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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 8

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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CONTENTS.

COPPER PRODUCERS PROSPERING

A wonderful change for the better in the copper market has been experienced during the past few months. For a few weeks following the outbreak of war the outlook of the copper mining industry was dark indeed. Now the owners of copper mines find themselves in an enviable position with a very pleasing prospect.

The first notable action taken by American copper producers in August was to cut down output to about one-half. Several mines were closed down and others were operated part time only. There was still an excess of copper produced, however, as there was already many million pounds in process of treatment. The price fell to around 11 cents, and there was not a very ready market at that price.

With copper at 11 cents many well known mines cannot make a profit on operations. Consequently there were more mines closed down, though some companies continued to work their mines even at a loss.

It did not seem likely that the price would rise sharply for some time. Germany, the largest European consumer of American copper, was cut off entirely. Consumption by the Allies increased; but domestic consumption was small.

Then a flood of orders for copper began to be reported. The price rose sharply; but it was predicted that the rise was only temporary. Further large orders from abroad and from American consumers have convinced the producers that good prices are to be expected for some time. The stocks on hand are said to be low. The forces at the producing mines are being increased, and other mines are being reopened. A busy year in copper mining districts seems assured.

The Boston News Bureau, in a recent issue, says regarding the copper situation in the United States:

"Strangely enough, the very event which at first shocked the industrial world, including the copper industry, into insensibility is now producing a demand for copper the parallel of which has never been witnessed. For instance had the month of February been a 31-day month instead of a 28-day month, the deliveries of copper for that period to domestic manufacturers would have eclipsed all records, and the high record month to date is 84,000,000 pounds. During the 31 days of March, however, all records for domestic deliveries were broken, and the price of the metal has naturally responded to this heavy buying.

"What is distinctly encouraging is the improvement in the demand for copper wire. This end of the copper consuming industry has been lagging behind, but is now picking up in most encouraging fashion. Of course, the brass mills and ammunition people are working

night and day to keep up with the foreign war orders, and the copper price outlook is distinctly in favor of a higher rather than a lower level."

A notable feature of the copper market is the unusually high price being paid for the output of certain Michigan mines. While the price for ordinary copper is about 16 cents, these Michigan companies are receiving about 17 cents per pound for their copper. In Michigan the copper occurs as the native metal and it is easily refined to a product having exceptionally valuable physical properties.

On account of its freedom from impurities, and its special physical properties, Michigan, or "Lake" copper commands a higher price than "electrolytic" at all times. For use in munitions of war the Michigan brands are commanding a higher premium than usual.

THE DEMAND FOR MOLYBDENITE

We publish in this issue an article on molybdenum ores which has been prepared by the Imperial Institute, London. There is a great demand for molybdenum ores just now and owners of deposits of molybdenite will do well to seize the opportunity which now presents itself. The Imperial Institute will be glad to have the names and addresses of any firms in Canada producing this mineral and wishing to communicate with possible buyers in the United Kingdom.

Molybdenite occurs in many places in Canada, generally in quartz veins and pegmatite dikes. In a special report Dr. T. L. Walker mentions the following localities as among the most promising seen in 1910:

Island opposite Romaine, lower St. Lawrence; Aldfield and Egan townships, north of the Ottawa river; deposits in the vicinity of Kewagama lake in the northern part of Pontiac county, Que., near the Grand Trunk Pacific railway; Brougham, Lyndoch, and Ross townships in Renfrew county; Sheffield township, Addington county, and Cardiff township, Haliburton county, in Eastern Ontario; and the Giant mine, Rossland, B.C.

A weekly newspaper devoted to the interests of the mining industry of Northern Ontario made its first appearance on Saturday, March 27. Its eight pages are devoted chiefly to interesting and reliable news of the silver and gold mines at Cobalt and Porcupine.

The new journal is owned and edited by Mr. Ben Hughes, who for several years has been resident at Cobalt, and is very familiar with the district. He has been a regular correspondent for several daily newspapers and has gained an enviable reputation as a contributor of reliable information.

Mr. Hughes is one of the Canadian Mining Journal's regular correspondents, and is responsible for the Cobalt and Porcupine news printed in our "Special Correspondence" section. He needs no introduction, therefore, to our readers. Those who are especially interested in Ontario silver and gold mines will welcome the "Northern Miner" because they know they can rely on Mr. Hughes' statements.

The article in this issue on Coke Oven Chemistry gives a clear account of the process of benzol recovery, which is a matter of considerable interest just now. The Dominion Coal Company has made arrangements for the installation of a plant at Sydney to recover benzol.

Alien enemies in the mining camps are enjoying unusual liberties. It is not likely that men who go about their work quietly and recognize that they owe something to the country which affords them a living, will be denied employment. There is, however, a growing demand that alien enemies who make themselves obnoxious should be taken to detention camps and their positions given to men who are loyal to the country in which they live. The mining camps should not be allowed to become a refuge for enemies of the Empire.

The Alexo nickel mine at Kelso, Ontario, made a new production record in March, sending out twenty-eight cars of nickel ore to the Mond smelter at Coniston The Kelso, compared with some of the Sudbury properties, is a very small mine with a very small plant; but it is being steadily and profitably worked.

A new phase in the development of the Kirkland Lake gold district has begun with the completion of a mill and cyanide plant at the Tough Oakes mine. Development work at this mine soon showed that an important ore deposit had been found. Production to date has been from hand picked ore and from ore treated in a 5-stamp mill. Production on a large scale has only just begun.

Power trouble at Cobalt, due to lack of water, is reported to have vanished with the warmer weather. The advantage of having auxiliary steam plants has during the past few weeks again been demonstrated to users of hydro-electric power in Northern Ontario.

The Minister of Mines of Ontario has announced that there will be no further extension of time for the performance of work on mining claims. An Order-in-Council, passed last year, provided for exclusion of the period August 15, 1914, to April 15, 1915, in computing the time in which work should be done by claim holders. The decision to grant no further extension will no doubt be welcomed by men looking for work.

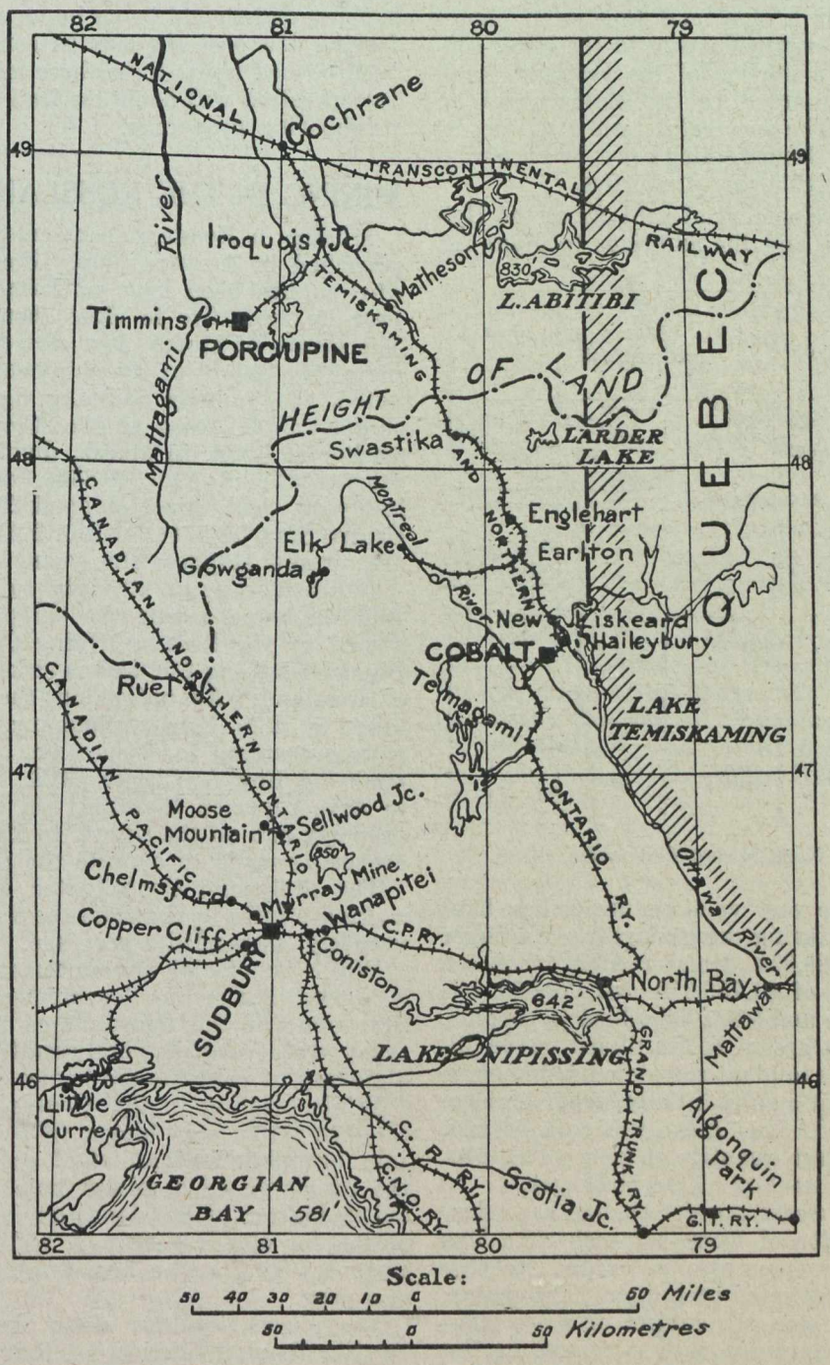
With the payment of the four per cent. dividend on April 22, Hollinger entered the list of mines which have returned their capital. Hollinger has now paid $3,060,000 in dividends, and the mine has just got nicely started on its career of production.

The visit of Mr. Joseph Leiter, of Chicago Wheat Pit fame, to Cobalt early in April is taken to indicate that this well known speculator is now interested in Northern Ontario mines. However, no danger of a "corner" need be feared.

PRESENT CONDITIONS AT COBALT AND PORCUPINE

During the past few months decided improvement has been made in the physical condition of several gold and silver mines in Northern Ontario and the indications point to increased activity during the coming summer. The price of silver, about 50 cents per oz., has not been good since the war began and has seriously affected the profits of Cobalt mines. Another adverse factor has been a shortage of power, the water supply being inadequate. In spite of these disadvantages there is good reason to be optimistic over the prospects of Northern Ontario's metal mining industry.

At Cobalt some well known mines have passed their most profitable period of operation, and during the past year a few have been almost completely worked out. That there is still a lot of silver ore to be mined, however, is indicated by the recently issued reports of some companies.



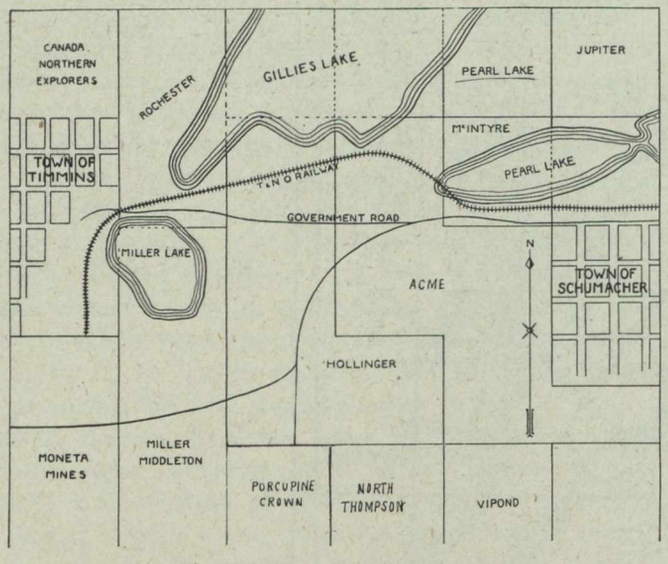
Cobalt, Porcupine and Sudbury Mining Districts, Ontario

Nipissing, the largest producer at Cobalt, has just reported for 1914 a profit of $1,578,715, of which $1,235,000 was paid out in dividends. In spite of the large output the company has been able to increase its ore reserves to about 10,000,000 ounces silver. The develop-

ment work necessary in placing new ore in sight has been paid for while the cost per oz. produced has been reduced. The year's record is a very satisfactory one. The company has a large ore reserve, a considerable area not yet developed, and started the present year with a surplus of $1,602,776.

Aside from the unexpectedly good report of the Nipissing company perhaps the most notable report is that which will be made by the Temiskaming Mining Company. Temiskaming has had a more spectacular career than many of the Cobalt mines, owing largely to the nature of its ore bodies. The mine has produced some very rich ore for a time and then been almost without reserves. Last summer it was in the latter condition. New work, in a portion of the property formerly unexplored, has resulted in the discovery of an important ore shoot. The successful results of the development work on the Temiskaming must be encouraging to the owners of neighboring properties.

At Porcupine the development of gold ore at the Hollinger and Acme mines, and the additions to plant for



Hollinger and Neighboring Properties

mining and treating the very valuable ore bodies, have been going on steadily during the past year. Hollinger produced in 1914 $2,688,354 from 208,936 tons ore yielding a gross profit of $1,786,679. $1,170,000 was distributed in dividends and $451,058 added to surplus. During 1915 operations are to be continued on an increased scale. Additions to plant completed or in course of completion will permit a substantially larger tonnage being mined and treated. The Acme will soon be in a position to produce a large quantity of gold. This property is owned by the directors of the Hollinger.

During the past few weeks a great change has taken place in the market value of Dome mine shares. The Dome has made no great increase in output recently nor has the grade of ore treated been high. The change in price has, therefore, been the subject of much comment, especially as it coincides with a change in the directorate. It is understood that during the past few months exploration by horizontal drill holes has resulted very satisfactorily. It is reported that at the sixth level cores from drill holes in a large orebody averaged $18 per ton. This ore has not yet been opened up. Most of the development work so far done at the sixth level is a drift in the foot wall, parallel to the orebody.

That the Dome has a very large tonnage of ore that should yield a profit of from $1 to $2 per ton is well known. If, in addition to this ore, any considerable body of high grade is encountered handsome profits should accrue. It is understood that mining costs have been reduced to $2.50 per ton of ore mined.

While Hollinger, Acme and Dome mines are likely to be the largest producers, there are several other profitable mines now being operated at Porcupine. Of these McIntyre and Porcupine Crown have been steadily operated. The Vipond, which was closed down for some time, has made a good record since it was re-opened last summer and should be an important producer this year. During the past six months considerable new ore has been opened up at these three mines, and their successful operation will doubtless lead to renewed activity on neighboring properties.

MINING IN THE ROSSLAND DISTRICT, B.C.

Mining in Rossland continues on a scale not approached in former years. For several months production has been kept uniformly in advance of last year by from five to eight thousand tons per month. The month of March, just closed, affords a fair example of the extent of the shipments and of the increase noted. In railway shipping figures, Rossland mines shipped 27,472 tons to the Consolidated Company's smelter at Trail, in March, divided as follows: Centre Star, 16,301; Le Roi, 10,881; Josie, 2,030. In March, last year, these mines shipped 20,513 tons, as follows: Centre Star, 13,571; Le Roi, 5,200; Josie, 1,742. There are no new shippers this year.

Indications point strongly to the re-entry of the Bluebird mine among the shippers. The property is owned by the Rosalia Mining Co., Ltd., formerly the Bluebird Mining Co., and is situated in the South Belt of Rossland. An option on the property has been taken by E. L. Tate, of Spokane, who recently had the mine unwatered for inspection. The examination was made by Roy A. Clarke, M.E., Spokane, who is said to have reported favorably on the condition of the property and on the assays, to Mr. Tate. Preparations are being made to operate the mine.

The Richmond Consolidated Mining Co., Ltd., is making efforts to continue the work on its South Belt property, suspended a year ago.

While no official announcement has been made, it is known that recent development work in the Centre Star mine of the Consolidated Mining and Smelting Company of Canada, has resulted in the continued discovery of valuable ore bodies at considerable depth.

While blasting in the Centre Star mine, April 2, Stephen Allan was blown to pieces. The coroner's jury brought in a verdict of accidental death, due to the discharge of a missed hole. Mr. Allan was the oldest blaster in Rossland, having followed the occupation for eleven years. A widow and four children survive. This is the first fatality in Rossland mines in a year.

The placer diggings along the Tulameen river, in the Similkameen district of British Columbia, are attracting many miners who have had placer experience in the Yukon and elsewhere. Several have gone from Rossland.—H. B. C.

The annual meeting of stockholders of Nipissing Mines Company, will be held at the office of the Company, at the Granite Bank Building, 242 Water Street, Augusta, Maine, on Monday, April 26. 1915,

THE SOURCES AND USES OF MOLYBDENUM ORES

A Memorandum issued by the Imperial Institute, London.

At the present time there is an exceptionally large demand for "steel hardeners." Two of the chief materials employed for this purpose are molybdenum and tungsten. Before the outbreak of war, Sheffield was largely dependent on Germany for its supply of the latter metal in the proper condition for making "high speed" steel. This was mainly because British manufacturers were not conversant with the best methods of extracting the metal and preparing it in the proper condition; now, however, they have largely solved the problem, and the metal is being produced in Great Britain. It is probable that this is only the beginning of a movement for the production of similar metals in the United Kingdom.

The great demand for the so-called "special steels" has increased the demand not only for tungsten, but also molybdenum, and early in December, 1914, molybdenite ore, containing the equivalent of 90 per cent. molybdic acid, was quoted at £6 10s. per unit per cent., or £585 per ton of 2,240 lb.

The widespread use of molybdenum has hitherto been hindered by the irregularity in the supplies of ore and the consequent high cost. The principal hindrance to the exploitation of known deposits has been the lack of satisfactory methods for concentration. A standard ore should contain a minimum of 85 per cent. of molybdenite (molybdenum sulphide, MoS_2). American buyers are stated to require concentrates containing 90 to 95 per cent. of molybdenite. The presence of copper, arsenic, bismuth or tungsten reduces the price of the ore.

Uses of Molybdenum.

The addition of molybdenum to steel increases the hardness, toughness and elongation of the metal. Molybdenum high speed steel, as used for machine tools, contains 8 to 10 per cent. of molybdenum, and is extremely hard and will retain its cutting properties even when raised to a high temperature.

The compounds of the metal are also used in scientific work, and as pigments in various arts and industries. The ammonium sale of molybdic acid is largely used in steel works and other laboratories as a reagent for the estimation of phosphorus in steel, soils, etc. Large quantities of molybdenum are consumed in this way. Molybdenum compounds are also used for the production of a yellow color on porcelain.

Occurrence and Output of Molybdenum.

Ores in the British Empire.—The only molybdenum ore of importance is molybdenite, MoS_2. It is widely, though usually sparingly, distributed, and is known to occur in the following countries of the British Empire: England, Scotland, Australia, New Zealand, Canada, Newfoundland, South Africa, India, Ceylon, the Federated Malay States and the Virgin Islands in the West Indies. It is also found in the following foreign countries: Austria, France, Germany, Russia, Norway, Sweden, the United States, Japan and Mexico.

The following information relates only to occurrences within the British Empire:

Australia.—During 1913 more than half the world's production of molybdenite ore came from Australia, mostly from Queensland.

