 25-ton pots on this yard level.

Under the lines where the furnace side walls were to go, concrete footings were introduced, and between these footings transverse tie rods were laid in iron pipes and the slag pouring continued. These tie rods carry anchor plates which hold the footings under the furnace walls

together and take up the lateral expansion thrust at the foot of the side buckstays. Under the furnace hearth the slag filling rises 12 in. above these concrete footings. On the concrete footings rise the silica-brick furnace walls. The horizontal area of the furnace is 23 ft. 6 in. by 116 ft. 9in. outside the brick work.

The side walls rising from the footings inclose 12 in. of poured slag which extends under the silica hearth. The side walls are carried up 27 in. in thickness to a height of 3 ft. 4½ in. and are continued with a thickness of 22½ in. for 5 ft. 4¾ in., making the total height of the side walls 8 ft. 9¼ in. up to the point where the cast iron skew-back block is laid for the arch roof. This height is maintained for a distance of 34 ft. from the fire end, from which point the skew backs slope down to correspond to the slope of the arch roof referred to below.

The end or fire wall is 3 ft. 6 in. wide at the bottom for a height of 2 ft. and is then stepped back to 22½ in. at a height of 3 ft. 8 in., and again stepped back to a width of 13½ in. at a height of 6 ft. 3 in. At the other end of the furnace, commonly called the skimming end or front, the construction is very heavy to resist the end thrust of the hearth. It consists of a brick block, 6 ft. wide and 3 ft. thick, which is stepped back to a width of 2 ft. 6 in. at the throat, at which point it is 4 ft. 9 in. high.

The roof at the fire end is of 20 in. silica brick. The height at the skew back is 7 ft. 9¼ in. above the bottom of the quartz hearth. The central line is 9 ft. 9¾ in. above the same point. The radius is 29 ft. 3½ in. on the under side of the arch.

When the hearth is in, the inside arch at the centre is 7 ft. 9¾ in. to 7 ft. 11¾ in. above the top of the hearth and about 6 ft. 8 in. above the skim line, or 4 ft. 8 in, above the centre line of the coal dust nozzles.

This height of arch is maintained for a length of 34 ft. from the outside of the fire wall. In the next 12 ft. the arch drops 1 ft. 10¾ in., giving a height of 5 ft. 11 in. to 6 ft. 1 in. above the top of the hearth and about 4 ft. 10 in. above the skim line. This height is continued straight through to the throat of the furnace.

The 20 in. silica arch bricks are used for 34 ft. on the straight arch and for 12 ft. more on the sloping arch. The remaining portion of the roof is of 15 in. brick. As the height of this roof has been changed at various times the heights given for the roof at various points are not exactly as calculated.

There are no side doors on the furnace. As originally built, doors were set at 12 ft. centres, but these have been filled up, so that the side walls present a continuous face of silica brick 22½ in. thick.

The hearth is silica sand tamped into place. No binder was used, though better results might have been obtained had some base been introduced. After about five days' firing 50 tons of high grade matte was put in to saturate the bottom. If steam from the silica sand came through the walls the heat was cut off for 24 hours to allow the moisture to escape. Some patches of bottom floated up, but not enough to interfere with subsequent operations. This bottom is almost flat, being 24 in. thick at the end walls and 22 in. thick at the tap hole, 36 ft. from the fire wall. Another tap hole is provided about 13 ft. from the fire wall.

In building the side walls, wood strips are introduced to provide for expansion. These wood strips, ¼ in. thick, are placed between every four bricks on the inside and between every six bricks on the outside. As these burn out they allow the brick to expand horizontally. The arch is laid in separate sections 10 to 12 ft. wide, with the usual wooden expansion wedges 2 or 3 in. thick between the sections.

The side walls, built as described, are carried straight to a point 26 ft. from the throat, where they curve inward, the space of 19 ft. 9 in. between them being narrowed up along a line of gradually increasing curvature to a width of 8 ft. 8 in. at the throat. At this point the opening is 4 ft. 3 in. high at the centre and 3 ft. 9 in. high at the sides. The arch here is about 4 ft. 8 in. above the skimming line.

From the throat a straight flue 8 ft. 8 in. wide leads to the waste-heat boilers and to the stack. Openings are provided along the side of this flue for cleaning out any deposited ash. An opening opposite to the throat is provided by raising the bottom of this flue about 18 in. above the throat and introducing a door in the space thus formed. This is very useful for removing any accretions of ash fused in the throat. The skimming door is placed on one side of the furnace, 16 ft. 6 in. back from the throat. This door, 2 ft. 6 in. wide by 15 in. high, allows slag to run off down to a skimming line 14½ in. above the hearth at the tap hole. The slag can rise 6 in. above this line before reaching the level of the side doors now bricked up. Outside the skimming door a cast-iron clay lined launder curves to a line almost parallel with the furnace and delivers the slag into 25 ton pots, which are brought in on a track at right angles to the furnace under the flue.

Charging the Furnace.

The furnace is fed in a rather peculiar way. When the furnace was started almost all the charge was introduced through two charge hoppers near the fire end, as in the usual western practice. The first hopper delivered through two openings 11 in. in diameter, 7 ft. 6 in. apart and 8 ft. from the outside of the fire wall. The second hopper delivered through two similar openings 18 ft. from the fire wall.

At present almost all the charge is introduced through hoppers along the side walls. Directly over the side walls, at the fire end of the furnace, large bins are provided, which discharge into small bottom dump cars. These cars run on 24 in. tracks, which are supported from overhead. Under these tracks a long trough extends down each side of the furnace just above the side walls. These troughs are filled from the cars on the track above them. Each trough has openings in the bottom, 2 ft. apart, which openings communicate by a slide gate with 6 in. iron pipes. These pipes pass into holes drilled in the roof bricks, which allow the charge introduced through these openings to slide down on the side walls, over which this charge forms an almost continuous blanket. As there are no doors on the furnace, and as the 6 in. pipes are clayed into the openings in the roof, it follows that no air is introduced into the furnace except what is purposely introduced at the fire end.

These pipes form a continuous line of charging holes, which extend the entire length of the furnace. The charge on the side opposite the slag door is fed all the way to the throat. On the slag side it is fed along as far as the slag door and no farther, as the cold air coming in while skimming cools the wall from the skim door to the throat and obviates the necessity of charging beyond this point. Six similar openings are used on the fire wall.

The walls are held in place by 12 in. I beams in pairs, with a space of 5 ft. between each pair, which form the side braces. These are wedged in at the bottom by wooden wedges against an iron strap in the con-

crete footings. The concrete footings are tied together as previously described by rods passing under the furnace. At the upper end the 12 in. I beams are tied across the furnace by 1½ in. rods.

The coal dust is introduced through five pipes, 5 in. in diameter. One of these pipes is on the centre line of the furnace; the others are in horizontal line with it at distances of 3 ft. 3 in. from centre to centre. These pipes are 5 ft. 2 in. above the bottom of the sand hearth, or 3 ft. 2 in. above the top of this hearth. They are about 2 ft. above the skimming line of the charge and the central pipe is about 4 ft. 8 in. below the highest point of the roof.

The Coal.

The coal used in firing is a good quality of slack. Analysis of one lot showed: Volatile matter, 34.70; fixed carbon, 55.40; ash, 9.45; sulphur, 1.30; moisture, 4.31 per cent.

This coal has a thermal value of about 13,500 B.t.u. per lb. It is about ¾ in. and under in size and contains about 7 per cent. moisture. It is dried in a Ruggles-Coles drier, 70 in. in diameter and 35 ft. long. One ton of coal burned on the grate dries 40 to 50 tons of slack coal to about 5 per cent. moisture, which falls to 2.4 per cent. moisture after grinding. About 10 tons of slack is dried per hour of running time. The coal is ground in Raymond impact mills. About 95 per cent. passes a 100 mesh and 80 per cent. passes a 200 mesh screen.

The pulverized coal is sucked by a fan to separators above the roof of the drier building, and slides down into a screw conveyor which delivers it into bins at the fire end of the reverberatory. The dust is fed from these bins by Sturtevant automatic-feed screw conveyors, one for each nozzle, the speed of which can be regulated. These screws carry the dust forward and drop it into the air nozzles about 2 ft. from the point where the nozzles enter the furnace. Any coal delivery pipe can be closed off by a slide gate, and any screw conveyor can be stopped by disconnecting the bevel gears attached thereto. In this way any desired number of the five burners can be run, and at any desired speed within wide limits. The amount of air delivered to each nozzle can be varied at will or cut off entirely.

As a rule the five burners are in operation. Each delivers about 13.5 tons of coal dust a day or about 19 lb. of coal per minute to the furnace. The total coal blown in is about 67 tons a day.

The dust drops from the conveyors into the air pipes, which carry it forward into the furnace. The air is supplied by a 4 ft. Sturtevant fan, running at about 1,300 to 1,400 rev. per minute. The air supplied by this fan is insufficent for the combustion of the fuel. Openings are left in the end wall between the coal burners. These openings are stopped by loose bricks, so that the amount of air is readily controlled. The draft at the fire wall is about 0.25 in. of water and at the throat it has a maximum of about 1.2 in. The combustion is very good. One test made for 10 days (Jan. 9 to 19, 1914) showed the following averages:

Coal consumption, tons in 24 hours	69.7
Gas temperature at throat, degrees centigrade	922
SO_2 and CO_2, per cent.	12.3
Oxygen, per cent.	6.5
SO_3, per cent.	1.14

During this test the average charge was 409 tons in 24 hours. This shows a ratio of 5.9 parts charge to 1 part coal, but much higher ratios have been attained. The average for March, 1914, was 6.84. This coal ratio depends largely upon the composition of the charge and the analysis of the slag produced.

A criticism might be made of the low temperature of the gases at the throat, 922° C. The usual practice in Western smelters is to carry a temperature of 1,200° to 1,300° at this point, and it might be thought that this low temperature indicated inefficient firing. The fact is that the heat of combustion is utilized in smelting ore along the side walls and consequently the escaping gases, having done more work than is usually the case, are relatively cold. The function of a reverberatory furnace is to melt ore, and not to raise steam, and for this reason the more heat that is absorbed from the coal gases in the furnace, the more efficient the operation and the cooler the escaping gases.

The ash from this coal causes very little trouble in operating. A small amount settles on the slag, but as this slag is high in iron it is not an undesirable feature. A small amount also settles in the flue and a few hundred pounds may stick around the throat. The ash, where exposed to high heat, forms a very light pumice-like fragile mass. The throat is cleaned out daily by opening the door under the flue. During this cleaning the firing is maintained at usual.

Advantage of Coal Dust Firing.

The great advantage of coal-dust firing is the absence of the usual breaks in the temperature curve due to grating or cleaning the hearth, and as a consequence a greatly increased tonnage and fuel ratio. The operation of firing, being purely mechanical, comes under the immediate and direct control of the furnace foreman and responds instantly to his regulation. In addition to this the peculiar method of feeding by almost continuous side charging obviates the breaks in the temperature curve due to charging or ordinary fettling. For these two reasons the chart of the temperature shows an almost horizontal line, rising or falling in almost exact concordance with the speed of the coal feeding device.