Queensland.—The annual report of the Under Secretary for Mines for the year 1912 states that the output of molybdenite in that year was 102 tons 6 cwt., value £17,349, as compared with 99 tons 10 cwt., value £13,278, in 1911. The Larkin mine, the property of the Irvinebank Company, maintained a monthly output of 1½ tons of molybdenite. Molybdenite was also obtained in the vicinity of Ollera creek, in the Townsville mineral field, to the amount of 17 cwt., value £143.

The output of molybdenite in Queensland in 1913 is given as 57 tons 2 cwt., value £16,185.

New South Wales.—Most of the molybdenite produced in New South Wales is obtained from the Whipstick mines, in the Pambula division, from which 73 tons of ore, valued at £6,400, were raised in 1913. The annual report of the Department of Mines for 1913 states that the total quantity of molybdenite exported in 1913 was 78 tons 16 cwts., valued at £6,802, as compared with 56 tons 11 cwts., valued at £3,706, in 1912. In the Deepwater division, the Bow Creek molybdenite mines raised 70 tons of crude ore, valued at £1,000, whilst at Kingsgate, in the Glen Innes division, a vigorous policy of devolpment was pursued during the year. A discovery of molybdenite, associated with other minerals, was made in the parish of Wunglebong, in the Tenterfield division, and the indications are said to be promising.

Molybdenite has also been found in South Australia, Western Australia and Tasmania, and specimens of the ore from these areas may be seen in the public exhibition galleries of the Imperial Institute.

New Zealand.—An occurrence of molybdenite was recorded in New Zealand in 1905 on the lower slopes of the Paparoa range, near Greymouth; but the deposit does not seem to have been worked hitherto.

Canada and Newfoundland.—There are numerous occurrences of molybdenite in Canada and Newfoundland, but there has been very little production of the mineral. In 1913, there was some prospecting activity in Ontario, Quebec and British Columbia. It is reported that a mine in British Columbia despatched a carload of high grade material for milling in Denver, and that a small trial shipment of the Ontario ore was made to England.

Virgin Islands.—Specimens of minerals from an abandoned copper mine at Virgin Gorda, Virgin Islands, were examined at the Imperial Institute in 1907 and found to contain molybdenite and molybdenum oxide. One sample represented material which would be worth concentrating if large supplies of the ore were available for treatment.

Ceylon.—Deposits of molybdenite occur in Ceylon at Hettimulla, four miles south of Ksgalla. A sample examined at the Imperial Institute in 1906 consisted principally of molybdenite, and contained nearly 51 per cent. of molybdenum, but according to the Progress Report of the Ceylon Mineral Survey the molybdenite bearing pegmatite deposit was neither extensive nor rich in the mineral.

Federated Malay States.—In the Federated Malay States molybdenite was observed by the Government Geologist in 1905 in a granite quarry near Bukit Panjang.

India.—There is no record of molybdenite having been worked in India. It has been observed in small quantity in the Patra river, near Mahabagh, and the Baraganda copper mine at Urmi, near Dumri, Hazaribagh district, Bengal; in parts of Chota Nagpur; in Rajputana and Mandaoria, near Kishangarh; and in Burma, on the road from Tavoy to Myitta. Molybdenite also occurs disseminated through the Travancore pyrrhotites and might possibly be worth separating from the ores should these ever be worked for copper and nickel.

Union of South Africa.—Outcrops showing molybdenite ore occur at Impendhle, at the foot of the Mahotoya range, Hlatimba river, Natal. A sample of ore from the Buschveldt district, Transvaal, examined at the Imperial Institute in 1906 contained molybdenite. Wulfenite, a molybdate of lead, has been found in small quantities in the Transvaal silver mines, Leydsdorp district. It is considered likely that molybdenite may occur in the vicinity.

United Kingdom.—In the British Isles molybdenite has been met with in the Cornish copper and tin mines, but usually not in paying quantities. It is stated to have been worked in Inverness-shire. It occurs at the Mount Sorrel quarries of Charnwood Forest, Leicestershire, and is said to have been raised at Calbeck Fell in Cumberland.

The Imperial Institute will be glad to place producers of molybdenum ores in communication with prospective buyers.

THE MICHIGAN COPPER INDUSTRY

The very satisfactory condition of the copper market and its effect on the Michigan copper mining district is reviewed editorially by Mr. Homer Guck, of Houghton, in the Mining Gazette, of April 3. He says:

An era of prosperity the like of which the Lake Superior copper camp has never known and which cannot but extend to all the other copper camps, is predicted by Michigan copper men. The European war, which caused partial suspension of mining and curtailment in general in this part of the country last fall, is now the agent of prosperity for the copper manufacturing industry, boosting metal prices to figures that have not been reached before since 1906. Activity at all the copper mines is normal and bids fair to become abnormal if the war keeps up. The suspension of war in Europe could mean a decided decrease in demand for copper metal for manufacture of war munitions, likewise it would mean the reopening of the great brass and copper foundries and manufacturing of brass and copper goods in Europe. This would add to the greatest demand for copper the world has ever known. The words of two prominent Belgian copper manufacturers who visited this section recently are recalled in this connection. According to these gentlemen Europe's crushed industries will spring into life anew and a great work of rehabilitation that will consume millions of lbs. of copper will be taken up. Metal needed to rehabilitate the great railroad and telegraph and telephone systems, alone, will mount into figures that cannot even be guessed right now. All Europe is running short of not only copper but steel for the largest of the warring nations have for years obtained the greatest supplies of their iron and steel from North America. The constant destruction of immense quantities of copper and brass war munitions merely means that the manufacture of these materials must be continued till the war ends and thereafter until universal peace comes.

Advices from the continent of Europe are that even the exploded shells are gathered from the battlefields that the copper and brass in their makeup may again be used, to such a pass have come Germany, Austria, Russia and other nations in their absolute need for copper metal. It is understood, too, that in the great naval shipyards in England, France, Germany and Russia more copper than ever before is specified for use in the armament of the great naval fighting machines. Experiments are being conducted by several nations with copper armor to bottom cruisers and battleships, the belief being held that its elasticity and toughness will make it nearer impervious to damage by mines and torpedoes than is either steel or any other substance. Steel armor, covered with heavy plates of copper, is being experimented with in some of the shipyards.

Practically all of the copper mining companies are taking on additional men, both for underground and for surface work and in the mills and smelters. The Calumet & Hecla company has added to its crews at its mills and smelters. The Copper Range is increasing its forces, while the Quincy is reported to have taken on about 40 men in the past month. The Tamarack Mining Co., which is preparing to resume rock shipments to the mills, will bring its forces up to about 350 men within a few weeks and later will increase them to 500 or more. The Isle Royale, as soon as it is given more milling facilities through the completion of its own three-head mill at Isle Royale sands, will increase the crews underground, besides taking on full crews at the mill. Three shifts will probably be worked at the mill and the daily copper rock production of the mine will be brought up to 3 000 tons.

About 4.500 men have benefited through the wage increases reported this week by the Copper Range Consolidated and the Quincy companies. Resumption of operations at the Algomah property in Ontonagon county will give employment to a limited number of men. At this property the shaft, which now is down 415 ft. is to be deepened until it approaches closely enough to the Algomah and South Lake group of lodes to make crosscutting practicable.

Forces at the White Pine property will be added to materially as soon as the whole plant is in running order.

Work at this property is to be crowded, both underground and in the crushing plant and the mill. Probably about 300 men will be employed in these plants and underground, besides which there will be a large surface crew. Most of the large shop work will be done, of course, in the Calumet & Hecla plant. The construction of a railroad from Ontonagon to White Pine is probable this summer. Operations at the Hancock mine will require additions to the underground forces within the next two or three weeks. Franklin mine, which can hardly start shipping before May 1, will also likely enlarge its crews. New Arcadian, which will send its first shipments to the Franklin mill within a few days, will not put on larger crews for some time as all shipments will be made from the large stockpile for some time to come, while the lode is being explored and developed by the present crew. No. 18 shaft of the Calumet & Hecla, which was closed at the time of general curtailment last fall, will take additional men. At the time this shaft was closed stoping was carried on up to the second level. Sinking was stopped last fall at shafts 6 and 7 of the South Hecla branch but may be resumed within a few weeks.

BEAVER CONSOLIDATED MINES ANNUAL REPORT

In submitting their report for the year ending February 28th, 1915, the directors of Beaver Consolidated Mines, Ltd., say in part:

Our operation for the past year was interrupted for a period of nearly two months, and from August 8th to October 1st our underground work was suspended entirely. The European war has seriously affected the market for our product, the average price for silver for the months of August and September being 53.81 cents an ounce as against 59.96 cents an ounce for the same months of 1913. For a time there was no official quotation on silver, but finally quotations were made from day to day. Since September, the price has dropped to as low as 47⅝ cents an ounce, but we have sold enough of our product at from 49 cents to 50 cents an ounce to take care of operating expenses.

When we resumed operations we did not engage as large a crew as had previously been working, but gave preference to married men who had been with the company for a long time. We have therefore maintained our efficient organization and we think our men have amply repaid the company by their loyalty and good service.

Our system of inspection, which has been of such good service, is still continued. This is an added expense over and above what we have to pay on account of the Workmen's Compensation Act, which went into force in the Province of Ontario on January 1st, 1915. We do not feel, however, that we would be justified in dispensing with the office of mine inspector on our property, as our aim is to protect our men as far as we can from the possibility of any accident.

Following is the record of development and stoping for the year:

	Feet.
Drifting	3,094.0
Crosscutting	1,393.0
Sinking	100.7
Raising	507.0
Total	5,094.7

Stoping, 5,807 cubic yards.
Station cut at the 900 ft. level.

Practically no further work has been done on the 200 ft., the 300 ft. or the 350 ft. levels. On the 400 ft. level, in a crosscut about 125 ft. west of the shaft, we encountered a very rich vein. We first struck this vein on the 530 ft. level and then drove crosscuts on the 460 and 400 ft. levels to develop the vein toward the surface. Since resuming operations in the fall, most of our work has been centred in developing this new vein on these different levels, from which we have taken many tons of ore. A great deal of work remains to be done above the 400 ft. level as well as below the 530 ft. level. It looks very much as if we had an entirely new vein system west of the one which has been and is still so productive. Very little work has been done during the last six months on the 600, the 700 and the 800 ft. levels on account of our reduced force. Previous to closing down in August, we had sunk the shaft to a depth of 900 ft., had cut the station at this level, and intended to continue further development at depth, but, under existing conditions, did not deem this advisable. However, with a reduced force and also a cessation of operations during a period of two months, our production for the year is the greatest we have had during the life of the company. While we are working in high grade in a number of places in the mine, we still desire to adhere to our policy not to undertake to estimate what we may have in place, owing to the erratic nature of the ground.

We have a large mill feed ahead, having approximately the same as last year or close to 45,000 tons (12,500 tons on the surface and about 32,500 tons on stulls underground), which we estimate will give us 1,200,000 oz. of silver. All the mining costs on this have been paid, but the mill costs still remain, and we estimate it will cost to raise this ore, mill it and put it in the form of concentrates for the smelter, less than $100,000.

During the year our mill handled close to 100 tons a day. The mill was shut down for two weeks in August at the time we closed the mine, and we have also been compelled to shut down at various times during the past winter on account of shortage of power in the Cobalt camp: Ore milled, 26,724 tons; concentrates produced, 347.95 tons; silver in concentrates, 415,707.86 oz.; earnings, less milling and marketing costs, $158,465.85.

Beaver Auxiliary.—At the time we closed work at the Beaver mine (August 8th, 1914) operations were suspended also at the Beaver Auxiliary, and we have thought it good policy not to resume during the present disturbed conditions. Previous to closing down we had sunk the shaft to a depth of 330 ft., and had done considerable crosscutting and drifting. The result of this work from a milling standpoint is very encouraging. Early last spring a dam was built across a ravine in order to create a reservoir for water supply, as a year ago we had considerable trouble and expense to supply the plant with water. We have on hand fuel sufficient to operate the plant for some months.

The Beaver Consolidated owns sixty acres outright, and three-quarters of the stock in the Beaver Auxiliary Mines Company, the holdings of which are one hundred and twenty acres.

Silver production.—Our production during the year was 900,000 oz. of silver, or 137,301 oz. more than the production of 1913-14, which, up to that time, had been our largest year. Of this 900,000 oz. of silver, we have sold 390,878 oz., and we still have in bullion in storage and in ore at the smelters, 509,122 oz. The cost of production was 21.54 cents an ounce.

Capital Expenditure and Dividends.—We have invested on capital account $35,128.25; we have paid one dividend of $60,000, and, exclusive of ore in dump and in the mine, we have ore on hand, ore in transit, bullion in store and due from smelters, aggregating an estimated value of $247,833.58, all of which appear in the financial statement.

Balance Sheet Beaver Consolidated Mines, Ltd., Feb. 28, 1915.

Assets.		
Cash on hand and in bank		$18,642.04
Inventories on supplies		10,232.32
Unexpired insurance		2,464.09
Unexpired stock transfer expense		184.25
Unexpired Workmen's compensation		1,048.00
Accounts receivable		5,064.40
Due from smelters		31,282.62
Ore on hand	$92,471.17	
Ore in transit	39,739.15	
Bullion in store	84,340.64	
		216,550.96

Cobalt Mines Hospital stock		350.00
Beaver mine		1,000,000.00
Buildings and Timbering		66,660.81
Machinery, plant and equipment		114,832.36
Furniture and furnishings		5,875.96
Development		82,934.15
Preliminary and administrative		14,578.35
Incorporation and organization		2,049.70
Erie mine property		1.500.00
Beaver Auxiliary Mines stock		141,750.00
Temiskaming Mining Co.'s stock		9,928.82
		$1,725,928.83
Discount on shares		863,973.07
		$2,589,901.90
Liabilities.		
To the Public—		
Pay roll, February, 1915.	$6,798.31	
Unclaimed wages	72.13	
Accounts payable	9,009.33	
		$15,879.77
To the Shareholders—		
Capital stock	$2,000,000.00	
Depreciation account	93,040.79	
Profit and loss balance	480,981.34	
		$2,574,022.13
		$2,589,901.90

THE EMBARGO ON TIN.

The announcement in the "London Gazette" of Friday last that, inter alia, tin, chloride of tin and tin ore had been added to the list of articles the exportation of which is prohibited to all countries other than British Possessions and Protectorates passed almost unnoticed by the general Press at the time, but the Metal Markets were prompt to realize its significance, and the sharp fall which has since taken place in tin values shows how the industry is likely to be affected. Though sympathizing, however, with the shareholders of tin mines, whose hopes have thus been disappointed, the recent course of the market shows that the step was necessary in the national interest, if only to prevent prices from going to an unduly high level. While not of the same vital importance as copper, tin still enters very considerably into the manufacture of military stores, and it is, of course, of vital importance to the meat packing industry. It is understood that licenses for the export of the metal will be granted, but only under such restrictions as will ensure that it does not pass into the enemy's hands, and it is to be presumed that, while the Order in Council only applies to the United Kingdom, similar measures have been taken to prevent exports from the Straits Settlements and other British Possessions. Financial Times, London.

MR. SCHWAB ON STEEL OUTLOOK.

New York, April 6.—At the annual meeting of Bethlehem Steel Company, President Schwab said:—"The past year has been gratifying to Bethlehem Steel Co. officials, and, I hope, to stockholders. Stockholders have been rewarded for their patience in now being able to realize substantial profits on their securities. While the year has been very bad for general steel business the Bethlehem Co. has been fortunate in being engaged in the manufacture of lines which are in strong demand."

Mr. Schwab did not touch upon the question of a common dividend except to say "Between $20,000,000 and $30,000,000 will be necessary to spend on the Chilean property and Bethlehem plant in this country, and this should be spent out of the earnings as our bonded indebtedness is larger than our capital stock. I hope that stockholders will approve of this policy."

Mr. Schwab further said he did not want to say anything that could be construed as approving or showing any connection with the stock market, and for this reason had nothing to say about dividends. He said he was not interested in the stock market movements in any way.

Speaking of the outlook for business this year, Mr. Schwab said:

"The general business outlook is encouraging. I think the steel business will show an improvement in volume of orders but I hardly look for much higher prices."

The retiring directors were re-elected. About 25 stockholders were present. Out of 297,700 shares of stock there were represented 212,319.

MOOSE MOUNTAIN DISTRICT, ALBERTA.

The Geological Survey has published a second edition of Dr. D. D. Cairnes' report on the Moose Mountain district, Southern Alberta. The report and the map which accompanies it cover an area lying south of and adjoining the Bow river and extending from the main Rocky Mountain escarpment on the west, to include part of range III, west of the 5th initial meridian, on the east, and extending south to township 18, i.e., to a short distance south of the south branch of Sheep river.

Coal had been found in several places within this district and natural gas had been found to the north, south, and east of this area in the same formations as those within it.

NIPISSING.

The report of the Nipissing Mining Company, Ltd., for the year ended December 31 last, discloses total income of $2,558,732, of which $2,516,065 was derived from ore production. These figures compare with the previous year at $2.804,093 and $2,756.612 respectively. The net profit for the year is given as $1,578,715, which compares with $1,645,108 in 1913.

Dividends paid in 1914 amounted to $1,235,000, and surplus was increased from $1,259,061 to $1,602,776.

INTERNATIONAL NICKEL CO.

New York, April 6.—As the result of increased orders received recently by the International Nickel Co. earnings on the common stock in the fiscal year begun this month, are expected to get a new higher record at 12 per cent. or better. March is reported as one of the best months in the company's history. Part of the demand for nickel is due to the introduction of a cartridge made exclusively of copper and nickel. Inquiries were recently made for the placing of a trial order of 5,000,000 of such bullets.

TRANSVAAL MINING.

Speaking at the meeting of the Lace Proprietary Mines, Ltd., Mr. Llewellyn Edwards said the exploitation of additional areas of the Eastern Rand was more a State problem than one for directors and shareholders, supporting his contention by instancing the British policy of supporting the credit of industrials.

PROGRESS IN METALLURGY*

By James Douglas.

As life advances one is inclined to look backward instead of forward, and the vista over which my memory carries me has been filled with such a shifting panorama of changes in metallurgy that the whole practice of the art seems to have been recreated.

The first cupola furnace that I ever saw in operation was at one of the group of mines at Capelton, Quebec, from which the Nichols company still draws some of its sulphur supply. At that time it was operated by a Hartford, Conn., company, under a General Adams. When its small brick furnaces made a campaign of a week and smelted 10 tons a day, the feat redounded to the credit of the operator.

The introduction of the water-jacketed cupola dates forward to the next decade. I was using one in Pennsylvania making copper matte, to the horror of a noted metallurgist, who could not conceive it possible that you could bring fused sulphides into contact with steel without rapid corrosion. In our ignorance we were doing what seemed to be an impossibility, and it is just that recklessness and disregard for precedent which has characterized so much of the work of American metallurgists, and carried us forward at such headlong speed.

Once the water jacket was accepted as the type of the copper cupola, its almost unlimited expansion in length, but not in width, was a matter of convenience rather than of skill. In Butte the cupolas have been enlarged by adding furnace to furnace.

The first reverberatories which I saw in operation were those in Professor Hill's Black Hawk establishment, where the concentrates from the Gilpin county gold mills were run down into matte for separation in England. Smelting was done with wood as fuel, and the capacity of the furnace was about 10 tons per diem. Shortly after this Professor Hill formed an alliance with Richard Pearce, who was running what, if I recollect aright, was called the Swansea works, at the bend of the river approaching Georgetown.

Mr. Pearce had been engaged in the separation of precious metals from copper products in Wales, and applied his skill to the local separation of the Black Hawk mattes. Soon the operations were shifted to the larger works at Argo, near Denver, where for many years the Ziervogel method was practised with much success. And to Pearce is due the credit of taking the lead in gradually expanding the size and capacity of the reverberatory, for at Argo and at the company's branch works at Butte this type of furnace grew rapidly in dimensions to 35 by 16 ft., and a capacity of 50 tons.

Big as these were, they were pigmies compared with the huge reverberatories of the present day, heated by oil or coal, smelting as much as 660 tons of charge a day, and fulfilling what the old metallurgist dreamed of as a possibility, but failed always of securing as a reality—the recovery of the waste heat in the form of power. (Mathewson's Development of the Reverberatory Furnace and my Cantor Lectures.)

The fate, however, of the Argo works, despite the science and experience which Pearce brought to bear upon his operations, was virtually sealed when the combined forces of the pneumatic method and the electrolytic separation came almost simultaneously to the aid of the metallurgist. The converter brings the matte to metal in a space of time measured by minutes. Electricity at one operation refines the copper and separates the precious metals, simplifying the process and saving time and money. The Argo works had therefore to go out of blast, and the metallurgist retire before the engineer and the electrician.

And so one has watched change follow change, machinery in every case taking the place of hand labor; and inasmuch as mechanical force can be generated to an almost unlimited degree, the rate of production has kept pace with the contrivances for generating and applying power. Thus it has come about that the trifling amounts which were made within the memory of man have increased to the stupendous production of to-day.

The changes have not been confined to smelting, but have been many and very conspicuous in the concentrating department. Isolated motors have in great measure abolished the countershafts; and grinding mills of many different makes have competed for acceptance in rapid succession. The National riffle has even displaced the jig in some mills, and now flotation is claiming to supplant all other methods. Whatever invention may for the time being claim supremacy, the experience of the past compels one to admit that the construction of the mill of the future should be so elastic that it can be altered with the least expense and embarrassment to suit the many changes which will become imperative. It will probably consist of a large square structure, within which the devices temporarily employed will be erected upon platforms and scaffolding which can be readily removed and replaced.

Iron.—We have been recalling incidents in the history of copper metallurgy, but it is the growth of the iron industry which excites our imagination and wonderment. Its consumption is really the barometer by which we can gauge the world's activity and the demand for other articles; for there is an economical relation in the use of one metal and another. As the demand for iron is the controlling factor, not only in the metallurgical world, but in the industrial world at large, it is iron which fixes the rate of production of virtually all the other metals. I pointed out some years ago that the relation of the consumption of copper to iron in this country was as 1 to 83. That relation has been maintained ever since, and holds good approximately in the world's consumption of iron and copper. That being the case, the demands for the metals, and therefore to a certain degree, the price which they will command in the market, depends upon the economic laws, which will inevitably override our attempts at interference. When these laws come to be better understood and submitted to as implicitly as we bow to the laws governing the forces of nature, the large groups of people who compose the industrial world, instead of engaging in rivalry, which is liable to degenerate into hostility, may possibly co-operate to advance the interests common to all. A world combine would be clumsy to handle, but a world's congress might pass international laws for the regulation of trade which would obviate some of the anomalies that exist to-day.

(*An address before the meeting of the New York Section, American Institute of Mining Engineers, Nov. 4, 1914.)

H. W. Hardinge.—I wish to acknowledge an unsettled credit due to Dr. Douglas of which he is probably not aware. When Dr. Douglas visited the Arkansas Valley Smelting Co.'s Leadville plant about 25 years ago, I was manager. A casual remark at the time by Dr. Douglas was the basis of certain changes in smelting operations through the conversion of a lead stack into a composite lead and copper furnace.

The furnace slags at that time, owing to a shortage of lead as a desilverizer, were running in the neighborhood of 3 to 4 oz. of silver per ton. Taking advantage of the suggestion by Dr. Douglas, as well as certain experiments already made by Herman Keller, the superintendent, one-half per cent. of copper, in the form of ore, was added to the charge. The resulting slags immediately dropped to less than 1 oz. of silver per ton. Later that portion of the slag dump, amounting to several thousand tons, which had been assaying unusually high, was taken into stock as an asset on the order of the president, A. R. Meyer.

At the time of these excessive losses in silver (which was when silver was selling at about $1 per oz.) the profit and loss balance had for several months been in "red," but within two months from the time the addition of copper was made to the charge, the monthly balance turned to a profit of $5,000, and to the best of my recollection a five months' average slag content of silver was 0.93 oz., and the balance for the fifth month changed to $17,000 profit; thus a casual remark resulted in the changing of copper smelting in Colorado, for up to that time the by-products of the lead furnaces in the form of copper mattes had been shipped from the State to the Orford Copper Co. and other refiners in the East and abroad. Shortly after this other smelters in Colorado adopted the same or similar methods, and within a year not a pound of the lead-stack copper mattes was shipped out of the State. The re-smelting of these slags, which had a good iron content, admitted of utilizing ores high in silica and at a correspondingly high smelting charge.

Previous to these and other experiments, lead-furnace mattes contained upward of 15 per cent. in lead, which was a detriment to the copper refining in the East, and for which a penalty was charged.

One of my colleagues in commenting upon the production of lead and copper in the same stack stated that it was impossible. This may have been a very well based opinion, but during the discussion there was a check upon my desk for $10,000 in payment for a shipment of this impossible product of lead bullion produced from the copper stack. The high-grade copper matte made in conjunction with the lead had been shipped to the Argo works, near Denver, where the silver and gold contents were extracted in reverberatory furnaces in conjunction with Dr. Pearce's "secret" method, which was also a subject treated in Dr. Douglas' previous remarks.

MINING IN MAYO DISTRICT, YUKON.

The following communication was made to the "Daily Province" of Vancouver, B. C., under date of February 8, by Mr. George Crisfield, of Galena creek, via Mayo landing, Yukon Territory:—

"As a resident and prospector of the Mayo district, Yukon Territory, I would like to correct a few impressions which were probably formed by the perusal of a certain article printed in one of the Vancouver newspapers. The article in question was an unqualified eulogy of the Mayo district as a land of opportunity for the workingman. I believe the final words were: You will make no mistake in coming to this Cobalt of the North, all we need is more people. I believe the writer of the article wrote those words without realizing how misleading they would be to the average worker looking for a market for his muscles.

"I would not like to see a large influx of laboring men into the camp looking for jobs, when jobs were extremely scarce. There are only four outfits employing labor in the placer diggings. They are as follows: The Minto Lake Hydraulic Co., which will employ probably eight or ten men at the most, since the completion of their ditches. Mr. Middlecoff probably employs fifteen or twenty men, while working two shifts. Another outfit working below Middlecoff on Highett creek employs from ten to fifteen men, while on Haggert creek, Abbott & Portlock employ probably six men.

"So you see at the very outside fifty men is all that can get work in the placer diggings. There are lots of men right here in the camp that need the work to fill that bill. The placer work generally begins the latter end of May and concludes in September, so it is a very short season.

"Then comes our so-called Cobalt of the North. At Silver King mine, owned by H. McWhorter, there are about ten men employed there at present and from all indications, although the overshoot is undoubtedly of good value, the crew will not be largely increased for some time to come. At present the mine may be said to be only a prospect, as far as permanency is concerned, for the full extent of the ore body is not known.

"Apart from that of the Silver King, there is only one vein uncovered up to the present and the value of that ore is problematical. This vein is about 2,500 ft. from the McWhorter workings. It is on the Adam claim, owned by Mark Evans, who is now sinking on the vein and is getting some good ore, but up to the present not in paying quantities. There are seven men prospecting on other claims in this vicinity and they are most of them finding some good float prospects, but that is all.

"Myself and Dave Robertson were, I believe, quoted as having located a rich vein on Lightning creek. Well, I hope it is true, but as we have so far done absolutely no development work it is impossible to say. The best that can be said of it is that it is a good prospect.

"Last spring the Mayo camp had been boosted a little too hard, consequently there were far too many men spent their hard-earned dollars to get here and had to go away disappointed. For a man with a grubstake who understands conditions in this northern country, I don't think a better country exists to-day to prospect in, but for a workingman looking for a job decidedly 'No!' I have been prospecting in the Mayo district for six years, so I know something about the camp, and I hope for the benefit of those who may have been enthused by the article I have referred to, that you will permit this effusion of mine."

It may be added that early in July, 1914, a shipment of 60 tons of ore from the Silver King Mayo district, was received at the Trail, B. C., smeltery.

Anaconda Copper Mining Co. has increased its production to about 80 per cent. of normal as compared with 50 per cent. for several months last year. The March yield of 19,000,000 lbs. was within 4,000,000 lbs. of normal output for this company's mines—23,000,000 lbs.

NON-METALLIC MINERALS USED IN CANADIAN MANUFACTURING INDUSTRIES*

By Howells Frechette.

(Continued from last issue).

Fuller's earth is used in the meat packing industry to clarify lard. The earth is usually ground to 120 mesh and is generally of English origin.

In the refining of petroleum a considerable quantity is used. For this purpose the earth is not ground so fine.

Small quantities are used to remove grease from woollen goods.

Graphite—Though one of the most important uses of graphite is for the manufacture of refractory articles, there is very little used in Canada for this purpose. In the manufacturing of crucibles, retorts, etc., flake graphite of a number of sizes is used. It should be of slow combustion and good thermal conductivity; but the amount and the chemical composition of the contained impurities are the main factors in determining the suitability of any graphite to this purpose. The presence of fluxing impurities would tend to shorten the life of the finished article, if not render it unfit for use.

Stove polishes consist essentially of finely ground graphite, usually 160 mesh, with which is mixed clay or some other material to act as a bond. Both the flake and amorphous varieties are used. Professor B. L. Miller says: "If flake graphite is used a higher lustre is obtained, which has a decidedly steel grey color. This is owing to the flattening out of the flakes on the metal surface when rubbed by the brush, and to the fact that light reflected from the surface of the flakes produces a higher lustre than when the amorphous graphite is used. Not infrequently both amorphous and crystalline flake graphite are mixed together to produce the desired results. With the amorphous graphite alone it is difficult to obtain a lustrous polish, while the crystalline flakes alone produce too light a color, but the combination of the two varieties will yield a black polished surface with expenditure of little labor. The polish obtained with the flake graphite alone, or with the mixture of the two, lasts longer than the polish obtained with amorphous graphite alone." For polish making purity is not of importance, from 70 per cent. to 80 per per cent. of carbon being usual.

The finishing step of the manufacture of gunpowder consists of polishing the grains with graphite. The powder is placed in a tumbling barrel with some very fine flake graphite and thoroughly mixed and shaken for some time. The thin film of graphite enveloping each grain acts as a protection against the absorption of moisture.

Graphite, on account of its extreme softness and unctuousness, is admirably suited for use as a lubricant. It is used in two manners; namely, dry, or mixed with oil or grease. In the accompanying tables, showing the consumption of minerals, graphite used in the manufacturing of these mixed lubricants is included, but only in a few cases record is made of the graphite used in the dry form as a lubricant. Flake graphite in various grades of fineness, from about 20 mesh to 200 mesh, is that employed and should be free from gritty matter.

Large quantities of graphite are used in the manufacturing of paints for special purposes, such as for covering structural steel work, iron and steel tanks and steel stacks. It produces a good weather and fume resisting paint. For this purpose a very fine, air-floated flake graphite is used. It should be free from grit and sulphide minerals.

In the casting of iron, it is desirable to coat the inner surface of the mould with some material which will prevent the metal from coming into contact with the sand of which the mould is made, and at the same time give to the casting a smooth surface. Graphite possesses certain properties which suit it to this purpose, and large quantities are used by the foundrymen. A fine grain, flake graphite is used, either alone or mixed with talc or "sea-coal."

Lead pencils are made by encasing thin rods of prepared graphite in wood to give the necessary strength. These rods are formed by mixing very finely ground amorphous graphite with clay, which is then molded into shape and baked. The hardness of the finished product depends upon the proportion of clay used and the temperature and duration of baking.

In electrical work graphite finds many uses on account of its conductivity, refractoriness and softness. For different uses various grades are employed, in all of which a high degree of purity is required, especially for the making of dynamo and motor brushes, in which case it must contain no grit.

Graphite is used by electrotypers for giving an electro-conductive surface to the matrix on which the electrotype is deposited. For this an extremely fine and pure grade of air-floated graphite is required. A very small quantity supplies the market.

Gypsum—The principal use of gypsum is for the manufacture of plaster of Paris, which consists of partially dehydrated gypsum. On heating finely powdered gypsum, within certain limits of temperature, it gives off part of its water of crystallization, but retains the power of again taking up a like quantity of water, and, at the same time, forming into a solid mass. This property of the calcined gypsum or plaster of Paris finds for it many uses in the arts and trades. A partial list of the uses is as follows: Wall plaster and decorations, moulds and patterns for various purposes, casts of art objects, etc., surgical and dental purposes, and as a cement. It is also the base of alabastine, used for tinting walls.

In the manufacturing of portland cement, gypsum is introduced into the cement for the purpose of regulating the rapidity of setting when mixed with water. Some cement mills purchase the gypsum ground very finely, while others purchase it in lump form or crushed to one-half inch. As a rule a minimum of 36 per cent. of sulphur trioxide (SO_3) is demanded.

Considerable quantities of ground gypsum and plaster of Paris are used by asbestos manufacturers in the manufacturing of pipe and boiler coverings, bill board, etc.

*Extracts from a report published by the Mines Branch, Ottawa, 1915.

In the paint making industry gypsum is employed in the manufacturing of "cold water paints," in which it acts as the body or vehicle for the color. It is also used to a lesser extent in the making of paints, mixed in oils. It should be pure white, very finely ground and free from grit.

Finely ground gypsum, when spread upon the soil, has the power of aiding in the decomposition of certain minerals and thus liberating plant-nourishing chemicals. It also plays a useful part when mixed with manure, which later is to be used as a fertilizer. It is used, either in its crude state or mixed with plant-nourishing materials, to form certain artificial fertilizers.

In the textile industry, very finely ground, white gypsum is used to some extent as a filler for cotton goods.

Iron Oxides—The principal uses of these ferruginous materials, aside from being used as sources of iron, are in the paint industry, where they are employed as pigments. Trueness and depth of color are the prime requisites. They should be very finely ground, and free from grit. They are used either raw or calcined, according to the color desired.

The very finely ground raw hematite produces the colors known as Indian red and Venetian red, but the principal source of these colors is from the residue from pyrite burning.

Besides the use of these materials for paint-making they are used to color mineral floors, sand-lime brick, match heads, rubber goods, paper and oilcloth.

Bog iron ore is used as a purifier of illuminating gas. It has the power of removing the sulphuretted hydrogen (H_2S), hydrocyanic acid (HCN), and hydrosulphocyanide (HSCN) from the gas. By exposing it to the air, after use, it becomes revivified and may be used again.

Iron oxide minerals are used as fluxes in the smelting of certain metals, and as desulphurizers and decarbonizers in open hearth steel making.

Mica finds a number of uses in the electrical industry on account of its dielectric strength, the ease with which it may be split into thin, flexible sheets, and in some cases on account of its transparency.

The following is a partial list of its uses in this industry: Motor and dynamo winding—commutator ring and segment insulators; electric lights—discs for interior insulation of light sockets, covers for fuse boxes; telephones—long, narrow slips on which fuses are mounted; electric heaters—pieces on which the resistance wire is wound, forming the heating elements of toasters, sad irons, etc., spark plugs—the insulation of some gasoline engine spark plugs is made of mica.

The mica is furnished to the consumers split to the necessary thinness and sometimes cut to shape. It must be free from electrical defects; that is, free from electro-conductive inclusions and in perfect sheets.

For commutator insulation, amber mica is best, as it wears, under the action of brushes, at the same rate as the copper which composes the segments of the commutator. It must be free not only from electro-conductive inclusions, but also from quartz and garnet.

For electrical purposes micanite is being extensively used. It is made by cementing together very thin, small sheets of mica into large sheets. For this purpose much of the small mica is used, which otherwise would be discarded as useless or else ground to powder.

Mica, on account of its transparency and resistance to the action of heat, is admirably suited to use as glazing for stove doors, furnace peep-holes and chimneys for lamps, lanterns and gas burners. Muscovite is generally employed, though phlogopite is frequently used. Transparency and freedom from stain are the prime requisites for these purposes.

Finely ground mica, free from quartz and garnet, is mixed with a heavy grease for lubricating purposes.

In order to produce a scintillating surface on wall paper very finely ground white mica is employed. For this purpose the mica is ground under water. It should be from 100 to 150 mesh and as nearly uniform in size as possible.

Coarsely ground mica is used in the surfacing of certain prepared roofings. Cheapness is the main consideration in selecting this material. Any variety of mica may be used.

In addition to the above uses there are many others of lesser importance.

Mica Schist—An increasing number of foundrymen are substituting mica schist for the firebrick used for lining cupolas. The rock is broken into convenient size and shape, about six or eight inches long, four or five inches wide and a couple of inches thick, and cemented into place with fireclay and fragments of the rock itself. It is reported that very good results have been obtained at a considerable saving over the cost of firebrick lining. It is used also to advantage in the patching of cupola linings, either on brick or schist.

Mica schist is used to some extent in boiler settings.

Mineral Phosphates—The major use of mineral phosphates is in the manufacturing of fertilizer. Since the tricalcic phosphate, of which they are composed, is only slightly soluble in water, it is customary to convert it into more readily soluble monocalcic phosphate, that it may be in a better condition to nourish plant growth. Some fertilizer manufacturers perform this operation themselves, while others prefer to purchase the material in the form of acid phosphate.

Phosphorus is manufactured from mineral phosphates by a process of reduction in an electric furnace. A considerable quantity of apatite and pebble phosphate is consumed in Canada for this purpose.

In order to enrich the phosphorus bearing basic slags from steel furnaces phosphates are occasionally added to the charge. Such slags are used as fertilizer ingredients.

A small quantity of apatite is used for making a high grade of acid phosphate, which is employed in the compounding of certain baking powders.

Peat—Aside from the use of peat as fuel, it is employed for several other purposes.

Owing to the potash and nitrogenous matter contained in it, peat makes a valuable fertilizer material. Humified peat is dried, ground and mixed with chemical or artificial fertilizers as a "filler." It not only introduces nitrogenous matter and potash in a suitable form, but owing to certain physical properties which it possesses, it tends to beneficially modify the soil on which it is used, improving its texture, and in the case of light, sandy soil increases its retention of water.

Peat litter is used to absorb liquid manures, blood and wet tankage, after which it is dried, ground and sold as fertilizer.