The maximum bath of matte and slag is 22 in. deep. A constant bath of 8 in. of matte is carried. This matte lies 6 in. below the skimming plate, so that after skimming there are 6 in. of slag and 8 in. of matte left in the furnace, making a total minimum depth of 14 in. The skimming door is banked up 8 in. with sand, so that just before skimming the slag is 14 in. deep. As the charge along the side walls occupies a great deal of room there is never at any time more than 40 or 50 tons of slag in the furnace.

In rebuilding this reverberatory, or in designing a new plant, the hearth should be widened to provide for a larger body of matte, which experience has shown to be necessary. As this method of burning coal and of admitting the charge into the furnace bids fair to come into general use it is to be expected that many changes, both in construction and operation, will be introduced. My belief is that reverberatory smelting along these lines will become cheaper than blast-furnace smelting and that a wider range of ores can be used in such a furnace than in the old style coal or oil fuel furnaces.

Mr. H. C. Barber has recently joined the sales force of the Standard Underground Cable Co. of Canada, Ltd., Hamilton, Ont. Mr. Barber is a graduate of the Faculty of Applied Science of the Toronto University, and he has occupied positions on the engineering and executive staffs of the Toronto Hydro-Electric System and the Hamilton Hydro-Electric Department, and on the sales force of the Packard Electric Company, Ltd., of St. Catharines, Ont.

COAL-DUST FIRED REVERBERATORIES AT WASHOE REDUCTION WORKS*

By Louis V. Bender.

After investigating the work of coal-dust fired reverberatories of the Canadian Copper Company, at Copper Cliff, Ontario, the management of the Washoe Reduction Works decided to experiment with and ascertain the advantages of using coal dust as a fuel in their reverberatories. Consequently, during the month of June, 1914, reverberatory furnace No. 8 was changed in order to use powdered coal as a fuel. The results obtained by this method of firing are gratifying and show a decided saving in cost of smelting as compared to grate firing with lump coal.

The furnace, as remodeled, is 124 ft. long by 21 ft. wide, and varies in height from 8 ft. 6 in. at the back end to 5 ft. 7 in. at the skimming end. The general construction of the furnace is similar to that of the other furnaces at this plant. There are no side doors to this furnace, as it was thought that with the present arrangement for feeding no "fettling" or "claying" would be required. The interior of the furnace can be inspected through the burner port holes, after shutting off the burners and giving a few seconds' time for the gases inside the furnace to clear away. The charging is done on either side of the furnace from longitudinal hoppers, extending a distance of 74 ft. from the back end of the furnace. Leading from the hoppers into the furnace are 6-in. pipes, spaced 19¼ in. apart, through which the charge is intermittently dropped. The charge is kept well above the slag line at all times; in this way the side walls are protected and no fettling is needed on this portion of the furnace. The remainder of the furnace requires fettling. After operating for three months, we found that the bricks were eaten into along each side wall from the skimming door back to the point where the charge had been dropped. The depth of this cutting away was 8 in. close to the front end and gradually tapered to zero at a distance of 50 ft., and was greatest on the side of the furnace having the larger flue connection. Hoppers will be put in for the entire length of furnace, from which fettling material will be dropped, to prevent this cutting.

After the run of three months, the roof was in excellent condition. At the back of the furnace the bricks were not cut into at all; at 30 ft. from the back end they were eaten away 2 in., but at 60 ft. distant they were as when put in. The roof is 20 in. thick. After operating for a while trouble was encountered in tapping the matte. The tap hole was on the east side of the furnace 83½ ft. from the front end. Charging could not be done over the tap hole, or for a distance of several feet on either side; also, owing to the method of charging, matte accumulated in the front of the furnace and could not be completely drained through the side tap hole.

When the furnace was down for fettling in front, it was seen that the calcines fed into the furnace sloped very gently from either side to the centre. This, of course, took up the space which in other furnaces is filled with matte and forced the matte to the front of the furnace, and also prevented its being drawn out at the side tap hole. The furnace will not hold more than 50 tons of matte; the other furnaces hold 175 tons. Finally, it was decided to tap the furnace at the front. A suitable runway was put in and a tap hole made to the side of and below the skimming door, and all of the matte was tapped therefrom. About 35 tons of matte is tapped per shift. The furnace is skimmed three times per shift. The gases are taken from the furnace through brick flues to either of two batteries of Stirling boilers, each battery developing 650 h.p. One of these flue connections was left as before with a cross-sectional area of 13½ sq. ft., the other flue connection has a cross-sectional area of 40 sq. ft. The smaller flue connection is only used whenever it is necessary to clean the boilers connected with the larger flue. This occurs once a month, and lasts for a period of three days, during which time the tonnage smelted is considerably less than when using the larger flue.

Conditions Which Are Imperative in Order to Obtain Successful Results in Coal-dust Firing are:

1. The coal, before pulverizing, must be well dried, down to 1 per cent. or less of moisture. This makes it pulverize better and burn more freely. Nothing is lost in drying it separately, as all the moisture must be evaporated before coal (or any other fuel) will burn, and higher efficiency is obtained when the moisture is driven off before using. The furnace itself is the most expensive place in which to dry the coal, as the effectiveness of the whole fire is lowered by the presence of moisture.

2. The coal must be finely pulverized. The increased surface has a direct bearing upon the efficiency obtained in coal-dust firing. It is well to recognize what this increase is. C. D. Demond, Chief Testing Engineer at the Washoe Reduction Works, says: "The approximate diameter of a 1-lb. lump of bituminous coal is 3 in., and its total surface one-quarter of a square foot, while 1 lb. of coal ground so that 95 per cent. will pass through a 100-mesh sieve and 82 per cent. through a 200-mesh sieve has a total surface of 8,000 sq. ft., more or less, depending upon the physical characteristics of the coal, or 32,000 times the area of the single lump."

These figures show that with finger grinding an enormous increase in surface is obtained, and, consequently, an increase in thermal efficiency. At Anaconda the grinding is done so that from 93 to 97 per cent. will pass through 100 mesh and 79 to 82 per cent. through 200 mesh. Coals with high specific gravity will grind finer in a Raymond pulverizer. N. L. Warford, in charge of our coal-dust equipment, says: "In cement work no better work is obtained when coal is pulverized finer than 95 per cent. through 100 mesh." (This gives from 75 to 85 per cent. through 200 mesh, the percentage depending upon the physical character of the coal). Coal thus pulverized will contain a high percentage of fine dust practically unmeasurable. As we can burn all the coal thus prepared, there seems to be no good reason for pushing pulverization beyond this point. Coal can be cheaply brought to this condition and the mills able to do this work have large capacity. Higher percentages may be obtained by the sacrifice of capacity, and consequently economy. This standard of approximately 85 per cent. through 200 mesh and 95 per cent. through 100 mesh is a practicable commercial standard and should be maintained.

*Extract from a paper presented at the New York meeting of the American Institute of Mining Engineers, Feb. 1915.

3. The delivery of the coal and air to the furnace must be controlled so that the proper quantities of each may be secured. Undoubtedly, the proper method of firing pulverized coal is to admit with the fuel the exact quantity of air required for the results to be attained, and to maintain this relationship as long as results wished for are obtained. We know that in order to get the best heat efficiency from fuel a certain amount of air must be provided for combustion. Any air in excess of these requirements dilutes the gases and lowers the temperature; and insufficient air will burn part of the fuel to CO_2 and part of it to CO, which means incomplete combustion.

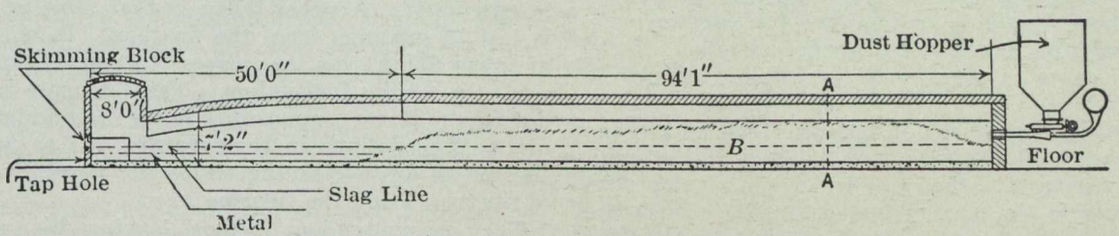


FIG. 1.—LONGITUDINAL SECTION OF COAL-DUST FIRED REVERBERATORY FURNACE.

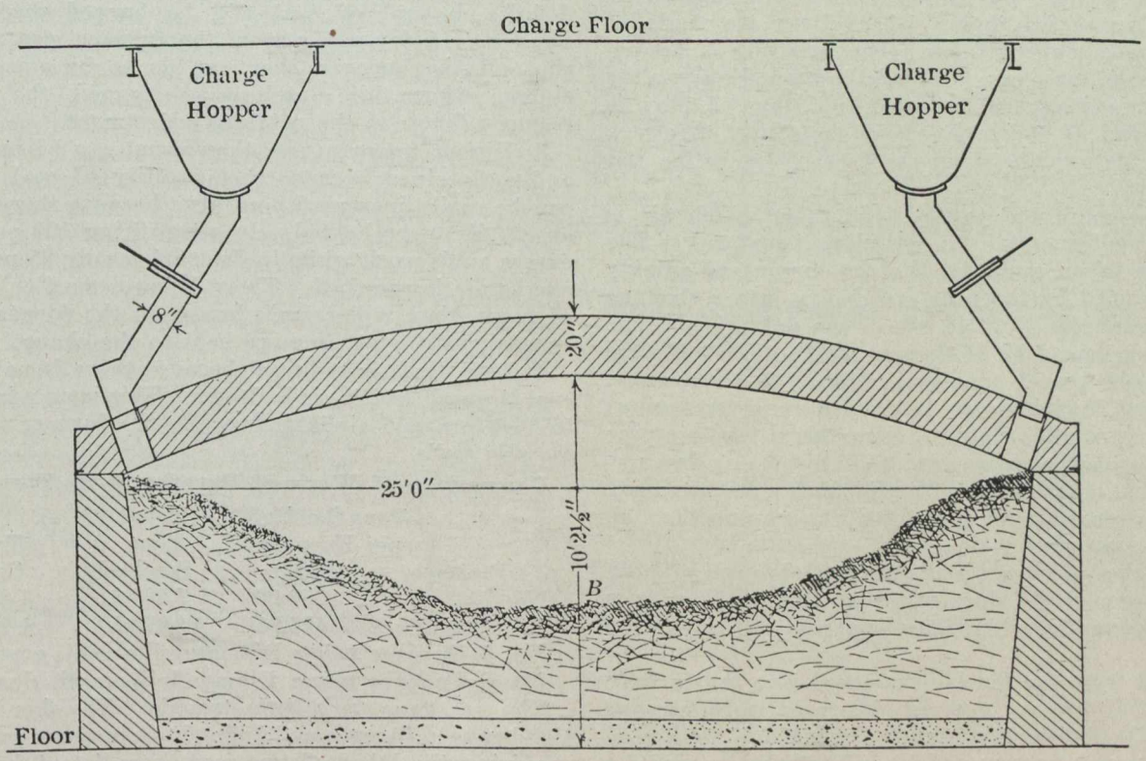


FIG. 2.—CROSS-SECTION OF FURNACE ON LINE *A–A* OF FIG. 1, SHOWING SYSTEM OF CHARGING.

4. The coal must contain enough volatile combustible matter to give the required combustion. In cement work coal containing as low as 22 per cent. V.C.M. has been used. James Lord, of the American Iron & Steel Co., recommends 30 per cent. as a minimum.

5. The furnace must be properly proportioned, properly equipped, and in good condition.

6. Provision must be made for taking care of the ash formed.

Equipment at Anaconda.

At Anaconda the following equipment is installed. It is larger than is required for one furnace, but was installed with the idea in mind of finally equipping the entire reverberatory plant for coal-dust firing.

The coal from the storage bin is fed into a 30 by 30 in. Jeffrey single-roll coal crusher, where it is reduced to 1 in. maximum size. It is then taken by a belt conveyor to the foot of an elevator passing over a Ding magnetic pulley, which removes any pieces of iron, bolts, etc. It is then elevated and fed by gravity into a 40 ft. by 6 ft. 8 in. Ruggles-Coles drier. The drier consists of two cylinders, the one within the other. Blades of angle iron are fastened to the inner side of the outer cylinder and the outer side of the inner cylinder, so arranged that as the drier revolves the material fed into the space between the cylinders is lifted and dropped on to the inner cylinder and at the same time carried to the discharge end of the drier. The outer cylinder at the discharge end extends beyond the inner cylinder and has a revolving head riveted to it; on the inside of the head are buckets which lift the coal and deliver it out through the central casting. It takes a particle about 30 min. to pass from feed end to discharge end of the drier. At the feed end the inner cylinder is extended beyond the outer cylinder and, passing through a stationary head, is connected with the fire box. The gases are drawn from the fire box by means of a 72-in. Sturtevant fan, forward through the

inner cylinder and back through the annular space between the cylinders to the stack. This exhaust fan is placed on top of the fire box and is connected to the drier by means of a 30 in. sheet-iron pipe. The fire box is fed with lump coal. The capacity of a drier depends upon the moisture in the coal and the speed of the fan. With Diamondville coal, we dry 18 tons per hour. During the month of September, 1914, we used 30 tons of coal to dry 1,984.77 tons of coal.

From the drier the coal is elevated, conveyed by a screw conveyor, and discharged into a steel bin placed above the pulverizer, which is in a separate building from the drier. It is not well to have the pulverizer in the same building with the drier, for the reason that if an accident should occur, causing the coal to overflow, it might be drawn into the fire chamber of the drier and cause a fire, with possible injury to employees.

The Raymond five-roller mill is used. It has an average hourly capacity of 4½ tons. At the top of the main shaft is a rigidly attached spider which rotates with the shaft and to the arm of which the five rollers are pivotally suspended by trunnions carried in bearings in the roller housing. Both upper and lower bearings of the roller journal are provided with long, removable, phosphor-bronze bushings. The rollers are made of cast iron with chilled faces. The grinding is accomplished by the force of centrifugal motion throwing the rollers outward against the steel bull ring. A plow is located ahead of each roller and constantly throws a stream of material between the face of the roller and the ring die.

A fan is connected to this mill from which air is admitted underneath the grinding surface. The material is taken away by the air current as quickly as it is reduced by the rolls and blown into a Cyclone dust collector placed 20 ft. above the pulverizer. The mill is thus kept free of fine material. The collector is of galvanized steel, cone shaped, and has a return-air pipe leading from it to the housing around the base of the mill. A surplus-air pipe from this return-air pipe relieves the back pressure and is an outlet for any surplus air that may enter with the feed. An auxiliary collector is placed to receive the dust escaping through this surplus-air pipe.

The finished product is discharged through a spout at the bottom of the dust collector, and is taken by a screw conveyor to a bin placed near to and above the furnace.

The coal from the bin is introduced into the furnace by means of an air current delivered through five "burners." The air current is produced by a No. 11 Buffalo fan at a pressure of 10 oz., and, by means of a pipe carrying a nozzle, is introduced into a 6-in. pipe leading into the end of the furnace. The coal dust, fed from the bin by a screw conveyor, drops upon this nozzle, which acts as a spreader, and is mixed with the air and taken into the furnace. A secondary air supply is obtained through the port holes through which the burners are projected into the furnace. These port holes are each 12 in. in diameter, which leaves an annular space 3 in. wide around each of the 6-in. pipes. By means of suitable dampers encircling the burners, this secondary air can be regulated. Another source of secondary air is through four openings between and above the burner ports, the size of the openings being regulated by putting in or taking out brick. The amount of coal fed is determined by the speed of the screw, which is easily regulated by a Reeves variable speed regulator. The entire grinding, conveying, and bin system, from the drier to the burners, is air tight, as far as practicable, with the result that the entire plant is extremely clean and free from dust.

The Advantages of This Method of Firing Are:

1. An increase in tonnage, which makes it possible to smelt the necessary tonnages with fewer furnaces.

2. The efficiency of this method is much greater than that of burning coal on grates. In burning coal on grates, there is a loss in transferring to the hearth the heat generated in the fire box. This does not occur in coal-dust firing, where the combustion occurs over the hearth itself. Another point is that none of the heat is lost in gratings from the fire box. In our practice of grate firing, this loss amounts to something like 10 per cent. of the fuel values. The efficiency is greater, due to a uniform temperature being maintained. There are no fluctuations in temperature due to firing cold fuel or to grate cleaning, or to the personal equation of the men firing the furnace.

The superintendent before leaving his work can adjust the feeding of the coal, and by securing this adjustment with a padlock he can be certain that a definite amount of coal will be burned during his absence. If, for any reason, the furnace men need to shut off the burners, they can do so by releasing a clutch; when this clutch is re-engaged, the burner resumes firing at the original adjustment.

3. Higher temperatures than usual can be produced and maintained because the quantity of coal burned can be easily increased, and also, because there is less excess air to be heated. In grate firing 100 per cent. excess air is used, while in dust firing only 25 per cent. excess air is required. There being a smaller volume of gases, they will remain longer in the furnace, and, consequently, give up more heat to the charge.

4. Less draft is required because there is no bed of coal through which air is drawn. This is an advantage in that less cold air is drawn into the furnace through the side walls.

Comparison of Work of Reverberatory Furnaces.

Furnace.	Tons Smelted per Furnace Day.	Total Tons Smelted.	Tons Coal.
No. 7	250.96	7.260.31	1.870.94
No. 8	475.75	14.272.52	1.984.77

No. 7 Furnace using Diamondville coal, grate fired.
No. 8 Furnace using Diamondville coal, dust fired.

The ash gave very little trouble. The flue connection between furnace and boiler is cleaned once per day, requiring the labor of two men from 4 to 6 hrs. each day. We found the flue was easier to keep clean when using coal containing 22 per cent. ash than when using coal containing 9 per cent. ash; this difference was due entirely to the physical characteristics of the ash. In the first case the ash was light and fluffy, while in the second case it tended somewhat to sintering. Approximately, one-half of the ash of the coal floats on top of, or is absorbed by, the slag, and does not noticeably interfere with the work of the furnace. For the month of September we took from the flue 85.54 tons of ash and flue dust.

Very little of the ash goes into the boilers. The boiler tubes are cleaned no oftener than are those connected to grate-fired furnaces.

The labor employed in the pulverizing plant is more

than normal on account of not using an economical unit. The drier is run 8 hours per day and requires three men to shovel coal to crusher and one man to tend the drier. With mechanical feeding of crusher, four times as much coal can be dried at the same labor cost. One man per shift of 8 hrs. tends the pulverizer. When more pulverizers are put in one man can tend two of them.

The repairs as yet are almost nil. In time, as the elevators, conveyors, etc., need replacement, repairs will cost something, but will never be very high per ton of coal prepared. The electric power for drier, pulverizer, fans, elevators, and conveyors totals 125 h.p. per month.

On account of not working an economical unit a fair average cost of preparing the coal cannot be given. The general opinion is that it can be done for 35c. to 40c. per ton of coal. This means from 5c. to 7c. per ton of charge smelted. There are three men per shift of 8 hrs. doing the skimming, tapping, and charging of furnace.

The management of the works are now planning a furnace of larger dimensions. Profiting by the work done by No. 8 reverberatory, a few changes in construction will be made. This furnace, shown in Figs. 1 and 2, will be 144 ft. long by 25 ft. wide, inside dimensions; 9 ft. 3½ in. high at the back and 6 ft. 6 in. at the front; flue area, 48 sq. ft. It will have hoppers for charging calcines and fettling material on both sides for its entire length. The tapping of matte will be from the front of furnace. The pipes leading from the charge hoppers will be enlarged to 8 in. The skimming plate will be 12 in. higher than in the other furnaces, thereby giving a larger reservior for the accumulation of matte. The top of the skimming plate will be 24 in. in height above the tap hole. The general construction will be as before. No changes are to be made in the machinery for preparing and delivering the coal to the furnace.

The efficiency of this method of firing is improving so rapidly that a paper is almost out of date before it can be read. New records for tonnage and fuel ratio are made almost every day. The average tonnage per day for the past week (Oct. 16, 1914) was 542.7, with a fuel ratio of 7.50.

PROTECTING AGAINST ELECTRICAL ACCIDENTS.

In his annual report submitted to the U. S. Secretary of the Interior, Dr. Joseph A. Holmes reviews the investigations made by the U. S. Bureau of Mines to safeguard miners from electrical accidents. Director Holmes makes the declaration that not only have many men been killed or injured from what are believed to be unnecessary electrical accidents, but indirectly electrical apparatus has been responsible for mine explosions and mine fires that have extensively destroyed both life and property.

He further says that, through the activity of the bureau in calling attention to dangers heretofore unappreciated in the use of electrical machinery, manufacturers have devised safer types of apparatus and States have enacted stricter laws governing electrical installations.

Much attention has been paid to the proper construction and use of electric and other safety lamps. Tests have been made to ascertain the comparative merits of different types of safety lamps, including their usefulness in furnishing light to miners, their relative safety, and their value in indicating the presence of explosive gas. The well defined principles that govern the mechanical construction of a modern safety lamp have been largely exploited in this country by European manufacturers and covered by patents in this country. During the present year some of these patents have expired, and, in consequence, American lamp manufacturers and lamp agencies have been inspired to develop new models. Already an improved safety lamp of American manufacture has appeared, and samples of others have been received by the bureau for examination and criticism. The bureau has studied all types of safety lamps on the market, and as a result has prepared a schedule of official tests to be used in establishing a list of permissible safety lamps for use in gaseous mines.

At the beginning of the year the bureau's requirements for testing explosion proof motors had been prepared and published. The work was necessary, because no successful explosion-proof motors had been developed in the United States. During the year only one motor was submitted for test, but this machine passed the tests successfully. It is believed that the bureau's approval will stimulate other manufacturers to renewed activity in producing such motors.

In the investigation of the ignition of coal dust by electric flashes, valuable results have been obtained. Coal-dust ignitions have been obtained under practical underground conditions with currents of surprisingly low voltage. The danger of dust explosions being started by such currents has been shown, but the work needs to be continued to determine the extent of the danger and how it may be nullified.

GOLD RECEIPTS AT VANCOUVER, B.C., 1914.

During the calendar year 1914 the receipts of gold bullion at the Dominion of Canada Assay Office, Vancouver, British Columbia, were as follows: Number of deposits, 1,115; weight in troy oz., 166,150; net value, $2,029,500. The corresponding information for the calendar year 1913 was: Number of deposits, 783; weight in troy oz., 111,500; net value, $1,448,625. The increase for 1914 over 1913 was: In number of deposits, 332; in weight of gold, 54,650 troy oz.; in net value, $580,875.