Pebbles—In the grinding of materials a certain type of machine is sometimes used, known as a pebble mill. The material to be pulverized is charged into the cylinder, which is rotated. The constant shifting of the pebbles contained grinds the material to a high degree of fineness. This type of mill is extensively used in the grinding of cement.

The pebbles used should be tough, hard and not easily split or chipped.

Well rounded pebbles of flint, quartzite and granite, measuring about four inches in diameter, are those usually used for the grinding of cement clinker.

Pumice—It is as a polishing material that pumice finds practically all its uses. In the finishing of fine furniture, pianos, carriages, etc., pumice is employed to smooth and polish the varnished surfaces. The finely ground and bolted pumice is generally used for this class of work, though occasionally the lump is used.

For the dressing of lithographic stones a small quantity of lump pumice is used.

In the polishing of pearl and bone buttons, celluloid goods, jewelry and other fine metal work, the powdered material is used. It should be very carefully graded as to size of grains, the grades ranging to an almost impalpable powder.

Pumice powder is used in the polishing of plate glass, following bevelling, etc. Freedom from large particles is essential.

In the manufacturing of scouring soaps, metal polishes, etc., finely ground pumice is used, and small quantities are used in toilet preparations, such as tooth and nail powders.

Pyrite—The main use of pyrite is as a source of sulphur in the manufacturing of sulphuric acid. The mineral is roasted in an oxidizing atmosphere, in specially designed furnaces. The sulphur content burns to sulphur dioxide (SO_2), and the iron to ferric oxide (Fe_2O_3). The gaseous sulphur dioxide is further treated to convert it into the trioxide (SO_3), which on taking up water becomes sulphuric acid (H_2SO_4). The ferric oxide which is the solid product of the roasting process, often spoken of as pyrite residue or cinder, is of the same composition as hematite. It is frequently smelted for its iron content, or, if the original pyrite contained copper, gold or silver values, these metals may be extracted by smelting or some other metallurgical process. The pyrite residue is used also for making paint. It is a brilliant red and makes the pigment known as red oxide or Indian red. The residue from a well roasted pyrite contains about one-half a per cent. of sulphur.

In his report on pyrites, Dr. Wilson states that "pyrites suitable for acid making should contain as much sulphur as possible. . . . . The greater number of acid makers demand a product containing not less than 42 per cent. sulphur; there are, however, a few large consumers who purchase ore as low as 37 per cent. sulphur. Many purchasers demand that the ore be free from arsenic, though in certain fertilizer works, ore otherwise desirable will be accepted if the arsenic content does not exceed one per cent. The presence of copper, zinc and lead, antimony, calcium and magnesium, fluorine, chlorine and selenium are undesirable. Ore containing pyrrhotite as well as pyrite is also undesirable, though it will be purchased by some consumers, if the sulphur content is not too low."

Sulphate of iron or copperas ($FeSO_4$) is manufactured by allowing water to trickle slowly through a bed of finely broken pyrite. In the presence of the water oxidation takes place, producing sulphate of iron, which is taken into solution by the water. By evaporating the water the sulphate of iron is obtained in crystalline form.

Pyrite is used in the manufacturing of sulphite pulp from wood. The pyrite is roasted in the same manner as for sulphuric acid making, except that care is taken not to admit an excess of oxygen to the roasting furnace. The sulphur dioxide is used in preparing the bisulphite of lime and magnesia as described in the notes on limestone.

Pyrolusite—When manganese dioxide and potassium chlorate are mixed together and heated, oxygen is given off. This is one method adopted for producing oxygen for industrial purposes, but it is being superseded by the electrolytic and liquid air methods.

Pyrolusite is used in the manufacturing of electric dry batteries. It should analyze at least 85 per cent. manganese dioxide and not over one-half of one per cent. ferric oxide.

In the melting of bronzes, manganese dioxide is added to the crucible as a desulphurizer.

As referred to before, pyrolusite is used for counteracting the green color of glass due to silicate of iron, introduced by impurities. Manganese dioxide when added to the glass mixture gives a purplish tint, this color is complementary to the green and thus destroys it, producing a colorless glass. It is used for the same purpose in porcelain manufacturing and enamelling on sheet metal. For these purposes the mineral should be as free from iron as possible.

Pyrolusite is used extensively in the manufacturing of varnish. It acts as a drier. For this use it should be high grade, very finely ground, and free from siliceous impurities.

Sand—Smelting. In the smelting of some ores containing basic gangue, quartz is introduced into the furnace charge as a flux. The quartz used for this purpose may be vein quartz, quartzite or sandstone. If it contains metallic values, it should be classed as an ore having desirable properties for mixing purposes; but if it is barren it must be considered merely as a flux. The quartz is delivered to the smelter as it comes from the quarry, or it may be crushed to any specified degree of fineness.

Crushed quartz is used as a material for lining certain metallurgical furnaces.

Foundries—A moulding sand should be of fairly uniform fineness and contain sufficient clay to give it body and strength to withstand the withdrawal of the patterns, the handling of the moulds and the action of the molten metal. It should be sufficiently porous to allow the escape of the gases developed by the hot metal. It should be refractory, otherwise it would sinter, closing up its pores and thus preventing the escape of gases, as well as fusing to the surface of the metal causing ugly castings which would not machine easily. The presence of lime is objectionable, as it tends to lessen the refractoriness and also gives off gas when brought into contact with the hot metal. Undecomposed feldspar also lessens the refractoriness, due largely to the contained alkalies. For heavy work a coarse, very porous and highly refractory sand is required, while for light castings of iron and for brass a finer sand is necessary.

The life of a moulding sand depends largely on the properties of the bonding material. When the bonding material is a good refractory clay, the sand may be used over and over again. If the clay loses its plasticity on heating, the sand deteriorates rapidly in use.

In order to determine the suitability of a sand for foundry purposes it is necessary to subject it to physical tests and finally to a test in actual foundry service. An ultimate chemical analysis is useful, inasmuch as it indicates the presence or absence of ingredients which would tend to lessen the refractoriness, but so far as alumina is concerned, the percentage is of doubtful value in determining the worth of the sand. The alumina is derived, not alone from the clay matter, but

from the undecomposed feldspar, of which there may be a considerable quantity in the sand. Therefore the percentage of total alumina is not indicative of the proportion of clay matter to sand grains.

In general, a good moulding sand is one consisting of angular, or sharp grains of quartz (small quantities of other minerals are always present) which are covered with a thin film of clay. The clay should not be in excess of the quantity necessary to produce a firm bond between the particles of sand when rammed in a mould. The clay should be plastic and refractory.

Large quantities of river, or sharp bank sand, are used in the making of cores for foundry moulds. It is the general practice to use available local sands for this purpose, without much regard for their suitability.

A core sand should be clean and made up of grains of suitable size for the work in hand. As in the case of moulding sands, a coarse grade should be used for heavy iron castings and a fine grade for light iron and brass castings. Especially for heavy iron castings, a sand should be selected which does not contain a large percentage of readily fusible or fluxing impurities, such as feldspar, lime and iron oxide. A sharp sand is more desirable than one made up of rounded grains, for it bonds better and makes a stronger core.

For the casting of steel very refractory sands must be used for the making of moulds and cores. Very sharp sand of at least 95 per cent. silica is usually specified. It must be free from fluxing impurities. In order to have a porous mould and yet give a smooth finish to the surface of the steel casting, a coarse sand is used to form the bulk of the mould, but a thin layer of very fine sand or ground quartz is placed in that part of the mould which will come in contact with the metal. This ground quartz is known as silica flour. It varies in fineness from 80 mesh to 150 mesh.

Fire sand is a highly refractory sand, 92 per cent. silica or over, used in bedding the floors of re-heating furnaces and gas-fired forges.

The cleaning of castings is frequently accomplished by means of a sand blast. A fairly coarse sharp sand is used for removing the attached sand, while for cutting out cores from hollow castings a much coarser, but not necessarily sharp sand is used. The more quartz there is in the sand the longer will be its life.

Ceramic industry—In the manufacturing of porcelain, enamel ware and enamelled bricks, finely ground quartz is extensively used.

In the manufacturing of porcelain, finely ground quartz, feldspar and clay are mixed together to form the body of the ware. (In the trade the term flint is applied to the quartz used in this industry. True flint is very little used on this side of the Atlantic.) In many glazes for porcelain quartz enters into the mixture.

The mixture used in enamelling metal ware and bricks is made up of a number of chemicals and minerals, one of which is quartz.

The quartz used for enamelware and porcelain should be finely ground, and should be as free as possible from impurities which would tend to produce "off-color" in the finished product. Iron oxide should not be in excess of one-half of one per cent.

Great care must be exercised in the grinding of the quartz, that little iron be introduced into it by abrasion from the machine through which it passes. It is usually ground to about 120 mesh.

Glass—Glass sand, the principal constituent of glass, is crushed sandstone, or a natural sand containing a very high percentage of quartz particles. As glass sand does not command a high price, it seldom pays to crush quartz or quartzite for this purpose. Owing to the hardness of these, there would be danger of introducing an undue amount of iron during the crushing, if ordinary methods were adopted.

As stated above, the usual material used is a natural, high silica sand, or a friable, easily crushed sandstone.

Glass sand should be very low in iron oxide, not exceeding one-half of one per cent. for white flint glass. It should be free from clay, feldspar and mica except in very small proportions. The sand should be of medium fineness, that is, between 20 mesh and 50 mesh, and should be fairly uniform in grain size. Sharp sand is preferred to that made up of rounded grains.

Sand-lime brick—The strength of sand-lime brick depends upon a firm bonding of the sand grains through the agency of lime. A mixture of sand and lime is pressed into bricks, which are then subjected to the action of steam under pressure, for several hours. A chemical union takes place between the lime and the quartz of the sand, forming hydrated calcium silicate. The sand used should not be too coarse. That passing through a twenty mesh screen and composed of grains ranging in size down to minute particles is desirable. In other words, the sand grains should be so graded in size as to leave very little interstitial space. The strongest bricks are made from sharp sand, which is free from inert minerals, such as clay, iron oxide, mica, etc. The clay and iron oxide are particularly objectionable, since they are liable to mask the grains of quartz and thus prevent the union of the lime and quartz. Ten per cent. of clay substance should be set as the extreme limit. Feldspar is less objectionable, but in large proportions is undesirable as it reduces the strength of the brick.

Artificial stone—In the making of artificial stone, common sharp sand is used in the mixture for the body of the stone and a white silica sand or crushed quartz for the face. The silica sand or quartz should be about 20 mesh size.

Building and concrete purposes generally—Sand for these purposes should be sharp and free from clay matter, vegetable matter, etc.

Paint manufacture—Finely ground quartz (silex) is used as a base for the making of wood fillers. To some extent, this same material is used as an "extender" in mixed paints. It is claimed to improve paint for outside service.

Abrasives and polishes—Owing to its hardness and the sharpness of the fragments, crushed and ground quartz is valuable as an abrasive and polishing material.

Ground quartz carefully graded as to size is used in making sandpaper and for sanding "sand belts" for wood working. Very finely ground quartz is used for polishing pearl and bone buttons, and for the making of metal polishes and scouring soaps.

Sharp river sand and silica sand are used for grinding and beveling plate glass and for "frosting" it by means of the sand blast.

Rubber goods—Finely ground quartz is used to some extent as a loader for rubber goods.

Matches—In the manufacturing of matches very finely ground quartz enters into the composition of the match head. A coarser grade of quartz is used for preparing the sanded surface of the box on which the match is ignited.

Sweeping compound—Clean river sand is employed in large quantities in the making of so-called "sweeping compound."

Fused quartz—Special chemical and physical apparatus is made from quartz by fusing it in an electric furnace and casting or pressing it into shape. Such apparatus is unaffected by sudden extreme changes of temperature and is not attacked by the common acids. There is no manufacturer of such goods in Canada.

Filter plants—Sand is used as a filtering medium for water. The following specification, furnished by Mr. Rust, late city engineer of Toronto, is that which was used in that city in the construction of their filtration plant. "The filter sand shall be clean sand, with either sharp or rounded grains. It shall be entirely free from clay, dust or organic impurities and shall, if necessary, be washed to remove such materials from it. The grains shall all of them be hard material which will not disintegrate. The effective size shall not be less than 0.25 millimeter nor more than 0.35 millimeter. The uniformity co-efficient shall not be more than 3.0. The sand shall be free from dust and shall not contain more than one per cent. finer than 0.13 millimeter, and shall be entirely free from particles over five millimeters in diameter. In all other respects the sand shall be of a quality satisfactory to the engineer."

Salt—The following is a list of the principal uses of salt in the Canadian industries, arranged roughly in order of the amount of salt consumed—preserving meats, fish, butter and hides; making hydrochloric acid and other chemical compounds of either sodium or chlorine; in soap making; glazing drain tile, etc., refrigeration; and in certain metallurgical processes.

Shale and Slate—Soft shales are frequently ground and used for brick making. Large quantities are used in a number of localities in Canada for this purpose. No record of quantities is available.

Slate is used as a roofing material. It is split into thin sheets and trimmed to convenient dimensions. There is only a small market in Canada for slate shingles, as they do not withstand the effect of our severe winters satisfactorily. It is also used to make electric switchboards, school slates and blackboards.

Crushed slate or shale is used for making "ready roofing." For this purpose it is crushed to about one-eighth or one-quarter inch size.

When ground very finely these rocks are used as filler for wood. Paint manufacturers prepare wood-filler by mixing the ground material with oil.

Talc—The particular properties of talc which make it useful in the industries are its softness, slipperiness, refractoriness, non-conductivity of heat and electricity, and its resistance to the action of most chemicals.

The principal use of talc in this country is in the making of paper. For this purpose it should be very finely ground, free from grit, and as nearly white as possible for the better grades of book paper. It is used as a filler to be added to the pulp to produce a white, opaque paper and also in the coating of paper. Agalite, on account of its fibrous nature, is the variety most desired by the paper trade because of its greater "retention" and the somewhat stronger paper resulting from its use.

Powdered talc is used in large quantities in the manufacture of talcum powder and other toilet preparations, and also as a filler or loader in the cheaper grades of toilet soap. For toilet powders a very pure grade is employed. It should be white and very free from grit. For soap the color is not so important a matter, but freedom from grit is insisted upon.

For filling and dressing cotton cloth white, grit-free powdered talc is largely used. It is also used in the preparation of cloth for window blinds, and to a lesser extent for other textile purposes.

A low grade of powdered talc is used as a foundry facing. That prepared from the foliated variety is best.

In the manufacturing of rubber goods talc finds two uses. In the preparation of the rubber, talc is added as a filler, for which purpose it should be finely ground and free from grit. It is also used to dress the moulds used in forming the rubber goods to prevent sticking.

Very finely powdered talc is used in the making of enamel and other paints. In most cases pure white stock is specified.

Talc enters into the composition of magnesite flooring. For this the cheap grades are usually employed. Agalite, the fibrous variety, is sometimes specified.

In order to prevent "ready roofing" paper and felts from sticking when rolled for shipment and storage, some manufacturers dust the prepared surface with talc. The lowest grades may be used for this purpose.

Talc is used sometimes in the insulating composition for electric cables.

Among other lesser uses of powdered talc are the following: dressing of fine leathers and kids, as a lubricant and as a powder for gloves and shoes.

In the making of gas burners, slate pencils, tailor's chalk and white pencils, pure grades of massive talc are used. Very little is used in Canada for these purposes.

Such soapstone as is used in Canada is purchased already manufactured into the desired sizes and shapes. Among the many articles which may be made from soapstone are the following: Electric switchboards, laboratory table tops, wash tubs, sanitary fittings, hot plates, griddles, stove linings, furnace linings, acid tanks and lining for causticizing chambers in sulphate pulp mills.

Tripolite—Owing to the finely divided and angular silica, which is the main constituent of tripolite, it is very useful as a polishing material for metal.

In those industries where there is much polishing of metal work large quantities of tripolite are used in the form of grease bricks. Much is imported into the country already manufactured and some manufactured here.

Among other uses of tripolite are the following: As a filler for rubber goods, as a heat insulator for steam pipes, in the paint industry as a wood filler, for making water fillers and as a filling for the walls of safes.

Before the introduction of wood pulp as the absorbent for nitro-glycerine in the manufacturing of dynamite, tripolite was used for that purpose.

HARDY PATENT PICK.

This agency held until recently by Messrs. Mussens Limited of Montreal has now been transferred to Mr. Geo. E. Leighton, with office address 318 St. James Street, Montreal and workshop and warehouse address No. 23 Colborne Street, Montreal, where all classes of the Hardy Patent Pick Co.'s manufactures are kept in stock.

Mr. Leighton will be pleased to receive enquiries for any of the Hardy Company's specialties, such as mining, contractor and agricultural tools and plant, pulverizing or grinding machinery and mills, elevating screening and coal handling plant, hammer and piston rock drills for steam or air, coal cutting machines, Hardy's special rock drill steel, either solid or hollow, etc.

THE EFFECT OF FROST UPON CONCRETE*

By John Hammersley-Heenan, Assoc. M. Inst. C. E.

The engineer who is called upon to carry out work in Canada during the winter finds that the methods of construction which were satisfactory in the summer will need considerable modification to suit winter conditions.

Concrete work, especially the lighter forms of reinforced concrete, used in building construction, needs greater care and supervision. As a result of considerable experience gained during the last few years, it can be said that the freezing of concrete will not damage it if it has first had a chance to set under favorable conditions for about two days. The affect of the freezing is simply to delay the process of hardening, which will again proceed under suitable conditions, and will eventually attain its full strength. If concrete is frozen before it has commenced to set, it will not be injured if precautions are taken to prevent it from freezing again after it thaws until it is sufficiently hardened to withstand the effects of subsequent freezings. It is alternate freezing and thawing during the process of setting that causes the damage.

To meet the foregoing conditions, when carrying out concrete work in winter, it is necessary to devise means of mixing the concrete with materials freed of frost, placing it in the forms before it has commenced to freeze, and then protecting it and keeping it warm for about two days. After that it may be allowed to freeze without fear of its being damaged.

In the case of concrete in mass, of large bulk, it is unnecessary to apply external heat, as the large body of concrete will generate sufficient heat during the process of hardening to enable the mass to set; all that will be necessary is to protect the outside of the concrete so as to keep the heat in. This can be done by covering the concrete with clean straw.

For light sections of concrete, such as in reinforced concrete, poured at a temperature not below 22 deg. Fahr., some engineers allow salt to be used in a proportion not exceeding 10 per cent. There are many arguments for and against its use. The author prefers not to use it, except in marine works, when the concrete is mixed with sea-water and the salt is admitted in that form. He has found that, instead of using salt, good results will be obtained for temperatures that do not fall below 22 deg. Fahr. by heating the water with a steam hose taken from the mixer boiler, and when necessary placing a few coke or wood fires on the heaps of sand and crushed stone, the usual precautions being taken to protect the concrete when in the forms, as described later.

For lower temperatures than those referred to above greater precautions must be taken to heat the ingredients by means of steam coils or radiators.