The following particulars show the sources, weight and net value of the bullion received during eleven months ended November 30th, 1914:

Sources.	Weight in Troy oz.	Net Value.
British Columbia ..	98,965.33	$1,002,285.51
Yukon Territory ..	56,405.85	911,718.06
Alberta.	30.08	511.55
Total from Canada	155,401.26	$1,914,515.12
Alaska.	357.22	6,289.07
Totals for eleven months.	155,758.48	$1,920,804.19

INSTITUTION OF MINING AND METALLURGY.

The council of the Institution of Mining and Metallurgy has elected Sir Thomas Kirke Rose to succeed Dr. F. H. Hatch in the presidential chair in March next.

The institution has every reason to be proud of the part being taken in the war through the individual patriotism of its members. The number on active service with His Majesty's forces is already over 200.

MINING AT ROSSLAND, B.C., IN 1914

The mines in Rossland camp, British Columbia, have in all years to date produced minerals of a gross value of more than $62,000,000. As the average annual total for five years, 1910-1914 has been approximately $3,-135,000, it may be seen that they are continuing to add substantially to the value of the mineral production of British Columbia. Official records show that from a total of $75,521 in 1894, there was an increase year after year until, in 1902, the maximum amount for any year was reached with a value of $4,893,395. The preliminary estimate for 1914 shows a higher total than for any other year since 1908, which seems to be convincing testimony that confidence in the stability of the mining industry of Rossland camp is well warranted.

Lode mining in Nelson district has passed its twenty-fifth annual anniversary; Rossland mines, though, still lack nearly two years of a quarter of a century of production, albeit their output in 1891-2 and 3 was very small. Early history notes often prove interesting; here are some, taken from the "Genesis of Lode Mining" included in the "Report on the Mining and Metallurgical Industries, 1907-8," issued by the Canada Department of Mines several years ago:

"The first production of copper was made in 1888-89, from the Hall Mines (Silver King), near Nelson, the value of the product—which consisted of a consignment of 100 tons—having been extraordinarily high, the ore containing from 220.5 oz. silver per ton and 17 per cent. copper to 574 oz. silver per ton and 43.36 per cent. copper. A small shipment of copper ore—10 tons—was also made from Rossland, in 1891, followed by 700 tons in 1893; but regular production was not commenced until 1894. Meanwhile it is interesting to note, in connection with Rossland's first production of ore, that the exceptionally high smeltery returns of $84 per ton—or 5.21 per cent. copper, 3 oz. silver per ton and about 4 oz. gold—were responsible for bringing about the first important investment of capital in that camp."

Incidentally, it may be mentioned that Mr. Wm. A. Carlyle, then Provincial Mineralogist for British Columbia, in a bulletin on the Trail Creek mining division, published in 1896 by the Provincial Bureau of Mines, gave the information that these high returns were from ore from the Le Roi, then only a prospect. After narrating the circumstances under which Col. E. S. Topping, then of Trail, acquired the Le Roi mineral claim, and his negotiations with the Spokane men to whom he bonded a 16-30th interest in the property under conditions which included the stipulation that $3,000 should be expended in doing development work during six months, and the commencement of work by Mr. Oliver Durant, Mr. Carlyle continued: "As work proceeded samples of the ore taken yielded as high as $60 in gold. Mr. Durant also looked over half a dozen other claims, including the Centre Star, War Eagle and Josie. He was satisfied with the showings in the new camp, and left Mr. E. J. Kelly in charge of the work of sinking a shaft on the Le Roi. As work proceeded samples of the ore taken out were forwarded weekly, with great difficulty, via Trail creek and Columbia river, to Marcus, Washington, and these on assay returned from traces of gold up to $472 per ton. In the spring of 1891, after many vicissitudes had been experienced, 10 tons of picked, pure sulphide ore from the bottom of the 35 ft. shaft where the vein was fully 9 ft. wide, was packed out to the Columbia and shipped to the Colorado smelting works at Butte, Montana. The returns obtained were at the rate of $84.40 per ton, or 3 oz. silver, about 4 oz. gold and 5.21 per cent. copper. The bond was then taken up, and in the course of time the remaining 14-30th interest in the property was sold by Colonel Topping to other parties. The Le Roi Gold Mining Co. was then formed, and about 70,000 shares of the treasury stock sold at a low price. After the proceeds of the sale of this stock had been expended, the embryo mine had to be closed until the winter of 1883-4, when, a road having been meanwhile constructed from the Columbia up Trail creek to the camp, the ore that had accumulated on the dump was hauled in sleighs to the river and shipped thence to the smeltery. Returns from these shipments gave a good profit, so active mining operations were begun, and the mine was fairly launched upon its career."

The Dominion official who described the Rossland ore, which contained about 4 oz. of gold to the ton as "copper ore," as above quoted, must have been just a little facetious, whether consciously or otherwise, for after twenty-three years of mining in that camp it is found that fully two-thirds of the total value of the production to date has been in gold. For the information of those interested in making comparisons, the following figures are submitted, they having been taken from the Consolidated Mining and Smelting Co.'s last annual report, for the company's fiscal year ended September 30, 1914: Output of Centre Star and Le Roi groups of mines for year, 252,878 tons of ore and 146 tones of concentrates. (Note—Allowing 6 into 1 for the concentrates, makes 876 tons of ore, which brings the total quantity of ore up to 253,754 tons.) Metal contents were: Gold, 121-792 oz.; silver, 102,195 oz.; copper, 3,621,195 lb.; gross value, $3,034,413. It will be seen that this gives an average value of rather less than $12 a ton. This compares with $14.51 a ton, shown in the company's report for the fiscal period ended September 30, 1913, as the gross value per ton of 262,508 tons, from the same mines, then included in the company's output returns.

Ore receipts at the smeltery at Trail up to December 24, inclusive, were as follows: Centre Star group, 170,-227 tons; Le Roi, 93,955 tons; Josie (Le Roi No. 2, Ltd.), 18,052 tons; Blue Bird, 38 tons; Phoenix, 4 tons; total, 282,656 tons; adding an estimate of 3,380 tons, which for the remaining week is a mere guess, brings the total for the year up to 285,656 tons. This, however, does not include the Josie second-class ore that was milled, but only the concentrate from it shipped to the smeltery. It is likely the total output for the calendar year, including Josie ore milled, was approximately 300,000 tons.

Centre Star—As December figures for the Centre Star and Le Roi mines have had to be estimated, those that follow are approximate, though unlikely to differ materially from the exact figures, which are not yet available. The total footage of development work done in the Centre Star group of mines in the calendar year is between 11,000 and 12,000 ft.; of diamond drilling there was done between 10,000 and 11,000 ft. Ore received at Trail from these mines totalled 170,227 tons at the end of the week of Dec. 24. The company's annual report shows that in the fiscal year, ended September 30, development work totaled 13,182 ft., and diamond drilling 10,479 ft. It is noteworthy that the grand total of development work in these mines was, at the end of Sep-

tember, 185,434 ft., or rather more than 35 miles. The output of ore was 172,379 tons, and of concentrate 9 tons; the metal figures are: Gold, 90,762 oz.; silver, 63,-131 oz.; and copper, 1,804,191 lb.; total gross value, $2,139,522. The general manager's comment was: "The company's mines in Rossland continue to show an increase in the amount of ore available, the greater part of the increase being due to tonnage developed in the Le Roi mine, where development work has yielded very satisfactory results.

"The crosscut from the Centre Star shaft, mentioned in the last Annual Statement as being driven to connect with veins developed on and above the War Eagle 14th level, and 300 ft. below that level, reached the ore about January 1, 1914 and although the orebodies so far opened on this 16th level have not been as large as on the 14th level, the prospects are that a large tonnage will be obtained between these levels. The Centre Star shaft below this level is being repaired, with a view to driving another crosscut, below this 16th level, to tap the vein at 300 ft. greater depth.

"The satisfactory results of development in the lower levels of the War Eagle strongly indicate the favorable possibilities of still deeper development."

Le Roi.—As already stated, December figures for the Le Roi have had to be estimated. On this basis, the total foootage of development work done in the calendar year 1914 was about 3,000 ft., and of diamond drilling about 11,000 ft. Ore received at Trail to Dec. 24 totalled 93,955 tons. The figures for the fiscal year are as follows: Development work, 3,259 ft.; diamond drilling, 12,016 ft. The grand total of development work done in the Le Roi group is 79,011 ft., or nearly 15 miles of underground workings.

Plant, machinery, buildings, and equipment generally at the Consolidated Co.'s mines are fully adequate to all operating requirements, so there were few additions made out of the ordinary during the year. The rebuilding of the Centre Star ore shipping bins was completed. The company has at Rossland a complete equipment for making tests in various methods of concentration, but no publicity is given to the operations and results at that plant.

Le Roi No. 2, Ltd.—No information was received quite recently from the Le Roi No. 2, Ltd., which has for years been operating the Josie group of mines, adjoining the Le Roi-War Eagle group. Published figures show that ore receipts at Trail from these mines to December 24 had totalled 18,052 tons. The following notes indicate the impressions received of this property when a visit was paid to Rossland last summer.

In the last report issued by the Le Roi No. 2, Ltd., it was stated that 1650 ft. level of the company's mine had been driven to within 5 ft. of the Annie-Black Bear boundary. The Annie is one of the Le Roi No. 2 Co.'s group of claims; the Black Bear is a part of the Le Roi group, now owned by the Consolidated Mining and Smelting Co. The ore there developed assayed gold 0.25 oz. to the ton, and copper 3.3 per cent., across an average width of 6 ft. Then, in the hanging wall of the same drift there were followed for a distance of 65.5 ft. two veinlets containing pyrrhotite, which in places enlarged to 24 in. The average assay value of samples of this ore was gold 14 dwt. to the ton, and copper 0.8 per cent., which value was afterwards verified by shipments of ore made to the smeltery. It is noteworthy that the ore obtained from these veinlets more than paid for the cost of work done in developing them. Since then a winze has been sunk from the 1,650 ft. level to a depth of 85 ft.; it is in ore all the way down and neither wall has been reached. There is little doubt that this ore continues upward into the Black Bear (Le Roi) ground and that it is of good grade and in considerable quantity in that mine, but no information to this effect has been made public. The Le Roi No. 2 is continuing the development of its northern territory, which part of its group of claims has not yet been extensively opened. Recent results are such as to induce the company to keep on working there, and ore production from that part of the property may be expected in due course. The company has taken an option on the Giant-California properties, lying to the west of its Josie group, and will do some development work on them. Some time ago production was maintained from these mines, but they have since been idle for several years.

To this may be added the statement that following the war troubles that affected so many mines, the Josie was idle for a few weeks, but work was resumed, and has been continued to date, and shipment of ore to the smelter has been maintained regularly.

South Belt—The South Belt was disappointing in 1914, for there was little mining done there. The Blue Bird made small shipments, and a few tons of ore was also sent to Trail from the Phoenix, but on the whole there was little progress made in that part of the camp. The Consolidated Co. acquired the Sunset No. 2 group, with other properties purchased from the Canadian Goldfields Syndicate, but it did not undertake development work there before the close of the year under review. Nothing has been done on the Sunset property for a number of years.

General.—One feature of the year that should not pass without mention is the considerable interest taken by miners and others in Rossland camp in the work of "first aid to the injured," for instruction in which several classes were organized by Mr. Dudley Michel, of the staff of the Provincial Department of Mines, and instructed by local doctors. While many took an active part in promoting this work, Mr. M. E. Purcell, superintendent of the Centre Star mines, led the way; Mr. E. G. Montgomery, assistant superintendent of the Centre Star; Mr. F. S. Peters, superintendent of the Le Roi; Mr. Ernest Levy, manager of the Le Roi No. 2, Ltd.; Messrs. G. J. A. Guisson and H. H. J. Johnson, of the Centre Star staff, were among those who "stayed with it," and qualified for the St. John Ambulance Association's certificate of competency to render "first aid."

To any one doubtful concerning the future of the lode mining industry of British Columbia, a short stay in Rossland camp may well be recommended as a certain cure, for no one could live there many days without realizing in a most unmistakeable manner the firm conviction and full confidence generally prevailing concerning the future of the mines there. Probably no where else in the province is there greater faith in the mines, which every one is well assured will continue to develop most satisfactorily and profitably and that the industrial and commercial life of the community will prosper accordingly.

CROWN RESERVE.

The annual general meeting of the shareholders of the Crown Reserve Mining Co., Limited, will be held in the hall of the Sailors' Institute Building, No. 8 Place Royale, Montreal, P.Q., on Wednesday, Jan. 27, 1915, at 3 p.m.

COAL MINING IN BRITISH COLUMBIA IN 1914

By E. Jacobs.

In 1913, labor troubles at Vancouver island collieries prevented total production of coal in British Columbia from being normal; in 1914 the effects of the European war are seen in decreased output of coal from mines on Vancouver island and in Crowsnest district, Southeast Kootenay, while in Nicola district less coal was mined owing to the change from coal to oil for fuel on the Canadian Pacific Railway Co.'s western lines. The decreases in production of individual districts may be seen by comparing the following figures for 1913 with those shown in the 1914 table below. The gross production in East Kootenay in 1913 was 1,331,725 long tons; in Nicola and Similkameen 265,542 tons; on Vancouver island 973,493 tons; total gross output 2,570,760 long tons as compared with 2,173,560 long tons in 1914. The loss in quantity of gross production of coal was therefore 397,200 long tons.

The districts in which coal was mined, and the proportions of production of the various mining companies, are shown in the following table:

Production of Coal in B. C. in 1914.

Vancouver Island—	Long Tons.	Short Tons
Canadian Collieries (Dunsmuir) Ltd.	533,014	596,976
Pacific Coast Coal Mines, Ltd..	122,927	137,678
Vancouver-Nanaimo Coal Mining Co., Ltd.	106,013	118,734
Western Fuel Co.	302,959	339,314
Total.	1,064,913	1,192,702
Nicola—		
Inland Coal and Coke Co., Ltd.	56,000	62,720
Middlesboro Collieries, Ltd. ..	60,000	67,200
Pacific Coast Colliery Co.	500	560
Total.	116,500	130,480
Similkameen—		
Coalmont Colliery	4,000	4,480
Princeton Coal & Land Co., Ltd.	15,640	17,517
Total.	19,640	21,997
Southeast Kootenay—		
Corbin Coal and Coke Co., Ltd.	74,230	83,138
Hosmer Mines, Ltd.	118,157	132,336
Crow's Nest Pass Coal Co., Ltd.	780,120	873,734
Total.	972,507	1,089,208
Gross production of coal	2,173,560	2,434,387
Made into coke	351,341	393,502
Total production, net...	1,822,219	2,040,885

The production in December having to be estimated, there will be some changes from the foregoing figures, but the differences the revised returns will make will be quite unimportant.

Output of Coke.

The quantity of coke made in 1914 is estimated at 266,483 short tons (237,930 long tons), of which 227,016 short tons was from the ovens of the Crow's Nest Pass Coal Co. and 39,467 tons from those of the Hosmer Mines, Ltd. This total output of 266,483 short tons compares with 319,323 short tons in 1913, which latter was a record year for coke-making in the province. With the exception of 1911, when labor troubles prevented production during the greater part of that year, the output for 1914 was the smallest of any year since 1906. However, an early increase in the quantity made is looked for, renewed demands for coke having led to the re-starting of 100 of the Crow's Nest Pass Co.'s ovens at Michel about the middle of December, with a prospect of still more being in use ere long.

Vancouver Island Collieries.

The strike of miners employed at the several collieries on Vancouver island declared by the United Mine Workers of America as from May 1, 1913, was continued during the greater part of 1914, but meanwhile the mine owners obtained all the men they required to operate their mines, so that when the U. M. W. of A. eventually called off the strike the production of coal was as large as market conditions called for. Unfortunately, though, less coal was required for bunkering purposes for, as already intimated, war conditions unfavorably affected the demand for it. The activity of German cruisers that sought to destroy the shipping of the allied powers at war with Germany, for a period of four months interfered with the steamship trade to which Vancouver Island collieries usually look for a considerable portion of their market. In December this interference was removed by the destruction of nearly all of those of the enemy's war ships that had been instrumental in disturbing the mercantile service in the Pacific Ocean of Great Britain and her allies. Again, the competition of fuel oil is felt in some measure, though not a very much larger degree than in 1913.

Canadian Collieries (Dunsmuir), Ltd.—There is little that is new to tell of in connection with the Comox mines (also known as the Cumberland mines) of the Canadian Collieries, Ltd., at some of which important changes, in the substitution of electric power for steam, were made in 1913, new equipment was added, and underground development was done. Work was stopped at the new mine known as No. 8. The improvement of the standard-gauge railway connecting the mines with the shipping docks at Union bay was completed, and generally adequate provision was made for a considerably enlarged output, but market requirements did not call for the larger production capacity of the Comox colliery being fully drawn on. All through the year more miners were available than there was full-time employment for, so the labor question did not lessen production, for all the coal that could be sold was got out. For a while there seemed to be a probability of the company's coke ovens at Union bay being used again, after having been unused for several years, but the negotiations with a copper mining and smelting company operating in the coast district were not brought to a successful issue before the close of the year, though not yet broken off.

At this company's Extension colliery, situated southwest of Nanaimo, good progress was made during the year. New electric locomotives were obtained to replace those destroyed by fire during the strike, and new surface buildings were erected. Good work was done underground, so that the mines of this colliery were restored to normal producing capacity and made an

output of coal accordingly. The producing capacity of this colliery is now fully 1,000 tons a day, as compared with 250 to 300 tons last year.

Western Fuel Company.—Considering conditions in the early part of the year, an excellent showing was made by the Western Fuel Co.'s No. 1 mine, Esplanade, Nanaimo, which was the only one of the company's group of mines that coal was mined from in 1914. No improvements, however, were made in this mine other than those to the haulage system from the foot of the shaft to the North Side workings where the producing capacity was increased 60 to 70 per cent. The company's Northfield (Brechin) mine was idle throughout the year; it is possible this mine may be permanently abandoned.

At the company's Reserve mine, situated three or four miles south of Nanaimo, two shafts each 10x26 ft. inside of timbers, 350 ft. apart and sunk to a depth of about 1,000 ft., sinking of which was commenced in April, 1910, were completed, and tunnels of about 200 ft. in length were driven back to the coal seam. The ventilation system has been completed, and the work of making a connecting heading in the coal undertaken. The coal where cut showed 14 ft. thick of the Douglas seam, the coal being clean, firm, and of good quality. The surface plant here, as well as the underground installation, will be modern in every respect. It is expected that the production of coal from this mine will reach 1,000 tons a day toward the latter part of 1915, and it is planned to increase to 2,000 tons the next following year. The company contemplates opening another mine in the district after the improvements at the Reserve mine shall have been completed.

Pacific Coast Coal Mines—At the South Wellington mines of the Pacific Coast Coal Mines, Ltd., operations were also resumed months before the calling-off of the strike. There was little worthy of particular notice at this company's Fiddick colliery, but at its Morden mine, situated two miles east of South Wellington, at which two shafts were sunk in 1912 and 1913—the main shaft 9x16 and the air shaft 9x12 ft. in the clear—a reinforced concrete and steel tipple was constructed, modern machinery installed, and the pithead generally completed along up-to-date lines. An 8-ft. seam of coal, reached at 600 ft. depth, is being opened here. At the company's Suquash mine, in the northern part of Vancouver island, completion of a new shaft and slopes to connect with older workings was resumed after interruption by the strike, besides which the requisite plant and machinery were put in.

Vancouver-Nanaimo Co.—Little information was obtained relative to operations throughout 1914 at the Vancouver-Nanaimo Coal Mining Co.'s Jingle Pot mine. The mine was worked under an agreement with the U. M. W. of A., and its output was, as shown above, about 118,000 short tons of coal.

Nicola and Similkameen.

Two companies operating in Nicola district produced coal on a commercial scale in 1914, namely the Inland Coal and Coke Co., Ltd., and the Middlesboro Collieries (formerly the Nicola Valley Coal and Coke Co.).

Owing to the competition of foreign fuel oil, which was substituted for coal in the several cases, the demand for coal was reduced by nearly one half, so that instead of an output of about 114,000 long tons each as was made in 1913, the first-mentioned company produced only 56,000 tons and the other 60,000 tons in 1914.

The Inland Co. continued development of its mines, chiefly the further sinking of the main slope, the extension of the levels, and driving a 300-ft. rock tunnel at the 600-ft. level to open No. 5 seam, which there shows 7 ft. of clean coal. This company's property, known as the Coal Hill Colliery is situated west of and about 500 ft. above the Middlesboro colliery.

Slackness of coal trade led to a curtailment of operations by the Middlesboro Collieries, Ltd., so Nos. 2 and 6 mines were idle, mining having been restricted to No. 4 seam, opened in 1913 on the west side of the property and known as No. 7 mine. A slope to the south dipping about 25 deg. has been driven more than 1,500 ft., with levels turned off to left and right every 200 ft. The coal is about 18 ft. in thickness with sandstone roof and floor. Present output from here is approximately 300 tons each working day. Development work on the slope is being continued. Several months ago No. 4 seam was also opened by a slope started from a point 1,000 ft. east of the tipple and has been driven 300 ft. The coal is practically the same as in No. 7 mine, but the roof is shale. It is intended to connect these new openings with No. 4 mine and thereby simplify the conducting of air currents and reduce the cost of haulage. With a continuation of development work in ratio to the output from stalls and pillars, an output from this colliery of about 1,000 tons a day can be maintained.

In Similkameen district, the Coalmont and the Princeton collieries were operated. At the Coalmont property about 3,500 ft. of development work was done. In the spring there were found two seams of coal, of 7 and 5 ft. respectively, with only a small parting between, making practically a 12-ft. seam of coal, giving on analysis, moisture 4.95, volatile combustible 35.93, fixed carbon 49.47, and ash 9.65. Small additions were made to steam power and ventilation facilities, and preliminaries for providing transportation to the railway three miles away were taken in hand. The Princeton Coal and Land Co. did 400 ft. of development work on a new slope and 320 on the counter, and more than 1,000 ft. on east main levels Nos. 4 and 5 with counters. Additions were made to both steam and electric equipment. With construction of more railway lines in progress in the neighborhood, the prospects for an increased market for coal are favorable.

Collieries in Southeast Kootenay.