The concrete having been mixed, and the portion of the work to be carried out decided upon, the floor immediately below it should be partitioned off with tarpaulins, and coke stoves arranged under the floor slab, allowing about one stove to every 800 sq. ft. of floor space. All loose dirt and snow must be removed from the forms with brooms, and a steam hose should be applied to remove all ice and frost, the steam playing continuously over the forms in advance of the concrete, thus warming them in readiness for the concrete. The concrete should be poured quickly and continuously, and as each section is completed a tarpaulin may be drawn over it, supported on wooden strips about 6 in. above the surface of the concrete. In most cases this protection will be sufficient, but during very cold weather it will sometimes be found necessary to form a sort of tent over the floor, in which extra stoves are placed to protect the workmen and the upper surfaces of the concrete.

Great care must be taken to have the fires kept burning continuously for two days, after which the concrete may be allowed to freeze without fear.

The work must be examined from time to time until it is found to be hardened sufficiently. During summer working the author has allowed the supports from the underside of slabs to be removed in four days, but on other occasions four weeks have not been found to be too long.

There are many examples of concrete works which have stood the test of time without showing any signs of being affected by frost; but, on the other hand, a few cases have been reported of very serious corrosion due to the action of frost, such as bridge piers and reinforced concrete piles.

Judging from the information available at present, concrete exposed in air in a dry locality need not be affected by frost any more than good building stone, and probably it will stand much better. Concrete always submerged under water is protected and need cause no anxiety. But concrete alternately wetted and frozen must be protected from frost. On work which is being carried out at Halifax, Mr. John Kennedy, M.Inst.C.E., is protecting the concrete piles between high and low water with a covering of wood about 2 in. in thickness, which it is hoped will prevent the action of frost.

*From a paper read at a meeting of the Institution of Civil Engineers (Great Britain), December 2, 1914.

AYER & LONGYEAR, INC.

Articles of incorporation have been filed with the secretary of the Commonwealth of Massachusetts by the Ayer & Longyear Co., Inc. The principal place of business within the Commonwealth is Boston, and outside the Commonwealth is London, Eng. The purpose of the corporations as stated in the articles, is to buy, lease and operate coal and other mineral properites; to transport coal and other minerals; and to own and operate vessels engaged in such transportation and other business incident thereto. John M. Longyear of Brookline, Mass., and Marquette, Mich., is president; Charles F. Ayer of Boston, treasurer; and Frederic Ayer, Jr., of Topsfield, Mass., clerk. The capitalization of the company is only nominal.

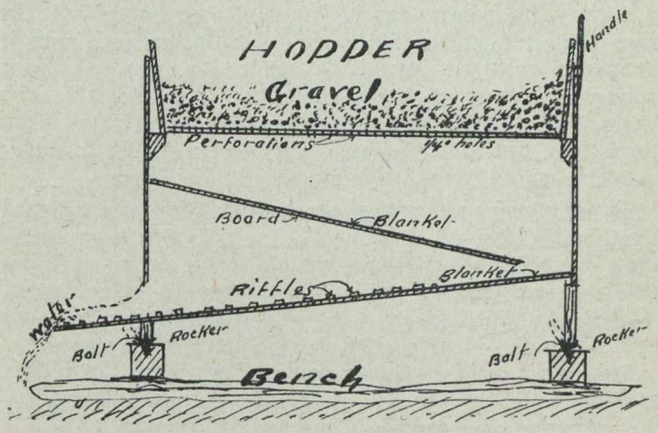
The Ayer & Longyear interests have been associated for nearly half a century in the ownership of vast tracts of land in the northern peninsula of Michigan, covering both the copper and iron mining regions and many of the largest iron mines there have been opened on land bought from these interests or still held in fee by them. They represent the principal ownership, outside of Calumet & Hecla, in the new White Pine mine. Mr. Longyear and associates also own and for several years have been developing, several islands in the Arctic ocean north of Russia containing rich coal deposits. He is one of the largest iron mine operators in Sweden, his properties lying largely in the rich Gellivare district, north of the Arctic circle.

The Michigan Geological Survey has just published a report, by Richard A. Smith, on the occurrence of oil and gas in Michigan.

ROCKER AND GRIZZLY METHODS OF PLACER MINING

By J. A. Macdonald.

It is only within the last ten years that the method of dredging for gold in the Klondyke has been carried on to an appreciable extent. Previous to that time the only methods employed were the sluice box and the rocker, and these are used to a considerable extent at the present time, for dredging requires a lot of money. A medium sized dredge with all appliances for operation costs from eighty to one hundred thousand dollars.



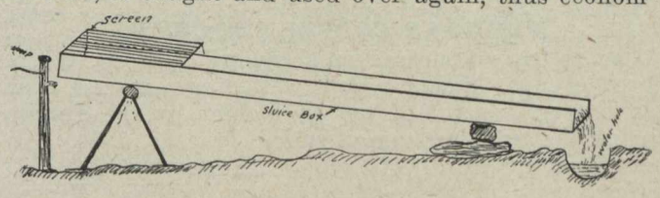
Sectional View of Rocker

In the early days of the Yukon the principal means of separating fine gold from gravel and sand was by the use of the rocker which, as its name implies, is a box some three or more feet long and two feet wide, placed on a pair of rockers after the manner of the old baby-cradle. On the top is a box or hopper, perforated with ¼ in. holes. Where plenty of water could be conveniently taken from a higher to a lower level a series of boxes, made of plank, are elevated on the trestles. Water enters at the high end and flows through them. They are fitted into each other at the joints, so that the stream is continuous through the boxes. They are called "sluice boxes," and are so sloped to allow the water to carry down the gravel and sand, and yet hardly move the gold.

In the methods used for extracting the gold from the gravel gravity is utilized. Gold is nearly twenty times heavier than water, and eight times heavier than rock. Gold is separated from the dirt holding it by the use of an inclined plane, over which a stream of water is made to flow. The gold bearing dirt is shovelled into the fast flowing stream, which carries along the lighter material and leaves the gold behind. To aid in arresting and holding the gold, barriers are placed in the bottom of the box. These are called "riffles." These riffles are now made of angle iron, cut into lengths the width of the sluice box and bolted together at a certain distance from each other. In the early days, however, the riffles were made of bars of wood, generally sections of small trees, cut in even lengths, and held in position by a section of plank nailed to their ends. These wooden riffles, unlike those made of iron, were placed longitudinally with the sluice box instead of transversely. Variations of the sluice box and riffles constitute all the methods of washing gold.

The sluice box requires a stream with a rapid descent. The fall in the box must be about one in four or five feet, so that in thirty feet of box there must be a head of five or more feet. The sluice box enables the operator to work a great deal more dirt than any other system of manual labor. The material is thrown into the head of the line of boxes and the water does the rest.

It is obvious that on a bar or bank mining there would be but few places where the miner could avail himself of the sluice box. In these cases the rocker is used almost universally. The rocker is worked on the principle of the baby-cradle, but it is also worked on the principle of the hand-sieve used in olden times for grain cleaning, and now to be seen in the modern fanning mill. The upper portion of the box, as the illustration shows, is the hopper. This is a box, six inches in depth, made to fit over and into the upper body of the main box. This upper detachable box or hopper has a bottom of heavy wire netting or a thin iron plate perforated with many holes, usually quarter-inch holes. Below the bottom of the hopper are two or three inclined shelves, made of board, as shown in the cut, and these inclined shelves or sieves are covered with pieces of blanket to hold the gold. The lower incline contains riffles, or a combination of blanket and riffles. Two strong rockers are fastened to the bottom of the box, and these rockers being placed on something solid and fastened thereto with a bolt from the centre of each rocker to the bench beneath are oscillated. The operator sets up his machine beside some pool or stream of water, and fills the shallow box, or 'basket,' with fine gravel, rejecting all the coarse parts. With a pail or long-handled dipper he adds water to reduce the gravel to a concrete-like consistency, and at the same time rocks the machine from side to side. The finer and heavier parts of the sand and gravel pass through the holes in the perforated bottom, and fall on to the inclined shelves below, down which they are sluiced by the water, the gold being caught by the wool of the blanket or in the riffles, as the case might be. Where two men were working together, one carries gravel to the hopper or basket, while the other operates the machine simply by the act of rocking and keeping the dirts well soaked with water. Usually the water as it flows off, is caught and used over again, thus economizing the water supply. If much work was being performed the blankets were taken out at intervals, and washed in a tub of water to get the gold out of them, and immediately replaced.



Grizzly

This method, though slow and laborious, was the only available method in many places in the Yukon. Two men working together could easily clean up from two to four cubic yards per day. In the early days of the Klondyke, around '98 and after, it was nothing unusual for two men to clean up one hundred dollars' worth of dust in a day. On the bars of Stewart river

a hundred dollars a day was considered only very good. In numerous cases a half dozen men have succeeded in taking out as much as fifteen to twenty thousand a month by the slow and laborious rocker method.

At the present time the rocker is little used in the working of claims by the miners in the Yukon. Prospectors, however, still continue to use the rocker in trying out prospects. It is the only method open to them to judge the value of a strike. The diminished value of the dirt bars the rocker, as it would not pay

Operating a Rocker

in the working over of poor dirt. With rich gravel panning out ten cents and over, the rocker method gave profitable results, but now when miners are satisfied with two to three cent pans, the sluice box is the only profitable method. With improved hoisting gear very good profits are now made in operating with grizzly and sluice boxes. Where the diggings are good several lines of sluice-boxes are used simultaneously. These are placed in position and the gravel piles over them, and when the operation of separating the gold begins three or more boxes are put into use.

In the new gold diggings on the Saskatchewan river around Edmonton, the rocker and the grizzly are only used. These bars, where the miners work are under water, and it is only in times of low water that they can be worked at all, in early spring, just before the ice breaks up, and in the fall.

MICHIGAN COPPER DEPOSITS.

The recently issued biennial report of R. C. Allen, Director of the Michigan Geological Survey gives a clear and concise account of the work done by the Survey during the two year period ended June 30, 1914. An item from the Director's report on progress that will interest some of the readers of the Canadian Mining Journal is the following.

"Mr. Reginald E. Hore has prepared for publication a monograph on the copper ore deposits of Michigan. This contribution is supplementary to that of Dr. A. C. Lane, whose work on the geology of the Keweenaw series was published in two volumes as Publication No. 6. A great deal has been written about the geology of the Keweenaw series; but relatively little attention has heretofore been devoted to a study of the copper ore deposits. Mr. Hore's work is a valuable contribution to the science of ore deposition, and will be very useful to geologists and others interested in this phase of geology. The manuscript is fully completed and ready for printing."

PYRITIC SMELTING*

Dr. H. Browne—If 35 years ago we had met to discuss the subject that is before us to-night, the criticism that we must all be mad or we would not be here at all would have been perfectly applicable. No group of men would have come together a generation ago to discuss the subject of smelting ores without extraneous fuel, or largely by the oxidation of their own impurities without incurring the imputation of being crazy.

But metallurgy, like all other branches of human industry, progresses by idealism. In every generation there are old men who see visions and young men who dream dreams.

Thirty-five years ago John Hollway conceived the idea that in the Rio Tinto ore the sulphur and iron, if properly oxidized, could be made to produce heat enough to carry on the smelting of the ores. He saw the vision. Twenty-five years ago Mr. Austin, of Montana, took out a patent on a furnace in which to carry out Hollway's ideas. He dreamed the dream.

Twenty years ago a man working in Montana grasped the possibilities of this idea. To him has been given that inexpressible pleasure which comes from realizing the idea and making the concept concrete. Gentlemen, it gives me great pleasure to introduce to you the man who made the ideal real, Robert Sticht, of Tasmania.

Robert C. Sticht, Queenstown, Tasmania.—I find it extremely difficult to act up, in the smallest degree, to the encomium passed upon me by Mr. Browne.

It is true it has been my good fortune to be able to put some sort of method into the "madness" of 25 years ago; but I am not the originator of the idea, nor the only one who has carried it out. Mr. Browne mentioned the originator, who undoubtedly is Mr. Hollway. He also mentioned Mr. Austin, who gave the first instigation to pyrite smelting as now practised. As against both of these men I was fortunate enough to be able to command the necessary natural resources to carry out the idea continuously in a practical way, so as to make it permanently possible.

At the time I left for Tasmania the method had been tried in this country, and it was my good luck to be connected with some of those efforts, and also to become posted on what Mr. Hollway had attempted. Fortified by his reasonings I was able to apply them to the blast-furnace treatment of pyrites, which he had not the opportunity of carrying to success, and to experiment with this method of treatment in two States, Montana and Colorado, in a small way, now and then.

I say "now and then," because, as a rule, the primary conditions were not favorable, and with this process, as with so many other "processes," it is much more difficult to get an ore which suits the "process" than a process which suits the ore. As remarked, the occasions for trying the real thing were few and lasted but a short time each.

Nevertheless, I thus had a certain foreshadowing of what course would ultimately lead to permanent success, gathered at Toston and Boulder, Mont., and Kokomo and Leadville, Colo. So when I got to Mount Lyell I had some idea how to proceed. I also had perhaps the necessary American "cheek" to go there on so small a basis, but I had every reason to believe that the conditions of ore supply, etc., in Tasmania were such as to make this new method particularly applicable there. I knew very little about the inner workings of pyritic smelting, but was one of three or four men in this country who knew how to do it practically—i.e., empirically.

(*Extracts from a discussion at a meeting of the New York Section, American Institute of Mining Engineers, Dec. 2, 1914.)

As time went on, my ideas became concrete, and now we feel we know its real scope and limitations. We know that in some territories it has been tried and abandoned, and in some cases I think more might have been done with it had metallurgical success not been interfered with by economic factors, the mere question of profitableness many times bringing the carrying out of an interesting theoretical idea to an untimely end. How well we all know this!

I understand questions will be asked during the course of this discussion, which has been honored with the title of an "address." I have not written any address, as I am on a vacation trip and do not intend to do any hard work. I have no figures at hand, and I think the general spirit of this meeting makes it unnecessary for me to produce them. It should resolve itself into a conversational discussion of the subject.

To begin: Of course you all know where Tasmania is. It is that little red spot on the map, among the possessions belonging to England, which occupies a southernmost position, immediately below the continent of Australia, and, except in the north, is surrounded by a tremendous amount of ocean in every direction. It is a small island with extensive mineral resources. Generally speaking, they are poor in values—low-grade propositions; but tin, lead, copper, silver and gold, and rarer metals and earths come from there.

On the west coast of that island there is a low but rugged mountain range, and in the center of that there is the orebody to which my attention was called.

I went there in 1895, single-handed; and if there is anything with which I am pleased it is the fact that I went with the knowledge I had picked up, and was given a free hand to put my modicum of experience to the test. Had I not been an American engineer I would not have been given the free scope accorded to me; and, consequently, what I have accomplished in Australia is due to the high regard which the American engineer enjoys all over the world. All the outlying places of the earth show the work of our hands, to the honor of our profession.

In Australia one American metallurgist had already made a signal success. It was H. H. Schlapp, of Broken Hill fame. We knew each other, and his belief in my statements, which to many must have seemed bordering on the impossible, was of service in giving me support. Dr. E. D. Peters had written a report on the property and gone into the question of treatment, but, owing to the novelty of pyritic smelting, both he and Schlapp were naturally inclined to go slow at first and start with the ordinary process. One day, however, I was asked at a directors' meeting, what would I do if the mine were my own. I said, "I would start with pyritic smelting right away!" and the chairman clinched the situation by responding, "Then go ahead your way!"

We started in a wilderness, and got a plant finished, with three furnaces and hot-blast paraphernalia, in a year's time. The transportation of the machinery was very difficult, as there was no railway at first. We had to build that simultaneously and it was completed just in time to settle the transportation difficulty. The latter did not allow us to get in over 150 tons of coke per month, and I knew I could use that up in one week if pyritic smelting would not work.

As remarked, we erected three furnaces. We started the first one June 24, 1896, and gradually enlarged the plant up to six furnaces. Then, not being able to smelt more than 500 tons a day in four out of those six furnaces, we put up a second plant with five more furnaces, so as to smelt 1,000 long tons a day. Nowadays 1,000 tons a day is not much, but this tonnage was a kind of standard at that time, and has so remained in Australia longer than in this country. Tonnages are, of course, on the increase everywhere, but, coming from foreign parts, when one visits your plants and sees 12,000 tons of ore smelted daily in a single one of them, one is simply overwhelmed, and proud of the colleagues who are doing it.

We soon became an important producer of an eminently clean copper. For a number of years it was thought necessary to smelt the ore twice, first into a lower-grade matte and then into converter matte. It was some years, I think something like six years, before we discarded this system of double smelting, and made converter matte out of the ore in one operation. The re-smelting of the matte, so as to enrich it, was an early trick of the pyritic smelters in the United States, to reduce freight and treatment charges on the matte, and was done by them at once. They found the matte much easier to smelt than the ore, and practised this concentration at a time when the big smelters still thought it could not be done.

We also installed hot-blast, and used it constantly on both ore and matte. In fact, in the first few years we could not have smelted properly without it, but finally the discovery that the amount of energy communicated to the reactions in the furnace by that hot blast was very little led to the conclusion that it could be abandoned without fear, and the turning point came when I suggested doubling the amount of blast per furnace by putting on two blowers, in place of one originally provided for each furnace, and using it cold. This brought the work a step nearer to Bessemerizing, which has always been my ideal point of view for the explanation and evaluation of anything connected with pyritic smelting. The pressure went up, so did the grade of the matte, and costs went down considerably. We then had eleven furnaces, and we discarded one plant altogether, once we found that, with an increased amount of air per furnace, we could get the same capacity out of one plant, and we cut the works down to one set of furnaces, five at that time, but now six.

Since then (1902-1903) we have been going the even tenor of our way with but very little metallurgical excitement, though constantly improving both plant and method. I am sorry to say, however, that our most ideal days are behind us. We now use more carbonaceous fuel than we used to and also treat not quite as much pyrites as before—say 850 tons a day, and 450 tons of siliceous ore, making 1,200 to 1,300 long tons a day in between two and three furnaces. We currently blow about 20,000 cu. ft. of air a minute into a furnace. The pressure is great—64 oz., sometimes 65 and 66. This is largely due to the fact that we have progressively increased the height of our column, so that now it is at times nearly 18 ft. high, above the tuyeres.

Mr. Geo. Guess—How long are those furnaces?

Mr. Sticht.—They are 210 in. long and 54 in. wide. We are not in the happy position of being able to utilize a furnace which is very long, as we practically smelt from hand to mouth, and, for instance, would be embarrassed for ore supply over the week ends, and at times of very boisterous weather, when the mine output drops.

The capacity of the works is greater than the capacity of the mines. The latter is decided by special considerations, and a very particular one is the value set for the siliceous ore we mine, and the extent to which it is extracted. There are great low-grade reserves in this mine, but not profitable at present reckoning, other-

wise we would be working 2,000 or 3,000 tons of ore a day.

The orebodies are not large enough for such great undertakings as you have here. I am sorry I cannot tell you about them, as the deposits are most interesting.

I mentioned the siliceous ore. We started without it, and, for a number of years, used barren quartzite and sandstone devoid of all metal values, for a siliceous flux. We had a pure pyrites from the start, free from all deleterious substances, and the gangue matter amounted to 8 per cent. at the time. It has gone up until now it is 12 per cent. or 14 per cent. The quartz we used had no pyrites or other value in it. Although gold is present in some of the siliceous rocks there, we could not use them on account of excessive cost for delivery.