Three companies operated, namely the Crow's Nest Pass Coal Co., Ltd., the Hosmer Mines, Ltd., and the Corbin Coal and Coke Co. There is little to report of the Hosmer colliery, for the reason that last summer it was closed, and it is understood that it has been permanently abandoned by its present owners who have finally given up work in country found to be so disturbed as to make profitable mining of the coal out of the question.

Crow's Nest Pass Coal Co.—The considerable decrease in production of coal and coke at this company's collieries, as compared with 1913, is attributed to a general decrease in consumption all over the region in which are its available markets, this having been especially true since the beginning of the war. New work was done, however, and additions made to equipment, as follows: At No. 1 East mine, Coal Creek colliery, there was installed a new Wilson fan with double engine drive capable of either forcing or exhausting

about 150,000 cu. ft. of air per min. There was constructed and prepared a double-track endless rope haulage tunnel 2,500 ft. long, which embraced driving a close drift 600 ft. long with 300 ft. of end roof cutting. This main roadway is now about ready for putting in the double-track system. At this mine there was also driven a third gravel inlet and drainage tunnel, 350 ft. long, this being intended to serve a triple purpose, namely, (1) to provide drainage at the lowest point of operations, (2) to afford duplicate inlet thereby reducing velocity of air currents, and (3) to give a greater measure of security to the approaches to the mine. Development was also done in New B. mine where a new fan was installed and the mine opened to a producing capacity of about 800 tons of coal a day. Other work done included pushing four-way planking development along the two sides of the old No. 2 mine, where on the demand for coal becoming normal, the company expects to recover a breadth of workings at least equal to the highest and best past output of this mine formerly very productive.

At its Michel colliery the Crow's Nest Pass Co. developed its new No. 8 mine to a capacity of 600 tons a day, and it redeveloped No. 3 seam on the south side of the valley through the syncline basin faults that form the line of crumpled bending between the Elk and Michel valleys, and coal of a greatly improved structure was found. Two new seams of coal were found on the south side of the valley, approximately 175 and 250 ft., respectively, above No. 3 seam and these were traced to suitable points for permanent development which will be undertaken immediately further expenditure in new work shall be deemed expedient. Generally, in 1914 the company provided for an increased output of coal to the extent of at least 1.000 tons a day more than the physical output of 1913.

Corbin Coal and Coke Co.—Much more surface stripping was done at the Corbin Coal and Coke Co.'s No. 3 mine, also known as the "Big Showing," where during the part of the year when there is no snow on the mountain operations are conducted on the open-cut or quarry system. A Marcus screen was added to the surface equipment. Production of coal was a little larger than in 1913—74,230 long tons against 72,788 tons.

General Notes.

No important progress was made in the non-producing coal fields in the province, although more prospecting and exploration of coal measures was done in several of the outlying fields. Until a railway shall be constructed to the Groundhog field in the northern Skeena country, where the occurrence of anthracite is claimed by owners of coal lands there, no effective advance can be made toward commercial development.

In conclusion, reference may be made to the Mine Rescue work. Beside the ample mine-rescue apparatus and men trained in its use that all operating coal-mining companies have provided, as required by provincial law, the Provincial Government has two fully equipped mine-rescue stations in the province, with Draeger mouth-breathing type of apparatus. Efficient men are in charge of these stations, and it is here that training is done to give opportunity to those who take it to qualify for obtaining Government certificates of efficiency. As well, instruction is given in the use of the pulmotor, and in the St. John Ambulance Association method of rendering "first aid to the injured."

A FIRST AID OUTFIT

By Magnus W. Alexander.

To train men in proper methods of first aid treatment of injured and sick persons, and not to furnish proper materials for this work would be doing half a job only; to furnish the materials and not to provide for their convenient storage and ready accessibility would be doing the job in a slip-shod manner. It is therefore important that first aid materials for effective treatment of slight wounds, or for emergency treatment of serious injuries, should be furnished and kept in a suitable container in which they can be readily carried. Such first aid outfits, in one form or another, are now in quite general use in industrial establishments, in stores and offices, in schools and even in homes.

For some first aid outfits, wooden or tin boxes are used as receptacles for the materials. Wooden boxes are usually heavy and are inconvenient to carry; tin

boxes are lighter in weight, but are easily dented and are apt to rust. Both are open to the complaint that it is difficult to keep them clean and in good order. These outfits have the added disadvantage that their entire contents, which cannot be seen at a glance, may have to be disarranged to get at a particular article which may be at the bottom of the box.

In order to provide a more sanitary equipment, glass jars have come into use as containers for first aid materials. Their advantages over wooden or tin boxes are obvious. If properly constructed, such outfits can be easily kept clean and quick access can be had to all materials.

The N. A. S. O. standard first aid jar was developed to meet all requirements of a compact, convenient, sanitary first aid outfit. The jar itself is structurally strong and is made yet stronger by a special annealing treatment. It was designed with smooth surfaces and particularly with straight walls on the inside to promote cleanliness and facilitate the removal of first aid materials. In the glass cover of the jar is moulded a convenient carry handle and the cover is securely held on the jar by suitable spring clips, which are a part of a metal cage in which the whole jar sits; this metal cage affords added protection against breakage of the jar. A rubber gasket between the jar and the cover makes the outfit dust-proof and equalizes strains in the cover. The jar is made only high enough to accommodate the bottles of medicaments stored in it so that the stoppers cannot come out of the bottles when the cover

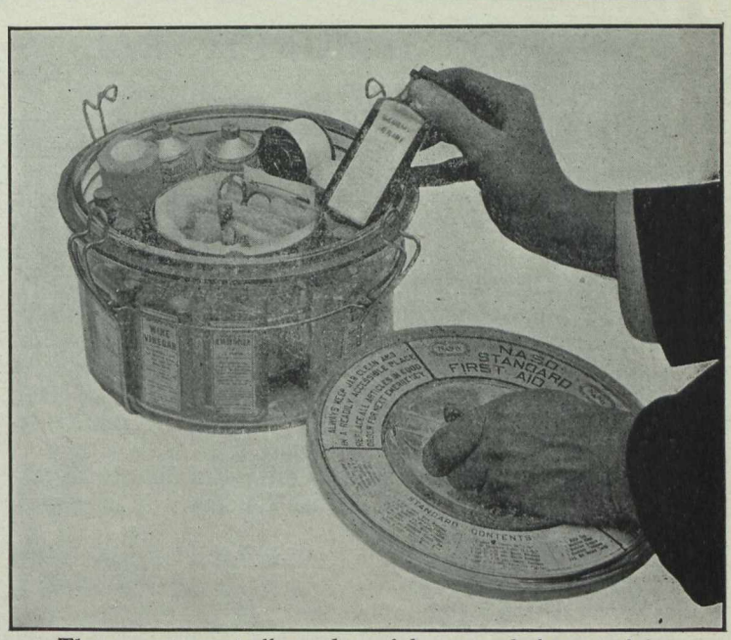
rests on the jar. Medicine bottle, bandages, absorbent cotton, burn ointment in collapsible tubes and a wire gauze splint are set along the wall of the jar so that they are plainly visible from the outside and can be quickly located. A metal dish of special construction, placed in the inside of the jar, keeps the materials just mentioned in their proper place. A metal dish itself is used as a receptacle for other parts of the contents, such as tourniquet, medicine glass, gauze bandages, medicine droppers, spoon, scissors, etc.

A glance at the accompanying illustration and list will show that a surprisingly large number of articles are stored in the jar, which is only about 9½ in. in diameter, 6 in. high, and complete with contents weighs only slightly more than 12 pounds. Yet the jar includes every material, which a large conference of physicians, with extensive experience in the treatment of injuries, agreed upon as necessary for effective first aid treatment by laymen.

Even a splint is stored in the jar and for this purpose a strip of flexible wire gauze 30 in. long and 4½ in. wide is used, wound into a small roll. This can easily be cut to the required length and can be shaped snugly around the broken limb; when held in place by bandages this splint affords ample protection to the broken limb until a physician can set the fracture.

Although it is not contemplated to use water in first aid work, yet when necessary, both the jar and the metal dish may be utilized as water vessels.

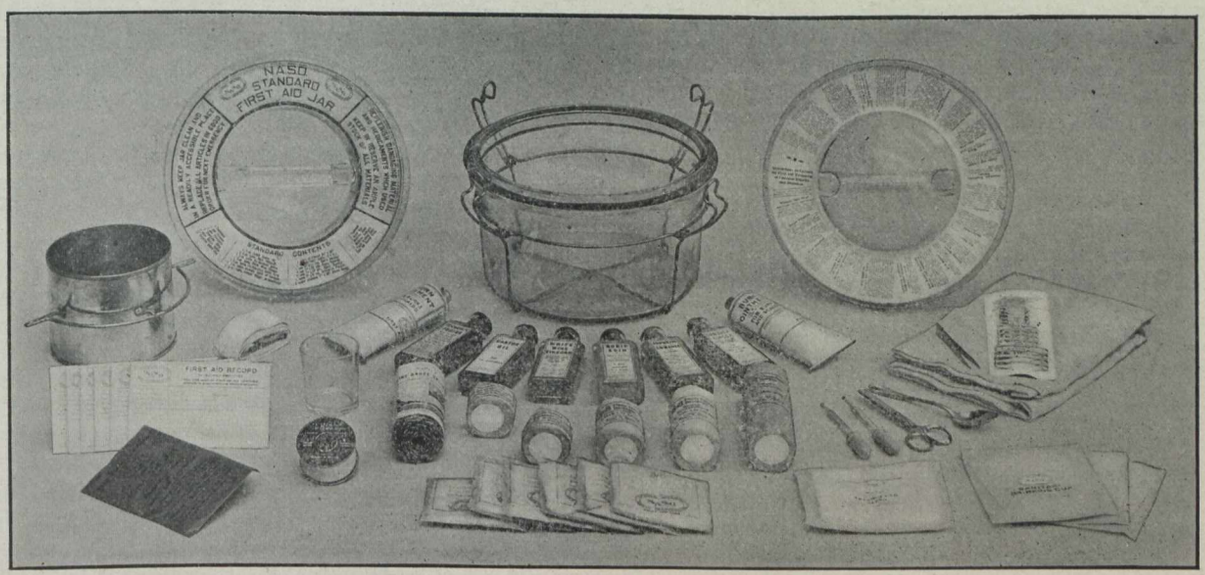
To furnish proper material for first aid treatment of injured and sick persons and not, at the same time, state how these materials should be used, would also be



The arrangement allows the quick removal of any article without disturbing the rest

kept in the padded shipping box, which is provided with an opening in the lid so that the whole outfit can be carried by the handle of the jar. When desired a lock may be attached to the box.

The whole arrangement of the N. A. S. O. standard first aid jar warrants the claim that it is a compact, convenient, sanitary first aid outfit. It is called the N. A. S. O. jar because it has been standardized by the



N.A.S.O. Standard First Aid Jar and Contents

doing half a job only. It is necessary therefore to include in the first aid outfit suitable first aid instructions. If these were provided in the form of a book or leaflet, they might be misplaced or lost. In order that they may always be at hand in the most convenient form, they are printed on the inside of the cover of the jar, while on the outside appears the standard list of first aid materials which should always be kept in the jar, also brief directions for the use and care of the outfit.

Some employers will desire to place a N. A. S. O. jar on each truck or wagon used in connection with outside construction work. In this event, the jar should be

Conference Board on Safety and Sanitation and accordingly stamped with its N. A. S. O. (National Affiliated Safety Organizations) mark. These jars may be secured from the secretary of any of the associations comprising the Conference Board, viz.: The National Founders' Association, 29 South La Salle street, Chicago; the National Association of Manufacturers, 30 Church street, New York; the National Metal Trades Association, People's Gas Bldg., Chicago; the National Electric Light Association, 29 West 39th street, New York. They are sold at practically the cost price, as there is no intention to make a profit on any of the articles standardized by these associations.

PERSONAL AND GENERAL

Mr. Henry Clark, resident engineer at Victoria, B.C., for Head, Wrightson & Co, Ltd., of Stockton-on-Tees, England, is to leave British Columbia on January 20 for Australia, on a business trip.

Mr. Chas. Graham, superintendent for the Corbin Coal and Coke Co. in Southeast Kootenay, B.C., spent the holidays as the guest of his cousin, Mr. Thomas Graham, Victoria, B.C.

Mr. Thomas Graham, chief inspector of mines for British Columbia, was called to Fernie, Crowsnest Pass, at the beginning of the month, having been advised by telegraph that Mr. Evan Evans, district mine inspector, had met his death, having been poisoned by gas on entering a mine after an explosion.

Mr. John Hopp, who has several hydraulic placer-gold mines in Cariboo district, British Columbia, is on a business visit to New York City.

Mr. F. Chas. Merry, who has for years been in charge of the mines of the Ferguson Mines, Ltd., in the Lardeau country, British Columbia, has retired from the office he has long held and is staying for a short time at Kaslo, B.C.

Mr. A. Bruce Ritchie, formerly on the engineering staff of the Consolidated Mining and Smelting Co., at the company's Molly Gibson silver-lead mine in Nelson mining division, has gone to Europe to take part in the war.

Mr. M. K. Rodgers, well known in connection with the development of the Nickel Plate gold mine in Camp Hedley, and the Hidden Creek copper mine on Observatory inlet, both in British Columbia, is now one of the directors of the Granby Consolidated M. S. and P. Co.

Mr. Gomer P. Jones, general superintendent for the Hedley Gold Mining Co., operating gold mines and a 40 stamp mill in Similkameen district, British Columbia, has been nominated by a number of Western members for election as a councillor of the Canadian Mining Institute.

Mr. W. H. Aldridge, of New York City, has retired from the board of directors of the Consolidated Mining and Smelting Company of Canada, Ltd., after having been on the board ever since the inception of the company.

Mining and Scientific Press states that Mr. T. A. Rickard is serving as a special constable guarding bridges, etc., in England.

Mr. Frederick William Rose, of London, England, a director of the Mining Corporation of Canada, Casey-Cobalt Mining Company and other Cobalt properties, died in London Jan. 8 at the age of 65 years.

Thomas Lynch, president of the H. C. Frick Coke Co., and a director of the United States Steel Corporation, died Dec. 29 at his home in Greensburg, Pa. He was one of the pioneer coke oven operators in the Connellsville region and as head of the Frick properties occupied a position of prominence in the coke and allied trades.

The 1915 New York meeting of the American Institute of Mining Engineers will be held Feb. 15 to 17.

Hon. G. Howard Ferguson has been appointed Minister of Lands, Forests and Mines of Ontario.

OBITUARY

J. C. Drewry, formerly manager of the Canadian Goldfields Syndicate, which owned a number of mining properties in East and West Kootenay, British Columbia, died at his home near Cowley, Southwest Alberta, on December 28, at the age of 60 years. The syndicate at one time owned a group of mineral claims that was afterward purchased by the St. Eugene Mining Co., all the assets of which were eventually included in the consolidation of mining and smelting interests to acquire which the Consolidated Mining and Smelting Company of Canada, Ltd., was organized. As the Canadian Goldfields Syndicate did no mining for years, its chief interest was in the dividends paid by the Consolidated Co., in which it held a number of shares, received as consideration for its interests in the St. Eugene Co. A few months ago the Consolidated Co. purchased the remaining mining interests in British Columbia that had long been held unworked by the C. G. Syndicate, so the late Mr. Drewry's even indirect interest with mining in that province then ceased. One brother, Mr. W. S. Drewry, of Victoria, B.C., is Inspector of Surveys for that province.

SPECIAL CORRESPONDENCE

PORCUPINE

Dome.—Diamond drilling has been suspended at the Dome for the time being though it is possible that a new contract may be let in February under altered conditions. In the meanwhile underground development has been resumed at full strength. Drills have been started again at the third, fourth, fifth and sixth levels.

Schumacher.—While but one drill is operating at the Schumacher mine good progress is being made with the plans for the erection of the 150-ton mill, which it is expected will be commenced in the spring. A site for it has been selected and work will commence when the weather is milder. Supt. Jos. Houston is making a study of the latest cyanide practice in the camp, for incorporation in his mill.

Jupiter—Work has not yet been re-commenced at the Jupiter mine although the shaft is being kept clear of water. Nothing has been done since the McKinley-Darragh relinquished its option.

Hollinger—This year, for service in 1914, the Hollinger distributed $12,000 as a bonus for loyal service. After the first year the disbursement to employees is 15 cents a day, the next year the rate is raised to 30 cents and the third year to 45 cents. This is an attempt on the part of the Hollinger mine to secure continuity of service and it is proving eminently successful at the big mine in Porcupine.

The gross profits of the Hollinger for the four weeks ending Dec. 2 amounted to $152,663 being a little less than for the preceding four weeks. The average value of the ore treated fell to $13.22 as compared with $14.09 per ton. The working cost per ton was slightly lower, being $3.40 as against $3.48 for October. Of this $2.09 was for mining, divided as follows: Exploration, $0.03; development, $0.45; and production, $1.61. The total mining costs were $41,116, while milling costs were $25,847.

On the 800 ft. level the No. 1 vein only is being worked at present. During November the mill ran 91 per cent. of the possible and treated 19,673 tons. The profits of the mine from the first of the year to Dec. 2 totalled $1,630,620.

The Porcupine Crown has been successful in finding good grade ore in the main vein at the 500 ft. level. Previously the results obtained from working on a stringer at this level had not been so good as at upper

levels. It was then resolved to cease work on the stringer and to crosscut so as to cut the other branch of the vein. This has been cut and the ore has proven to be of good grade and width though not quite so remunerative as at the upper levels. There is also more graphite in the ore. This may necessitate some alteration in the milling practice.

To date the Porcupine Crown has produced only a few thousands short of a million dollars. Last year alone $677,000 was produced. Measures will be taken to at once proceed with the opening up of lower levels and it is expected that before the end of the year three new levels will be developed. The sinking of a winze on the ore body at the 500 ft. level will be commenced this month. The main vein has been opened up to the south past the fault on three levels.

Practically 25,000 tons has been placed on stulls underground as a reserve for the mill. The ore is broken at 200 and 300 ft. levels mostly and is all ready to draw.

During the month of December the mill treated 125 tons on an average daily. About 40 per cent. of the ore treated is coming from development work.

Vipond—During the past four months ending Dec. 31 the Vipond Porcupine produced $90,000. The mill is now yielding at the rate of $25,000 a month and a good extraction is being obtained.

McIntyre—During the past twelve months the McIntyre Porcupine produced $550,000. The grade was very low during the first three or four months of the year and the profits were correspondingly short; but about $70,000 a month is now being taken from the mill, with a much better profit per ton.

COBALT, ELK LAKE AND SOUTH LORRAIN

Timiskaming—The position of the Timiskaming mining company has been considerably improved within the past three or four months and there is now a good tonnage of ore broken ahead of the mill. A very rich little shoot of ore has just been discovered on the 450 ft. level at the back of an old stope and is now being taken out. Further exploration is discovering good mill rock at the back of the big stopes made when the high grade was taken out of the mine some years ago. In the diabase at the 750 ft. level the discoveries made a short time ago are turning out to be of some importance.

Crown Reserve—Working in an old stope at the 150 ft. level on the Crown Reserve a very rich vein has been discovered. It is two and a half inches wide of spectacular ore. Development is also establishing the fact that there is very good milling rock on the side of some of the old stopes. Narrow stopes are being carried through to within a short distance of the boulder clay under Kerr lake without any great difficulty.

The discovery on the 75 ft. level of the Silver Leaf, under option to the Crown Reserve, is proving to be of importance. It has now been sunk on for a distance of 15 ft. and the vein is stronger and wider than when it was struck. There is also good mill rock on both sides of the vein. The importance of the discovery is enhanced by the fact that here the conglomerate is quite deep and there is not likely to be much change in the formation for 200 ft.

Platinum Discovery—Interest has been aroused by a report of mineral discoveries at a point near Rutherglen, 33 miles east of North Bay on the main line of the C. P. R. The discovery was made owing to the work undertaken by a prospector named H. C. Clark, who has been pursuing a lonely search for mineral on some claims for the past six years. Clark came to Northern Ontario from Pittsburg and he is backed by business men of that town in his enterprise, which he has capitalized as the Mattawan mining company. Last October he took 500 pounds of his ore to Pittsburg and it was there treated in an electric furnace. The returns received were very remarkable showing high values in gold and platinum.

Some time afterwards a Buffalo chemist obtained some of the ore and he declares that he has discovered it to be radio active. The ore according to the Pittsburg sampling also contains molybdenite, graphite, copper, zinc, pyrite and nickel. Other samples taken have shown no gold, but some platinum. The presence of platinum in the ore in perceptible quantity makes the discovery of some importance.

The claims upon which Clark has sunk two pits 35 ft. deep are situated three and a half miles from Rutherglen and about half a mile from the railway. While there is not much excitement a thousand claims have been staked and recorded in Toronto where the territory is unorganized and in Sudbury where it has been surveyed into townships. An application has already been filed that a recording office should be opened at North Bay as it is obviously a disadvantage to have to travel so far to record.

Chambers-Ferland—Interest is keen in the camp as to future developments in the new shaft of the Chambers-Ferland. There is a general disposition to believe that there is a good chance of discovering good ore bodies on the extension of the Nipissing veins, one of which undoubtedly runs into Chambers-Ferland territory. Several calcite veins have been cut to date, but none of them carry silver values of any importance.

Nipissing—The loss the camp has sustained by reason of the war is easily seen in the case of the biggest mine in the camp, the Nipissing. The big mine last year produced 100,000 more ounces of silver than in the previous year and yet the gross receipts were more than a quarter of a million dollars less. The gross production in ounces amounted to $4,600,000 and the net value of the ore produced was $2,566,000. The costs per ounce were slightly less than the previous year.

The dividend record of the Cobalt camp for the past year showed a net decrease of $2,880,000, fifteen companies announcing decreases and but five increases. Some modification of the statement should be made in view of the fact that the Mining Corporation of Canada now controls and pays dividends on operations of the Cobalt Townsite, the Cobalt Lake and the City of Cobalt mines.

Buffalo—Satisfactory progress is reported from the Buffalo mine since it started up. About twelve drills are working underground and it is stated that the ore reserves are being well maintained.

NIPISSING MINES CO.

Nipissing Mines Co.'s estimated net profits for November were $115,354, against $123,009 in October and $102,146 in January.

The past two months' operations resulted as follows:

	November	October
Estimated production ..	$189,029	$200,384
Operating costs	73,674	77,374
Estimated profits	115,354	123,009

For the past few months the company has been shipping all its bullion to England where a better market has been found than in New York. The British purchases go almost entirely into coinage and for transshipment to India where silver passes in trade payments.