Early in 1903, a neighboring company, known as the North Mount Lyell Co., which had no connection with us, originally, failed. They had been fortunate in the development of a property which was at first hardly more than a wildcat, had erected smelters and built railways, both in imitation of and in opposition to ourselves; and finally had to give up work, after practically spending £800,000 for nothing. In the meantime they had sold us 80,000 tons of their ore, so that we were fully familiar with it. When the amount of their reckoning came they approached us with a proposition to amalgamate, and this was eventually done by the two companies simply coalescing. The works they had erected became superfluous and their mine was taken over by us, their various staffs being paid off. The failure of the North Lyell company was due primarily to professional incapacity, i.e., inability to see that, under the local conditons, it could not possibly pay to treat a siliceous copper ore, of even 10 per cent. copper, and practically devoid of silver and gold values, by ordinary matte smelting, either in blast furnaces or reverberatories, both of which they tried. Nature had meant the two mines to be worked together as they are now being worked, and nature finally had her way. Our company had the stronger gold in nature through possessing the pyrites, which the other company practically lacked. For our part, however, we were willing to amalgamate for the reason that the copper value in our pyrites had very much decreased and was now, for a large part of the body, only 1½ per cent. We had gradually come down from an initial 4½ per cent., through 3½ per cent., to 2½ per cent., or rather 2.35 per cent., which we maintained for some years, and this was also getting scarce. It had always been known that an important portion of the deposit was only ½ per cent. in copper, but this had been regarded as beyond the pale of treatment, though now it is the best we have. The accession of the North Mount Lyell mine came at an opportune moment for both parties, for we have since established its value beyond the dreams of its promoters, and have paid the North Lyell shareholders dividends which they would not have obtained otherwise.

And now it must be remembered that we work these two mutually complementary ores, and only two, that those ores are very pure, that the siliceous ore has free silica in it up to 70 per cent.; that our pyrites is practically free from zinc and lead, and that there is not too much alumina or heavy spar, and that from the metallurgical point of view all conditions are very favorable. Of course we treat small quantities of less easy ores, but they do not affect the average.

We have plenty of water, and quartz, clay, and limestone handy, and a highly specialized staff. So the Mount Lyell company has made its reputation on the strength of those two ores. We have not had any experience in smelting bad ores, or middling bad ores, such as the process has been tried on in this country. We have never had to solve certain problems with which you have been confronted. The only material which is difficult there is middle-class siliceous ores with 45 to 50 per cent. of silica, combined, which are really hydro-mica schists, impregnated with copper pyrites. These run too low in copper value for us, and we cannot do anything profitable with them until the flotation processes are perfected.

It will interest you to know that the superintendence of the smelting operations has always been in the hands of Americans, George F. Beardsley at first, after myself; then A. Lewis Dean, and now Robert P. Roberts. The other officers are all Australians, and a most excellent lot of men also. As is but natural under the circumstances, owing to isolation, etc., the personnel of the staff has not changed greatly since the beginning, and that is true in all ranks of service.

Circumstances have been favorable to our consistently smelting about a 2.25 per cent. copper ore. As remarked, the Mount Lyell pyrites ran that after a short period of higher assay, and now that it has come down to 0.5 per cent., or even only 0.2 per cent., it is being treated together with the North Lyell ore, which as mined assays 6 per cent. We thus still have a 2.15 to 2.25 per cent. average and out of this we produce a 45 to 50 per cent. copper matte, by one smelting, at the rate of over 1,000 tons of ore daily, in an average of a little over two furnaces. Unfortunately for the maintenance of the purely pyrite state of the smelting, i.e., a nearly cokeless smelting, the Mount Lyell ore has got lower in iron and sulphur by a few per cent., and the further fact that its copper value has fallen so considerably makes us give the preference to the North Lyell ore as much as possible. The effect has been that we now use a great deal more coke than we used to. Instead of having 42 to 44 per cent. of iron the Mount Lyell now has only 35 per cent., and the corresponding sulphur, and the conditions are such that one cannot operate with the low coke percentage of the older practice.

At one time the amount of coke on charge went as low as 0.1 per cent. per half year. Now, we use from 3.5 to 5 per cent. and occasionally we exceed that a little. That is simply due to the fact that conditions have altered. The composition of the slag has altered too, though it still forms itself, as before. Instead of running 30 to 32 per cent. in silica, as it used to do in the past, it now goes 36 and 38 per cent. The iron in the slag, instead of being 52 per cent. FeO, is now 45 per cent. FeO. We have always used some lime, and the amount on charge is kept constant, irrespective of the consequent slight variation in the CaO contents of the slag. The alumina is not very abundant, about 7 per cent. in the slag. The copper content of the slag from this high concentration smelting, of 20 into 1, may be a little higher than it would be in the double smelting process, but we have not assured ourselves that it really is.

We have about the usual relation between the copper contents of the slag and the matte, and the average slag assay is from 0.35 to 0.45 per cent. copper, according to the grade of the matte. Our slag stream runs 50 to 60 ft. over forehearths before it is discarded into the drain, where it is washed away, and we catch a little matte in each compartment.

We have never refined our own copper, for the reason that the disposal from Australia was difficult and relatively unprofitable. For many years the blister went to Baltimore, and several of the important questions affecting the sampling of this material were pioneered on our product. The situation at the present time is that since the Mount Morgan company's property in Queensland has developed from a gold mine into a copper mine, and circumstances have obliged them to go into refining on their own account, they have given us better prices than any one in America, so it is not only patriotism, but also business, to send the material to them. Just at present, although the European war is on, our company is running with its accustomed regularity and on full capacity, and the Board thinks we can continue as long as the war may last. The copper goes to England now, whereas before most of it went to France and Germany.

Our labor conditions are unique. You hear much of how bad things are in Australia in that line. Certainly, in some respects, they could not be worse in connection with certain classes of men, such as the wharf laborers, and there are constant strikes in most ranks, but that must be put down to a certain hysteria which is being engendered in the men by the new-born consciousness that they are now playing a part in the affairs of the world at large which was not vouchsafed to their forebears. In Australia, I think, this condition of neurosis will pass away early. As you are aware, the relations between capital and labor are there regulated by some very wise and prudent laws. The principal drawback is that the particular judge of the Supreme Court who handles the arbitration cases is too much of a pure lawyer, and not enough conversant with the peculiarities of the human material he deals with, for his decisions to be wholly satisfactory. We have had very little trouble with our own men. We had one strike over a matter of discipline, but the men went back to work unconditionally as far as this question was concerned, after three months of cessation of work, and we gave them higher wages afterward, without their asking for it.

Outside of us the mainland companies have frequent labor troubles, though much of this is due rather to psychological than to economic causes. As far as Mount Lyell is concerned it must be borne in mind that we are decidedly a "one-mine camp." In addition to the parent mine (Mount Lyell) we also own the North Lyell mine and practically all the other properties in the Lyell district. The importance of our enterprise to the State of Tasmania may be gathered when I say that it is generally held that without us the State would go bankrupt. We have one-third of the mine employees in the State in our employ, and are regarded as a patriarchal kind of concern. Our position makes it both necessary and possible for us to do things not feasible under more circumscribed conditions.

In the case of the fire of October, 1912, in the North Lyell mine, we ran the smelters for over six months with almost no profit for no reason but to keep the men together. It would have been highly imprudent to shut down, as this would have depopulated the district, and the resumption of work would have given us endless trouble and expensive delay.

Relations with the unions are quite amicable, and just as we have not had any very serious trouble with them so far, I do not inticipate any in the future. They are legally responsible the same as the employer, and want it so. This must be remembered, that in those countries all classes are exceedingly law-abiding; this applies to the lowly working man as well as to the highly capitalistic citizen. There is also a reasonable conservative element among the men, which keeps them in check. The word "socialism" is wrongly applied to many things going on in Australia. The men at heart are simple decent fair-minded men, and not adherents of the red flag. They like to have property of their own. There are only 4,000,000 inhabitants of all classes in all Australia, and 1,000,000 in New Zealand, so the population is widely acquainted within itself, like the units of a big city, and it is a fact that they can enact public measures there which could not yet be enacted here. Life is less complex than in the United States, and has an old-world ring about it even in the mining camps. Of course the men have their peculiarities, which are inclined to both amaze and irritate an American, but once understood they are agreeable to handle and most loyal. The nationality of the men is practically all British. Legislation totally forbids the entry of the Asiatic races and the southern European peoples you have here in such masses. There are almost no Italians and but a few Greeks, and not even very many Irish. On the other hand, there are very many Scotch. The Cornishmen, once prominent there, are less so now, and there are no Welshmen of importance anywhere in the smelting line. Scandinavians and Germans are scarce.

I now seem to have traversed a good deal of ground without giving much information. Will not some one kindly ask a question?

George A. Guess, Toronto, Ont., Canada.—The subject of pyritic smelting has interested me for some time. I have been engaged in the work for about eight years.

The information we have had in America regarding Mount Lyell practice has been rather meagre. We knew a few of the basic facts, we knew of the 100 per cent. oxygen efficiency, and that a very low coke ratio was used. In American practice there did not appear to be anything like the practice in vogue at Mount Lyell. All the American plants doing pyritic smelting have had to use more coke, and it has been very interesting to learn to-night that the higher coke now in use at Mount Lyell has been a result of treating less pure ores, due to the exhaustion of the deposits of heavy iron pyrites, and that present practice at Mount Lyell is now more like the work in America.

The amount of oxygen in pyritic furnace gases was a subject of my attention while with the Tennessee Copper Co. There you know there is an acid plant. The Tennessee furnace gases contain oxygen. Some recent pyritic work I have been doing gave opportunity to again check the oxygen efficiency. Although we did not sample the furnace gases in this case, the blowers were new, we knew what volumes of air they delivered, and, correcting for temperature and barometric pressure, an accurate calculation was possible. We were smelting an ore containing practically no sulphides but iron pyrites containing copper. There was little or no pyrrhotite. About 87.5 per cent. oxygen efficiency, I figured, was the result in this test; which extended over a period of 6 days when everything was running normally. Our furnaces at Tennessee, as you may know, were at one time dampened back so much in order to get a pressure on the gases going to the acid plant, that no false air could get to the furnace gases. This gave opportunity to sample the gases, which we sampled for SO_2 every 15 min. At stated periods we examined for oxygen. We noted that when a charge containing a high amount of sulphur as pyrites was dumped into the furnace the SO_2 immediately went up. Now I cannot see how the SO_2 content could go up unless there

were free oxygen in the upper shaft of the furnace. If no SO_2 were formed until the focus of the furnace was reached we would never have that rise immediately after the charge was dumped in. So in my experience I have never found a 100 per cent. oxygen efficiency.

It is interesting to hear this evening that Mr. Sticht has had these gas analyses repeated recently, and that the results have practically checked up the original finding. It is probable that his high oxygen efficiency is due to the high ore column which he carries.

Anyox is the latest addition to pyritic plants in America, and is already no infant. It will be one of the big smelting plants in America.

The furnaces are 30 ft. long. They were 50 in. wide at the tuyeres, and had a uniform bosh from the sole plate to the feed floor. That was changed, the upper tier of jackets being set vertically 6 ft. apart. The lower jackets were moved out, so that the furnaces are now 52 in.

There seem to be no contractions in the pyritic charge until it reaches the focus of the furnace; and I see no reason why there should be a bosh in the jacket until somewhere near the focal point.

The System of Charging.—I believe that Mr. Sticht has a much better system of charging a furnace than is practised in America if we except the little plant at Ducktown where the Freeland charging machine is used, which gives an ideal charge. The charge cannot go in in the careless manner used in the ordinary copper furnaces. If that careless manner is used it will form crusts and more crusts. I think we will have to pay more attention in this country to the charging of pyritic furnaces, particularly in order to get long campaigns and better running.

The Anyox Ores.—The mixture of the two ores contains nearly enough silica to flux the ores. When that mixture is being smelted there is not much latitude in the charge. If one has a clean pyrite, with a low silica, and uses clean siliceous material, clean quartz, there is better control over operations. One has cleaner material and less endothermic reaction in his furnaces, with a hotter focus, resulting in a better slag. When the silica is combined with alumina, and the alumina in the ore runs up to 7 per cent. or better, and there is a good deal of schist, and the charge does not allow very much clean quartz, the range of operations is restricted, and the furnaces have difficulty in smelting and are likely to get into trouble.

The Anyox ores may give difficulty in their high alumina content; but so far 8 per cent. alumina in the slag does not give trouble. We ran several days with 8 per cent., or higher, but we have never gone to 9 per cent. I do not know how that would be.

Coke consumption is about 5 per cent. on the ore.

I would like to ask this question, Mr. Sticht: You were using 20,000 cu. ft. per furnace, per minute in a 17½ ft. furnace; did you run with constant speed or constant pressure?

Mr. Sticht—The pressure varies. We run with practically constant speed.

Mr. Guess—I think the constant speed is better.

Mr. Sticht—You can force the 20,000 cu. ft. up one blow hole, and in that case your pressure would go down. Now, it is more to the point to count the revolutions of the blowing engine, in other words, its delivery.

Mr. Guess—If your pressure went from 55 to 65 or 70 oz., what would that indicate in your furnace?

Mr. Sticht—That it is too tight.

Mr. Guess—How do you correct that?

Mr. Sticht—We would consider something ominous was about to take place if we kept on, but it would only amount to an eventual automatic stoppage of the furnace after slowing up, accompanied by an excessively high matte, up to 60 or even 70 per cent. in copper. But we would not try to loosen up the furnace with slag charges, as this would only be a way for wasting coke. We would run to the bin with the coarse ore.

Mr. Guess—You think it is due to fines?

Mr. Sticht.—Yes.

Mr. Guess—Would you have 25 per cent. of fines in your total charge?

Mr. Sticht—Oh, no; that is a great deal.

Mr. Guess—What would it be?

Mr. Sticht—Say perhaps 10 per cent. This difficulty has never troubled us. If one portion of the bin gets very fine, we go to another bin with coarse ore and equalize it. It is only the pyrites that sometimes gets fine, and some of the schisty North Lyell ore, and if the furnaces want a little nursing we nurse them. Fine schisty ore gives more trouble than fine pyrites.

Mr. Guess—Most people that run blast furnaces like to have their charge as free from fines as possible, and I thought they were particularly disadvantageous in the pyritic furnace at Anyox. This fall the crushing plant broke down, and the ore was bulldozed. We had a "dynamite rock breaker." Steel rails were set with openings of 13 in., and the rock was dumped on those and broken through with powder. The men did not break the rock smaller than necessary to get it through, and we had pieces go to the furnaces as large as a suit case.

The ore was unscreened, and we had 20 to 30 per cent. fines. It was a case also where there was 5 per cent. moisture in the ore. It was a rather undesirable mixture to smelt. The stuff smelts all right.

We were running with constant air pressure, 1,000 ft. of air per foot of furnace length per minute. The pressure would be from 36 to 44 or 45 oz. Our slag was 37 per cent. silica; 42 or 43 per cent. FeO; 6 per cent. of lime, and 7½ per cent. of alumina.

Mr. Lloyd—Below what point did you call your ore fines?

Mr. Guess—One-half inch.

H. A. Prosser—Does the furnace run better after or before you put in these large lumps?

Mr. Guess—I do not think large lumps of ore are an objection. As a matter of fact, we were getting the furnaces straightened around to run, and the crusher broke down while that was in progress, so I do not know that these large pieces are not helpful to the furnaces.

The method of charging can be improved upon. It was not possible to place the charge as well as it can be placed, and a crust was formed along the jackets, and as the crust built out the large pieces sometimes could not pass and formed a bridge. When that happened there was trouble.

Mr. Lloyd—I asked a question with regard to the fine ore. The expression has been used many times, and I asked Mr. Guess what he called fine ore, and got the answer from him "below ½ in." This question has been discussed by many people; it has struck me that the name "coarse ore" or "fine ore" depends on how the ore acts under heat. I have had cases where ½ in. ore would be beautifully coarse ore; and again I have had cases where larger than ½ in. ore would be called "fine ore."

What I want to say is that the sulphides act differently in different cases according to how they are con-

structed or crystallized—the roughly granular stuff will break down quicker than finely crystallized stuff. And if the ore did not break down under heat, and was not fine, one would not use such large chunks. In other places by decrepitation coarse ore might become fines and the fines still finer.

Mr. Guess—Speaking in reply to that, Mr. Lloyd, I remember I wanted more iron one time, and I got a shipment of heavy iron sulphides—iron pyrites that contained low silica. It was all 3 in. stuff. When it was put into the furnace there were explosions that were like musketry shooting all over the place. The result of the rapid decrepitation was that the ore went into pyrites sand and ran the furnace pressure up. Decrepitating ores have no place in a blast furnace.

J. B. F. Herreshoff—I saw the work at Anyox, before Mr. Guess went up. I asked Mr. Guess what he did, when he came back from his trip. He said: "I cannot say that I did very much, the ore was suited to pyritic smelting;" but I think he did make some changes up there which were vast and efficient.

But Mr. Guess will not object if I say that before he went up they were pouring the converter slag into the receptacle. Mr. Guess had some of the slag chilled, and put back into the furnaces. He paid particular attention to the charging of the furnace, and found the fine material in the ore bothered by improper distribution in the furnaces.

When I was at Anyox the difficulty was with the furnaces. The blowers gave 15,000 cu. ft. of air to the furnaces, and the pressure was about 48 oz.; when the furnaces ran at high tonnages, the pressures dropped to 36 in., and they got 30,000 cu. ft. through.

PRECIPITATING SMOKE

Owing to the conservation movement in the United States and to the agitation of farmers against the smelter smoke nuisance, an efficient process of electrical precipitation has been developed. The comparatively small cost of the installation, and the small amount of electric energy necessary for its operation, put it within the reach of almost any plant where its installation is desired or where a nuisance exists.

The process is used for removing either solid or liquid particles carried in suspension in air or other gases. This is done by submitting the gases and suspended particles to the action of a strong electric field maintained between so-called "collecting electrodes" and "discharge electrodes," the latter being insulated from the former and connected to a suitable source of high electric potential. To keep the current flowing between the electrodes through the gases, unindirectional direct current is used. The gases passing between the electrodes become ionized and the suspended particles are removed by the forces acting between the electrodes.

The process has been used successfully for precipitating smoke, cement dust, fumes from acid plants, chlorine gas from electro-chemical plants, zinc oxide from roasting mills, tar from illuminating gas, and fumes and dust from smelters and many other industries.

It is not improbable that this process could be successfully used for collecting the "mist" from sulphite pulp plants and for overcoming the round-house smoke nuisance.

As an example of the power used, one plant treats 30,000 cubic ft. of gas per minute with a power consumption of from 3 to 5 kws., voltage 50,000.—W. J. D.

MUSSENS LIMITED.

Mussens Limited (in liquidation) has sent out the following circular letter:—

We have much pleasure in notifying you that Mr. John J. Robson, Chartered Accountant, of Montreal, who was recently appointed Provisional Liquidator, has, by order of the Court been appointed Permanent Liquidator to this Company. The Court has also granted our application to be allowed to continue the business for a period of six months.

We take this opportunity of notifying you of these facts and advising you that we feel able to demonstrate to our creditors that we will succeed in the efforts which will be put forward to reduce our stock, collect our open accounts and materially reduce overhead charges, with a view to getting into a position to reorganize and continue in business.

While we are in Liquidation, we are carrying on an active campaign for business, and we trust that we may continue to receive your support. We have a good connection throughout the country and all purchases made by us from now on will be paid for by the Liquidator.

Operating as we are, under the most strenuous conditions which have ever existed in Canada, we know that it will take some time to achieve the result at which we are aiming, but if we continue to receive the support of our principals as in the past, we are satisfied we can show good results and ultimately re-establish this business on its old footing.

Since the Liquidation proceedings were put into effect, we have been flooded with letters from manufacturers, as well as from our customers, extending their hearty support and assuring us of their continued patronage. We, therefore, take this opportunity of thanking our friends for this evidence of confidence in us and in our ability to win out.

We also desire to impress upon our customers the fact that we are carrying on "business as usual," and that, although we were always pleased to receive their orders, we are now more anxious than ever to be favored with same.

We conclude by asking our principals to continue the support which has been so freely given us in the past, and we ask our customers to give us an opportunity of supplying them with any material which they may require. All inquiries will be promptly attended to and orders will be filled without delay.

BOOK REVIEW.

MINING WORLD INDEX OF CURRENT LITERATURE—Vol. VI., last half year 1914—By Geo. E. Sisley, Associate Editor Mining and Engineering World—Published by Mining World Co., Chicago—Price $2.00—For sale by Book Department Canadian Mining Journal.

This excellent index to mining literature differs from previous editions by the inclusion of a brief digest of nearly all entries.

The work of preparing the index is a very laborious one and the publishers deserve the heartiest thanks of those who have occasion to search for information concerning minerals and their treatment.

All articles appearing in periodical magazines published in America, Europe, Africa and Australia on mining engineering, metallurgy, mining geology, mineralogy, etc., are to be found here in classified form. The valuable publications of the world's industries, institutes and affiliated engineering and technical societies are listed, as well as publications of Geological Surveys and Mining Bureaus.

CHEMISTRY OF COKE-OVEN OPERATION

Mr. John W. Lee, chief chemist of the Grassmoor Company, Limited, of Chesterfield, delivered a presidential address to the Yorkshire Junior Gas Association at Leeds University, on Feb. 27. The following summary of his remarks was published in The Iron and Coal Trades Review," March 15:

The battery of by-product coke ovens upon which I have gleaned for my address consists of 110 Otto ovens. Sixty of these are of the waste-heat type, and fifty regenerative ovens. Of the waste-heat ovens 50 are 33 ft. 7 in. long by 6 ft. 10 in. high, and 1 ft. 9 in. wide. The other 10 waste-heat ovens are 33 ft. 7 in. long by 7 ft. 2 in. high by 1 ft. 9 in. wide. The 50 regenerative ovens are 33 ft. 7 in. long by 6 ft. 10 in. high by 1 ft. 9 in. wide. The heating of the waste-heat ovens is done by means of 15 vertical flues, and that of the regenerative ovens by 18 vertical flues.

The weight of stamped wet coal charged per oven will average 8.25 and 9.1 tons in the waste-heat oven and 9.7 tons in the regenerative; and the charge will be burnt off in 34 hours and 36 hours respectively. The total capacity of the ovens is about 550 tons of coal per day. The coal used for coking consists of mixtures of the holing slacks obtained from the Tupton, Dunston (Heathcote), Deep Hard and Blackshale seams. Average analyses of these, before washing, show:

	Tupton.	Dunston.	Deep Hard.	Blackshale.
	p.c.	p.c.	p.c.	p.c.
Moisture.	5.52	8.08	5.61	3.93
On dry basis—				
Ash.	11.33	16.12	20.70	8.80
Volatile matter..	28.84	28.66	26.88	31.64
Fixed carbon ..	59.83	55.22	52.42	59.66
Chlorides equal to NaCl	0.112	0.023	0.049	0.086

The slacks are washed in a Humboldt washer, and after washing the average of daily analyses over a long period gives: Moisture, 11.31 per cent. On dry basis: Ash, 6.08 per cent.; volatile matter, 34.06 per cent.; fixed carbon, 59.86 per cent. Chlorides equal to NaCl, 0.056 per cent.

Average daily tests show 3.5 per cent. of the coal in the dirt. The coal is charged into the ovens, after stamping, by means of a Buchanan machine, and can also be charged from the top in case of a breakdown of the charging machinery.

Coke.

The coke is discharged from the oven by an electrically driven ram, travelling on wheels (which also carry the stamper box) into a "Goodall" coke quencher. The quencher is driven by a motor. The coke is quenched by passing a "Darby" quenching hood, and finally on the revolving table. After draining, the table is reversed, and the coke passed, by means of a conveyor, over a screen into the railway wagons direct. The "Goodall" quencher is an excellent machine; and by its use the moisture content of the coke can be easily controlled, and the breeze and dust kept down to a low figure.

Using a coal mixture of the following composition: Moisture, 12.99 per cent.; ash, 5.65 per cent.; volatile matter, 30.53 per cent.; fixed carbon, 50.83 per cent., the coke yield was made up of: Large coke, 95.2 per cent.; small coke, 2.0 per cent.; dust—below ½ in., 2.8 per cent., giving an analysis:

	Large coke.	Small coke.	Dust.
	Per cent.	Per cent.	Per cent.
Moisture.	1.80	16.97	21.55
Ash.	9.45	10.33	12.47
Volatile matter (on drying.	0.69	3.27	5.56

The ovens have an ascension pipe of 11 in. diameter.

Tar.

The volatile products pass up the ascension pipe into the hydraulic main, which follows the usual coke oven practice, and is of the "dry" type. The temperature of this main varies from about 110 deg. to 150 deg. C. By circulating tar through the main very little trouble is experienced with pitching-up. Some solid deposit has collected of the following compositions: Ammonium chloride, 48.0 per cent.; tar (ether and benzol extract), 30.8 per cent.; coal dust and free carbon, 21.2 per cent. The tar, after circulation, had a specific gravity of 1,166, and gave on distillation:

	By volume.	By weight.
	Per cent.	Per cent.
Ammoniacal liquor	3.1	1.8
Light oils, up to 170° C....	2.3	1.9
Middle oils, 170° to 270° C.	21.6	31.4
Heavy oils, above 270° C..	10.3	10.6
Pitch.	....	53.6
		99.3

Free carbon content, 13.4 per cent.

The collected tar from all points had a specific gravity of 1,164, and gave on distillation:

	By volume.	By weight.
	Per cent.	Per cent.
Ammoniacal liquor	2.1	1.8
Light oils up to 170° C. ...	2.3	1.9
Middle oils, 170° to 270° C.	29.4	26.5
Heavy oils, above 270° C...	17.8	16.6
Pitch.	....	52.6
		99.4

Free carbon content, 11.2 per cent.

Leaving the hydraulic main, the gas enters the "Serpentine"—a series of pipes, 24 in. in diameter and 1,350 ft. in length, set horizontally, which serve as air condensers. The gas leaves here at a temperature of about 65 deg. C., and being divided into two streams, enters a battery of three water coolers, rectangular in section, 5 ft. 4 in. by 7 ft. by 19 ft. high. Leaving the coolers at a temperature of about 18 deg. C., the gas passes through liquor sprays. The sprays were put in to assist the ammonia scrubbers in the removal of ammonia. They have not proved of much use for this purpose, but certainly serve as excellent tar extractors, and therefore indirectly help the scrubbers. After the sprays the two streams of gas join, and pass through two tower scrubbers 8 ft. 3 in. in diameter and 23 ft. high.

A series of tests showing the strength of the ammoniacal liquor collected at each point may be of interest:

	Free NH_3. Per cent.	Fixed NH_3. Per cent.	Total NH_3. Per cent.
Hydraulic main ..	0.102	7.093	7.195
1st coolers	0.382	0.083	0.465
2nd coolers	1.454	0.051	1.505
3rd coolers	4.675	0.085	4.760
Before sprays ..	1.295	0.051	1.346
After sprays	1.303	0.051	1.354
No. 1 scrubber...	0.741	0.034	0.775
No. 2 scrubber...	0.398	0.017	0.415

At the outlet of the ammonia scrubbers, the gas is divided up into two streams again, and each stream passes through two benzol scrubbers, each 8 ft. 3 in. diameter and 56 ft. high, filled with wooden grids. In order to prevent corrosion in the tubes of the benzol stills, it is essential that the gas entering the benzol scrubbers should contain the minimum amount of ammonia. One gramme in 100 cu. ft. should be attained in good working. My plan is to keep a 24 hour test running at the outlet of the benzol scrubbers; and our average over twelve months is 0.07 gramme per 100 cu. ft. (equal to 0.06 lb. of ammonium sulphate per ton of coal (10,000 cu. ft.).

Creosote oil is constantly circulated over the grids in the benzol scrubbers, and absorbs the benzol from the gas. From these scrubbers the gas passes to the ovens, boilers or purifiers.

Ammoniacal Liquor.

The liquor is converted into sulphate of ammonia in a plant of the well-known Wilton make, and calls for no special description. Two stills, each capable of dealing with 80 tons, and one still of 150 tons per 24 hours, two saturators, each of sufficient capacity to produce about 10 tons per diem, and a centrifugal dryer, comprise the plant. Excellent sulphate is produced, of a good color, averaging: Sulphate of ammonia, 96.90 per cent.; chloride, 0.03 per cent.; free acid, 0.48 per cent.; moisture, 2.50 per cent.; insoluble matter, 0.04 per cent. The waste liquor (six tests per day for a year) averages: Free NH_3, 0.0056 per cent.; fixed NH_3, 0.0014 per cent. The "Devil" liquor averages: Free NH_3, 0.0228 per cent.; fixed NH_3, 0.0062 per cent. About 0.9 ton of sulphuric acid and 2.5 cwts. of lime are used per ton of sulphate produced.

Except during a period when the acid supplied contained a large quantity of arsenic, no difficulty has been experienced in producing a salt of good color. The acid should be as free as possible from iron content. A typical acid gave, at 143 deg. Twaddel: Sulphuric acid, by titration, 80.640 per cent.; iron equal to Fe_2O_3, 0.059 per cent. The gases from the saturator, after cooling, pass into the main supplying gas to the ovens and are there burned; the chimney gas averaging 1.4 gramme of SO_3 per 100 cu. ft.

Benzol Products.

The method of extracting the benzol from the gas is as follows: A circulating tank divided into four compartments contains the wash oil. No. 1 contains fresh oil and is filled by gravitation from the railway tanks on the siding adjoining. The wash oil used is coal tar, creosote, and should approximate to the following specifications: Specific gravity, 1,000, distilling not more than 5 per cent. up to 200 deg. C. (bulb in vapor), not less than 90 per cent. up to 300 deg. C. (bulb in vapor), and contain not more than 5 per cent. naphthalene and 1 per cent. water. No. 2 compartment contains benzolized oil, No. 3 partly benzolized oil, and No. 4 debenzolized oil. A battery of seven pumps, running at 40 revolutions per minute off one shaft, is connected to these tanks. By an arrangement of three-way cocks the suction of each pump may be put on any compartment in the circulating oil tank, and the delivery set into compartments Nos. 1, 2 or 3. The oil is pumped from No. 4 compartment on to Nos. 3 and 4 scrubbers, and runs by gravitation back through the scrubbers into No. 3 compartment, is picked up again by Nos. 3 and 4 pumps, and delivered on to scrubbers Nos. 1 and 2, running back into No. 2 compartment. The benzolized oil, containing about 5 per cent. of benzol products, is picked up by pumps Nos. 5 and 6 and delivered into the crude benzol still. This still is divided into three parts—a top box (which serves the three purposes of oil warmer, dephlegmator, and benzol cooler), a dephlegmation suction and a distilling section. The cold benzolized oil enters at the bottom of the top box, and is heated to about 90 deg. C. by the vapors from the dephlegmator passing into the top chamber of the box.

The oil is finally raised to a temperature of about 115 deg. C. by means of indirect steam. The heated oil then enters the top tray of the distilling section of the apparatus, and passes over a series of trays, fitted with hoods. At the bottom of this section dry steam, at a pressure of 100 lbs., is blown in. The action of the steam bubbling through the wash oil liberates the crude benzol, which, together with the steam, passes through the dephlegmation section, through the top box, on to the condenser. At the bottom of the condenser the oil and water are separated. The water, which should not contain more than 0.1 per cent. of NH_3, is delivered into the ammoniacal liquor well. The crude oil goes into the storage tank.

The stripped oil from the crude still passes through seven coolers, each 23 ft. 6 in. long and 9 in. in diameter, with four limbs in each, of the Lucas design, constructed strictly on the counter-current principle. Leaving the coolers at a temperature of about 18 deg. C., it returns to circulation through tank No. 4.

The crude benzol is now distilled at about 200 gallons per hour in the first rectifying still by means of indirect steam at a pressure of not less than 100 lb. to the sq. inch. This still has a capacity of 6,000 gallons, with a trap dephlegmating column, supplemented with a top box through which water can be passed. During distillation the products are separated into crude 90 per cent. benzol, crude 90 per cent. toluol and crude 90 per cent. solvent naphtha. The residue in the still, consisting of light creosote saturated with napthalene, is run into cooling pans. After cooling the creosote is drained off from the naphthalene and returned to circulation through tank No. 4. A typical distillation gave 6,382 gallons into still; 3,863 gallons 90 per cent. crude benzol; 601 gallons 90 per cent. crude toluol; 409 gallons 90 per cent. solvent naphtha; 1,256 gallons of oil returned to circulation. The oil returned to circulation had a specific gravity of 1.015, and on distillation with the thermometer bulb in the vapor showed: First drop, 166 deg. C.; up to 200 deg. C., 14 per cent.; 200 deg. to 270 deg. C., 86 per cent.

The crude products are separately washed in an acid-proof agitator, partially homogen lead lined, of the Lucas design. The working capacity of the washer is 4,000 gallons. The products are first washed with strong sulphuric acid, 168 deg. Twaddel (92 per cent. by titration), to extract all resinous substances dissolved in the crude products. After washing for an hour, the acid residue is run off from the bottom of the washer into acid pots, and the "treacle" boiled up with direct steam. The carbon is solidified, and

the acid, of about 32 deg. Twaddel, containing 18 to 20 per cent of sulphuric acid, is used in the sulphate of ammonia plant. After draining off the acid, the contents of the washer are agitated with caustic soda solution to 40 deg. Twaddel for an hour. After standing, the residual solution of soda, etc., is drained off, and the washed product passed into a second rectifying still, similar in capacity and construction to the first, and is distilled by means of indirect steam. Washed solvent naptha is distilled with indirect and direct steam under vacuum. After washing and distillation, the products obtained are pure 90 per cent. benzol, pure 90 per cent. toluol and pure 90 per cent. solvent naphtha. Each portion, after being condensed, passes into its respective storage tank, and is ready for despatch.

Over a year's working, for each ton of acid used 7,544 gallons of products have been washed, and for each ton of "Kausticine" (90 deg. Twaddel 43.4 per cent. NaHO) 34,214 gallons.

The loss in washing is 5, 6 and 25 per cent. in benzol, toluol and solvent naphtha respectively. The relative qualities of the washed products recovered have been 74 per cent. benzol, 10.8 per cent. toluol, 15.2 per cent. solvent naphtha, and the average quantity 2.5 gallons per ton of dry coal. In use the wash oil thickens, and its efficiency decreases. It is then taken out of circulation, and returned to the distiller. The spent oil has a specific gravity of 1,090, and gives on distillation: Up to 200 deg. C., 11.6 per cent.; 200 deg. to 300 deg. C., 69.4 per cent.; residue, 19.0 per cent. There is used 0.096 gallon of fresh creosote per gallon of washed product recovered while the loss of creosote is 0.044 gallon.

Gas.

Of the gas produced, from 75 to 90 per cent. is required to heat the ovens of the waste-heat type, and 50 to 60 per cent. those of the regenerative type. The rest is used for lighting, heating, in gas engines and for burning under boilers. Under the first three heads about 7,000,000 cu. ft. per day are used. As the gas at the outlet of the benzol scrubbers contains over 900 grains of sulphuretted hydrogen per 100 cu. ft., it is purified by oxide of iron in four purifiers of the Milbourne type, each 20 ft. square by 5 ft. deep. The boxes hold about 30 tons of oxide in two tiers, on ordinary grids. Two classes of oxide—"Lux" and bog —are in use. Laboratory tests of these gave:

	Lux. Per cent.	Bog oxide. Per cent.
Moisture as received	48.26	43.86
On dry basis		
Organic matter and combined water	8.81	32.06
Iron equal to Fe_2O_3	73.59	56.94
Calcium equal to CaO	1.69	1.23
Insoluble matter	9.39	8.68
MgO. alkalies, etc. (by difference)	6.52	0.69
H_2S absorbed—		
On dry basis—		
First fouling	20.6	21.5
Second fouling	19.8	17.4
Third fouling	26.5	14.1
Fourth fouling	20.9	12.3

Working the purifiers on the old system, and without air addition, in practical use the bog oxide picked up sulphur, as follows:

	Moisture. Per cent.	Sulphur. On wet. Per cent.	Sulphur. On dry. Per cent.
First time out	37.83	6.61	10.63
Second time out	27.67	15.74	21.76
Third time out	10.47	36.94	41.26
Fourth time out	2.73	47.52	48.85
Fifth time out	3.58	48.64	50.46
Sixth time out	3.99	55.68	57.99

Working the backward rotation system, and adding 2 to 2.5 per cent. of air, the following result was obtained:

	Moisture. Per cent.	Sulphur. On wet. Per cent.	Sulphur. On dry. Per cent.
First time out	24.33	22.70	30.00
Second time out	13.00	45.92	52.78
Third time out	6.96	60.00	64.49

The amount of gas passed per charge increasing from 9,000,000 cu. ft. to 65,000,000. The average composition of the purified gas is: CO_2, 3.6 per cent.; CnHm, 2.6 per cent.; O, 0.3 per cent.; CO, 7.6 per cent.; H, 50.2 per cent.; CH_4, 30.1 per cent.; N, 5.6 per cent.

The unpurified gas contains cyanogen equal to 1¼ lb. of $Na_4\ Fe(Cn)_6\ 10H_2O$ per 10,000 cu. ft. The sulphur content was 25.48 grains per 100 cu. ft., and the calorific value 550 B.T.U. gross (500 net). The bulk of the gas is used in three engines of the Westinghouse vertical tandem type, each having four cranks and eight cylinders, of the dimensions of 15½ in. and 16½ in. by 16 in. stroke. The full load of each engine is 500 b.h.p. at 300 revolutions per minute. The engines are coupled to 350 kw. Westinghouse alternators, generating three-phase current at 440 volts and 50 cycles; direct-coupled exciters being provided. The total load on the connections is about 1,280 h.p., and consists of fans, haulages, rams, quenchers, creepers, conveyors, picking belts, workshops, machinery, etc. The engines, at a load-factor of 59 per cent., use 46 cu. ft. of gas per unit of electricity. The cost per unit including charges for management, running, repairs, purification (not gas), is 0.12d.