MARKETS

TORONTO MARKETS.

Jan. 12—(Quotations from Canada Metal Co., Toronto)—
Spelter, 6 cents per lb.
Lead, 5 cents per lb.
Tin, 35 cents per lb.
Antimony, 17 cents per lb.
Copper, casting, 13½ cents per lb.
Electrolytic, 13½ cents per lb.
Ingot brass, yellow, 10c. per lb.; red, 12 cents per lb.
Jan. 12—(Quotations from Elias Rogers Co., Toronto)—
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

GENERAL MARKETS.

Jan. 8—Connellsville coke (f.o.b. ovens)—
Furnace coke, prompt, $1.60 per ton.
Foundry coke, prompt, $2.20 per ton.
Jan. 8—Tin, straits, 33.50 cents.
Copper, Prime Lake, 13.50 cents.
Electrolytic copper, 13.37½ cents.
Copper wire, 14.50 to 14.75 cents.
Lead, 3.75 to 3.80 cents.
Spelter, 6.00 cents.
Sheet zinc (f.o.b. smelter), 8.75 cents.
Antimony, Cookson's, 16.50 to 17.00 cents.
Aluminum, 18.75 to 19.25 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $44.00 to $45.00 per ounce.
Platinum, hard, 10 per cent., $47.00 to $49.00 per ounce.
Bismuth, $2.75 to $3.00 per pound.
Quicksilver, $50.00 per 75-lb. flask.

SILVER PRICES.

December—	New York. cents.	London. pence.
26.	48¾	...
28.	48¾	22 11/16
29.	48⅞	22¾
30.	48⅞	22¾
31.	48⅞	22 11/16
January—		
2.	48½	22 9/16
4.	48¾	22⅝
5.	48¾	22⅝
6.	48¾	22 11/16
7.	48⅞	22¾
8.	49	22 13/16

COBALT SHIPMENTS.

Nipissing shipped on Saturday, Jan. 9, about a quarter of a million dollars in silver bars. This will go far towards reducing the large stock of bullion stored in the mill since silver fell to around the 50 cent mark. About 400 bars were shipped for London. The Mining Corporation of Canada shipped last week one car of concentrates from the Cobalt Lake mine and five from the Cobalt Townsite and City of Cobalt combined. This English company has never shown any disposition to curtail output in the expectation that silver would soon rise in price. The Coniagas also shipped three cars of ore and the Trethewey its customary two cars a month. The La Rose was of low grade to Chrome. The discovery of the Timiskaming mine and the promising developments at the Crown Reserve and the Silver Leaf has resulted in a more optimistic spirit in the camp in regard to the future.

STANDARD MINING EXCHANGE, TORONTO.

Jan. 11, 1915.

	Asked.	Bid.
Cobalt stocks—		
Bailey.	.02	.01⅝
Beaver Con.	.22½	.21½
Buffalo.	1.00	.75
Chambers-Ferland.	.14½	.13½
Coniagas.	5.75	5.25
Crown Reserve	.72	.69
Gifford.	...	.01
Gould.	.01½	.01¼
Great Northern	.04½	.03¾
Hargraves.	.02¼	.01¾
Hudson Bay	41.00	30.00
Kerr Lake	4.50	4.25
La Rose	.80	.70
McKin.-Darragh-Savage.	.58	.52
Nipissing.	5.85	5.70
Peterson Lake	.27¼	.26¾
Right of Way	.03	...
Seneca Superior	1.90	...
Silver Leaf	.02⅝	.02½
Timiskaming.	.12½	.12
Trethewey.	.15	.14
Wettlaufer.	.07	.05
York, Ont.	.06¾	.06
Porcupine stocks—		
Apex.	.01¾	.01½
Dome Extension	.07½	.07
Dome Lake	.35	.32
Dome Mines	6.40	6.30
Foley O'Brien	.18	...
Gold Reef	.04½	.04
Homestake.	.15½	.13
Hollinger.	22.00	21.75
Jupiter.	.10	.09½
McIntyre.	.24	...
Pearl Lake	.03⅝	.03½
Porcupine Crown	.84	.80
Porcupine Gold	.00½	.00⅜
Porcupine Imperial	.02¼	.02⅛
Porcupine Pet	.18	.15
Porcupine Tisdale	...	.00½
Porcupine Vipond	.28	.27
Preston East D.	...	.01¼
Rea Mines	...	.22
Teck-Hughes.	.09	.08⅛

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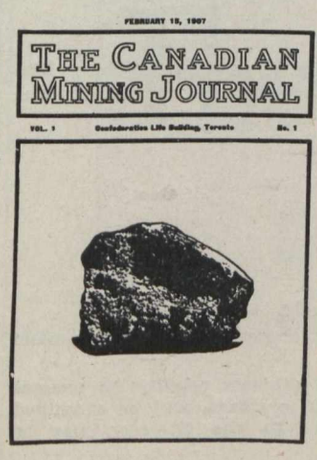

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PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Prospector's Handbook No. 1. Notes on radium-bearing minerals, by Wyatt Malcolm.
Summary Report of the Geological Survey for the year 1912.
NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
QUEBEC
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.
Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.
ONTARIO
Museum Bulletin No. 5. A Beatrice-like Organism from the Middle Devonian, by Percy E. Raymond.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
NORTH-WEST PROVINCES
Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.
Memoir 52. Geological Notes to Accompany Map of Sheep River Gas and Oil Field, Alberta, by D. B. Dowling.
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Museum Bulletin No. 4. The Crowsnest Volcanics, by J. D. MacKenzie.
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BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 51. Geology of the Nanaimo Map-Area, by C. H. Clapp.
YUKON AND NORTH-WEST TERRITORIES
Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.
NEW BRUNSWICK AND NOVA SCOTIA
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
May 118A. Pleasant River Barrens Gold District, Lunenburg County, Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N.S.
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Map 100A. Bell River, Quebec. Geology.
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NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BUYERS AND SELLERS OF METALS

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

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

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

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

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

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

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

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

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

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

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

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

ALPHABETICAL INDEX TO ADVERTISERS

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Continued on page 30.

Canadian Miner's Buying Directory.—(Continued from page 28.)

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Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
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Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.

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Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

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Roberts & Schaefer Co.

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Northern Canada Supply Co.

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Pumps—Turbine—
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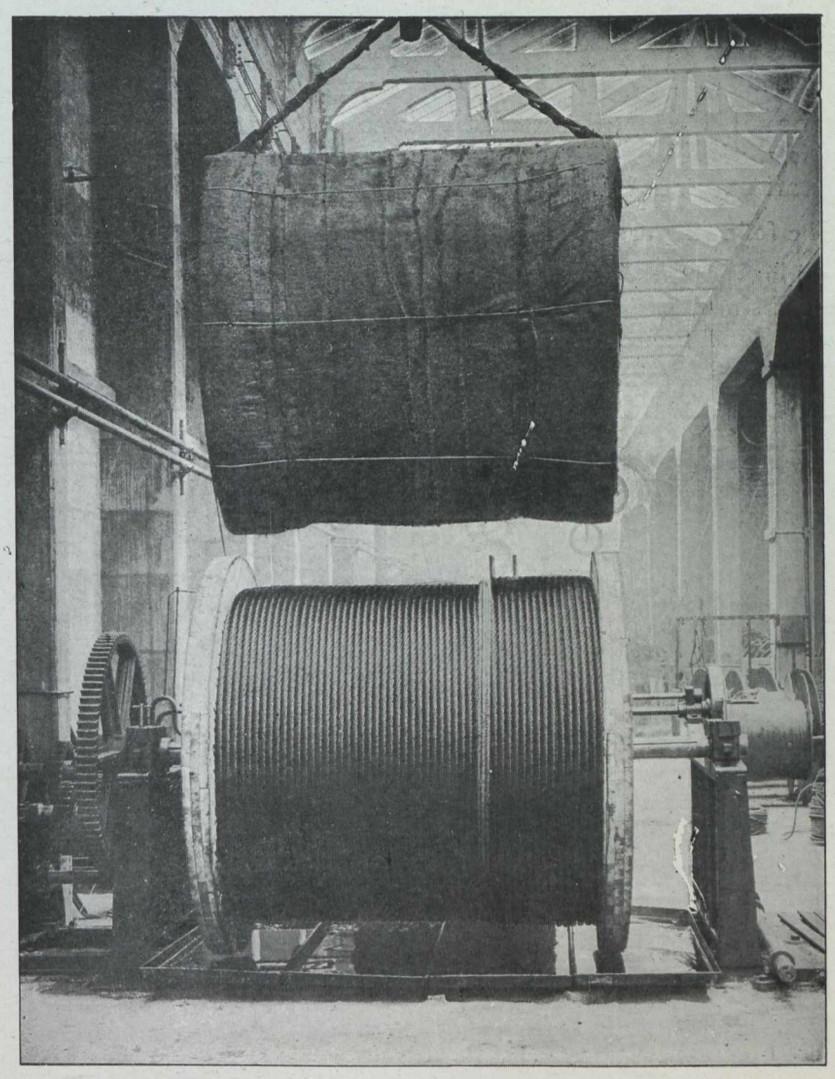

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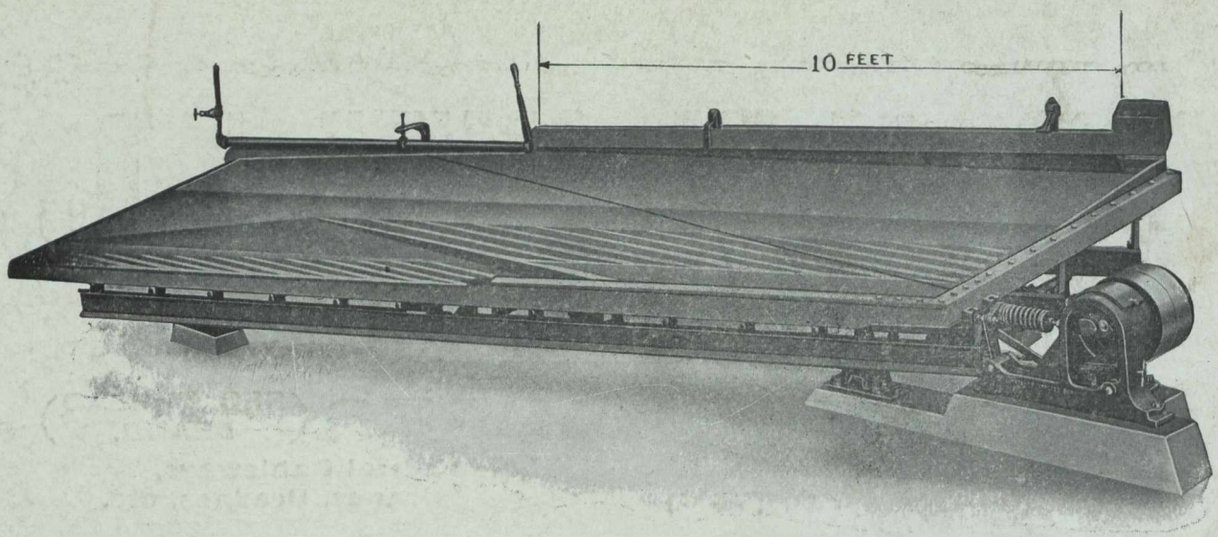

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