Experience has proved that a daily test of the exhaust gases for carbon dioxide, oxygen, and carbon monoxide results in an economical gas consumption. Average of good working results shows: Carbon dioxide, 9.8 per cent.; oxygen, 2.2 per cent.; carbon monoxide, nil.

The steam required for the whole coke oven plant is generated in three Babcock and Wilcox boilers by means of the waste gases from the waste-heat battery. The temperature of the waste-heat flue approximates to 1,000 deg. C. Charts obtained on a thread recorder demonstrate its regularity. On the colliery a saving of many thousands of tons has been obtained by an installation of three CO_2 recorders of the Simmance-Abady type. An increase of CO_2 percentage in the chimney gases from less than 5 to 10 per cent. has been obtained, representing a theoretical saving of 17 per cent.

The chief economic minerals of German East Africa are mica, gold, garnet, coal, iron ore, uranium minerals, copal, trona, and salt. All these exist in such quantity that they are either already worked or will prove worthy of consideration under suitable conditions as regards transport facilities. Mica, gold, and garnet are exported almost wholly to Germany, while most of the copal is exported to Zanzibar and England.

HEDLEY GOLD MINING CO.

The annual report of the Hedley Gold Mining Co., operating in Similkameen district, British Columbia, for the year 1914 shows continued profitable progress and results, as under:

Report of President.—During the past year everything in general, at mine and mill, has gone along very well. The ore bodies being opened in lower levels continue to hold their size and value. Everything seems to indicate a long life for our mine.

Our superintendent, Mr. G. P. Jones, and his assistants are to be commended for doing good and economical work on our new power plant, which should give us surplus power to develop some portions of our property not now being worked. We hope that this new and cheaper power will increase our earnings enough to pay for the new development work planned as just mentioned.

Report of General Superintendent.—During the year 1914 the 40 stamp mill treated 78,494 tons of ore of an average assay value of $10.80, and having a total assay value of $847,349.39.

Extraction showed a recovery of 94.09 per cent. of the assay value of the ore, or a total of $797,340.76. Extraction by concentration was $644,851.58, and by cyanidation $152,489.18.

All the ore treated in 1914 was mined from the Nickel Plate property. Practically all the development work done was in the nature of extensions of drifts, inclines, crosscuts or stopes, and practically all this work was in ore, waste having been encountered only in passing through the Andesite sheets that form the foot and hanging walls of the ore. The boundaries of the big stopes in the upper section have been extended east and west and beyond the lines of payable orebodies as previously estimated. The ore on the east side is still of satisfactory grade and strength, which indicates considerably more ore in that direction. The ore in the old stopes is being left, while the lower levels are being pushed forward into new country. The stopes in No. 5 incline below No. 4 tunnel level have all produced high grade ore, and drill holes from the third level through the footwall indicate another section of payable ore. Assays of the cores taken from these holes give an average value of $20 a ton. This ore will be mined from the second level of the Dickson incline.

The Dickson incline has been extended to 750 ft., and stations have been cut at the 100, 200 and 600 ft. levels. The whole incline has been provided with pockets and all necessary equipment, so that it is in first-class condition for doing good work. Stopes have been opened on the first, second and sixth levels, all in ore of satisfactory grade, with that from the stopes on the sixth level, however, of a rather better grade than that from the others. A 160 ft. raise from the sixth level of the Dickson incline to the fourth level of the No. 5 incline above, has been holed through; two stations have been cut in it and from both of these good ore is being mined as well as from the top of the raise and from the 600 level, there thus being four separate beds or ore which are being mined through this raise into the pockets of the 600 level of the Dickson incline.

The sinking of the Dickson incline has been resumed; this should intersect and open large bodies of payable ore below, the occurrence of these having already been proved by the diamond drill. The indications from this part of the mine, as well as those from the ground northeast from the Dickson incline below No. 4 tunnel, are very promising. From the No. 5 incline, at each of the levels, drifts have been run in this direction, and all have encountered shoots of payable ore

The total amount of new work done during 1914 was not large, which was due primarily to want of power. Fortunately the mine has not suffered as a result, for the ore yielding sections are in first-class condition for mining, and it is not difficult to maintain an output of ore of the present grade.

In the month of December, 1913, the directors authorized the selection of a site on Similkameen river and the submission of proposals for a hydro-electric power system, plans for which were afterward accepted. Construction work on the dam was commenced about January 1, 1914; the whole system was completed and in operation by January 2, 1915. The situation of the dam is on Similkameen river, just below its confluence with Twenty-mile creek. The dam is of the stoplog type; from it the water runs in a flume of 9 x 7 ft inside dimensions for 15,000 ft. to the forebay, from which the turbines are supplied through an 8 ft. steel penstock. The twin turbines, of the Francis type, were manufactured by S. Morgan Smith Co., of York, Pennsylvania; they have a capacity of 2,100 h.p. The 1,250 kw. alternating current generator and all the electric machinery at the power house were supplied by the Canadian Westinghouse Co. The governor was provided by the Lombard Governor Co.

There has also been installed, in addition to the old power house, a new 2,000 ft. compressor, manufactured by the Canadian Ingersoll-Rand Co., and direct-coupled to a Canadian General Electric synchronous motor of 440 h.p. This unit, together with the present compressor, which will also be driven by an electric motor, should supply ample compressed air for the mine and allow a surplus as well. The new plant was started without a hitch and ever since has been operating satisfactorily.

During the year all other departments were brought to their highest efficiency. Special mention may be made of a new tube mill now being put in. There has also been added to the mill equipment a new 24 x 36 Traylor jaw crusher. At the mine all buildings have been rearranged, so as to have the men's sleeping quarters as comfortable as possible. A large building has been erected for a dining room, cook house, wash house, lounge room, etc. There has been installed a complete new fire protection system, with a large tank reservoir for water supply.

Diamond drilling, drifting and stoping indicate that there is at this date as much reserve ore as there was at the corresponding period of last year, and it is of equally good grade. It can be said confidently that the mine never looked better than now, and it has a very promising outlook for the year 1915.

Report of Treasurer.—The net profits for the year 1914 were $388,228.65. The dividends for the year totalled $300,000, or 25 per cent. on the issued capital of the company. The amount of undivided profits after payment of all dividends was, on January 1, 1915, $360,324.88.

The new, all-the-year-round, water power plant was completed. The expenditure on it in 1914 was $178,980.78, which amount was charged to capital account; adding $13,028.57 expended in 1913, the total cost of the system was $192,009.35, or $7,990.65 less than the original estimate of $200,000.

The cost of the new Traylor crusher, $7,079.54, was

charged to capital account; also the cost of a house built for the mine engineer, $1,979.34. All other expenditures, including extension of the Dickson incline, new mine buildings, and new fire protection system, were charged to operating expenses.

The company, on its formation in 1909, was provided with a cash working capital of $280,000. To this should be added $360,324.88, of undistributed profits. The following sums have been expended since the company was formed and charged to capital account: Additions to mill and plant, $136,352.96; new mineral claims purchased, $145,913.13; new power plant, $192,009.35; total, $474,275.44. This leaves a working capital of $166,049.44, as at January 1, 1915, consisting of cash and accounts receivable.

Although the net profits from operations in 1915 were more than enough to pay dividends equal to those of the years 1912 and 1913 (each of a total of $360,000), the directors deemed it wise to maintain a cash surplus of at least $100,000.

Statement of Operations and Earnings.—This gives details of monthly totals. The year's totals are as follows: Tons of ore milled, 78,494; average assay value, $10.80; total value recovered, $797,340.76; expenditure, $409,122.11; profits (including $6,274,76, interest on company's funds), $388,228.65.

Balance Sheet.—Assets: Original investment (mines, mine buildings, reduction plant, etc.), $920,000. Additional investments: Additions to machinery and plant, etc., as shown above, $474,275.44; cash, $108,715.78; accounts receivable, $57,333.66; total assets, $1,560,324.88. Liabilities: Issued capital stock (authorized, $1,500,000), $1,200,000; surplus at January 1, 1915, $360,324.88; total, $1,560,324.88.

LE ROI NO. 2, LIMITED

The fourteenth annual general meeting of the shareholders of the Le Roi No. 2, Ltd., was held March 17th, at Salisbury House, Londonwall, E. C., Lord Ernest Hamilton (chairman of the company) presiding.

The Chairman said: In dealing with the report and balance sheet for this year, I propose to put before you this afternoon matters of general policy rather than a survey of the details connected with the development and management of the mine. For two years we have paid no dividend. This has been due to two causes. Firstly, to a system of what I may describe as overcaution on the part of the management, who have strongly urged upon us during that period the necessity for getting the development of the mine very conspicuously ahead of its ore production. This is, no doubt, broadly speaking, a very prudent policy, but, if carried to extremes, it is obvious that it results in a highly-developed mine which produces no dividends for the shareholders. In this connection there always is, and always must be, a certain variance of opinion between the managers of a mine and those who are responsible for the payment of dividends to the shareholders. This variance of opinion has, in our case, resulted in several interviews which we have lately had with the firm who manage our property, and I think that, as a result of those interviews, we have come to a perfectly satisfactory understanding with Messrs. Alexander Hill and Stewart. We believe that the condition of the mine is good, and that the prospects for the future are very much better than might be indicated by the paper results of the last two years. I will not say more on this subject, as it has never been part of our programme to hold forth unduly optimistic prospects, which may be upset by the changes and chances of mining. The second cause which I refer to as having interfered with the payment of dividends is the fact that during the past two years we have been forced to make certain money payments, in order to preserve the value of our interest in the Cloncurry property. I am glad to be able to inform you that the point has at length been reached when these disbursements are beginning to come back to us, and I think I may safely say that this investment, extremely troublesome though it has been, will, in the end, show a profit to the company.

The Van-Roi Property.

With regard to our other outside interest—the Van-Roi—I regret that I am not able to be so optimistic. The circumstances in which this property was originally taken up have frequently been gone into at these meetings, and I need not go over the same ground again, beyond reminding you that it was taken up on the very strong recommendation of our managers, who personally inspected the property, and who made such reports on it as seemed to remove all elements of risk from the enterprise. This was done, as you remember, at a moment when the Le Roi No. 2 mine showed signs of giving out, and the idea was that the Van-Roi property would take its place as a provider of dividends. This has, unfortunately, not proved to be the case, and there is no getting away from the fact that the whole undertaking was a very great mistake. The position now is that the Van Roi Co. owes the Le Roi No. 2 a considerbale sum of money, and the usual problem arises as to whether it is worth while to put in more money on the chance of getting back that which is already gone. For the time being the directors have decided that it is not worth while so doing, feeling fairly confident that the opinion of shareholders would be in favor of utilizing Le Roi No. 2 profits for dividends rather than for development of another property, the results of which must, of course, be problematical. I do not wish it to be understood from this that we consider the Van-Roi property to be valueless, because this is very far from being the case. But the great trouble is that it was started with insufficient working capital, and that, in order to give it a fair chance, more money is required than we see our way at the moment to put into it. If any company, however, with a small free working capital, were to take it over from us, the probability is that they would make a very good thing out of it, in view of the fact that in one year the mine made a profit of £30,000, and that it is undoubtedly very far from being exhausted. In the meanwhile, the Van-Roi property is shut down, and all the expenses connected with it have been reduced to an absolute minimum.

Development of the Mines.

Mr. Stewart (of Messrs. Alex Hill and Stewart) gave details of the development of the mines, and stated that, on the whole, the position had been vastly improved by the developments which had taken place in the deep ground, and had given the mines a new lease of life. He emphasized the need of extensive development, and thought an expenditure of £15,000 to £20,000 on development annually was required in the Le Roi No. 2 group of mines to keep them alive permanently.

In the course of the discussion which ensued, Mr. Williams suggested an amalgamation with the Van-Roi Co., seeing that they had a very large amount of money at stake in that concern. This suggestion was opposed

by Mr. Lionel Harris, who regretted that the Le Roi Co. had ever taken an interest in the Van-Roi. He did not think that the Van-Roi would ever be a success, because the grade of the ore was too low.

The Chairman thought that the Le Roi Co. might become the absolute owners of the Van-Roi Co. if that concern were reconstructed with an assessment on the shares of something like 4s. The other shareholders, probably, would not put up their assessment, and the Le Roi would become the absolute owners of the property. He felt that they must come to some finality with regard to that concern. Certain expenses were accumulating, which in the end would fall on the Le Roi, because they had guaranteed the overdraft. In reply to a question, he said that they hoped to be able to pay another dividend before the close of the current year; in fact, they had an assurance from the managers that they should be in a position to pay another 1s.

Van-Roi Mining.

Lord Ernest Hamilton presided at Salisbury House, E.C., at the general meeting of the Van-Roi Mining Co., Ltd., and, in moving the adoption of the report and accounts, said the mine was at the present moment shut down, as they had no more money with which to continue work, and every expense had been cut down to the lowest possible figure compatible with keeping the property alive. The position with regard to the company was rather peculiar, as he believed that practically every shareholder in the company was also a shareholder in the Le Roi No. 2. They had so far been financed by the Le Roi No. 2, but the time had come when that company did not see its way to financing the Van-Roi Co. any further. He thought they must look at the situation from the point of view of Le Roi No. 2 shareholders, and agree that it was better to make a certain loss over the one property rather than dissipate the profits of the other company in pursuing the development of a mine which had so far proved profitless to the shareholders. At the same time, he did not wish it to be considered that they looked upon the property as valueless. They had not the working capital to develop it, but their managers held the very strong opinion, which was shared by the board, that with a few thousand pounds of working capital the property could be made to pay good dividends. With regard to the future he was not in a position to say anything definite. They might be able to sell the property or lease it to another company, and suggestions had also been made with a view to their absorption by the Le Roi No 2.

VIPOND.

At the annual meeting of the Porcupine Vipond Mines, held in New York, total assets as of March 31, were reported at $41,275, composed of $15,415 in bullion, $22,495 in current accounts, and $3,365 in accounts receivable. President Ward said that all the liabilities of the company, including the bond issue of $65,000, would be liquidated within six months, but as he personally held $50,000 of this issue he was willing to place it in trust for a year. The rest of the bondholders would, if they wished, be paid off in the period specified.

Mine Manager Poirier estimated total ore reserves at 48,300 tons, worth approximately $430,000.

PERSONAL AND GENERAL

Mr. Wm. Cooper, superintendent of the Temiskaming mine, Cobalt, was married last week to Miss Hackett of Toronto.

Mr. J. G. Sipprell has been appointed safety engineer at the Temiskaming mine, Cobalt.

Mr. J. V. N. Dorr has been visiting cyanide plants in Northern Ontario.

Mr. A. A. Hassan is examining manganese deposits in Tennessee, West Virginia and Virginia.

Mr. Geo. Watkin Evans, has just returned to Seattle from a professional visit to Southeastern Alaska.

Mr. J. F. Mitchell-Roberts has resigned his position as chief engineer to the Wilfley Mining Machinery Co., of London, to take up private work. He will be absent from London for about nine months.

Mr. R. E. Hore has returned to Toronto after visiting mines at Porcupine and Cobalt.

Mr. H. H. Lavery is mine surveyor at the Dome mine, Porcupine.

Mr. G. B. Church, formerly chief engineer, Goldfields Consolidated Mines Co. is now on the staff of Dome Mines, Ltd.

Mr. A. Marshall, Chemical Inspector, Indian Ordnance Department, has compiled a new treatise on explosives which will be published by J & A. Churchill.

Michigan College of Mines graduates of New York and vicinity have formed a New York M. C. M. club. W. E. Parnell is president and Jas. S. Dunstan, 42 Broadway, is secretary.

Fraser & Chalmers, of Canada Limited, announce that on account of the necessity for increased space, brought about by their rapidly growing business, on May 1st their Head Office will be transferred to No. 59 Beaver Hall Hill, Montreal.

Mr. D. H. McDougall has been elected President of the Mining Society of Nova Scotia.

Mr. Robert G. Drinnan is now in charge of the Hillcrest Collieries, Alberta, succeeding Mr. John Brown.

Sir Robert Hadfield has been selected by the British Government to have charge of engineering works.

Dr. F. S. Pearson is in Toronto.

Mr. Jos. Leiter of Chicago visited Cobalt and Porcupine mines early in April.

Mr. Leon Charles Thrasher, an American mining engineer on his way to the Broomassie mine, West Africa, was among those lost on the steamer Falaba, which was sunk by a German submarine March 29.

Mr. Ralph Stokes is at the front with the Royal Engineers.

Mr. W. E. Cameron, who until the suspension of operations after the outbreak of war in Europe last summer had charge of the several Slocan properties in Slocan district of British Columbia, that were being worked by the Consolidated Mining and Smelting Co., is now superintendent at the Rambler-Cariboo silver-lead mine in McGuigan basin, which mine was the first in the Slocan district at which important deep-level development work was done.

Mr. Lorne A. Campbell, general manager for the West Kootenay Power and Light Co., and auxiliary organizations that supply electric power to mines and smelting works in West Kootenay and Boundary districts, British Columbia, was recently presented with a handsome sterling silver tray, suitably engraved, as a token of the appreciation of his services as representative in the Provincial Legislature of the constituency of Rossland. The presentation was made by Mr. M. E. Purcell, superintendent of the Consolidated Co.'s Centre Star-War Eagle group of mines at Rossland, on

behalf of the citizens of Rossland. Mr. Campbell has since been unanimously renominated as the Conservative candidate for Rossland constituency at the next Provincial election.

Mr. Roy H. Clarke, of Spokane, Washington, recently examined the Blue Bird mine, in the South Belt of Rossland camp, B.C., preliminary to a proposed resumption of development work and ore production at that property.

Mr. A. W. Davis, formerly on the mining engineering staff of the Consolidated Mining and Smelting Co. in British Columbia, who with seven other engineers left that province early last autumn for active service in Europe, has written to a friend in the West that with the exception of Messrs. Thomas Brown and B. T. O'Grady, who have received commissions as officers in the Imperial Army, the British Columbia party is still intact and is with No. 1 Company, Canadian Engineers, in France. Mr. L. B. Reynolds (B.Sc., McGill, 1903), formerly of Nelson, was at the time Mr. Davis wrote at the company's base in England partially incapacitated by reason of having sprained one of his ankles.

Mr. Geo. H. Dickson, Kingston School of Mining, for a number of years engaged in mining engineering in British Columbia and Alberta, is now with troops in training near Victoria, B.C.

Mr. S. S. Fowler, general manager for the New Canadian Metal Co., owning the Bluebell lead-silver mine at Riondel, Kootenay lake, B.C., has returned home from a visit to Ontario.

Mr. John Hopp, who is the largest hydraulic placer-mine operator in Cariboo district of British Columbia, has returned to the Pacific coast after having been in New York and other eastern cities for three months. He was in Victoria, B.C., on April 1.

Mr. Thomas Kiddie is at Morenci, Arizona, on a visit to his son, Mr. John Kiddie, mine manager there for the Arizona Copper Co.

Mr. Andrew G. Larson, of Vancouver, B.C., has opened a branch office in Spokane, Washington, to the more conveniently attend to mining engineering work he has to do in the Coeur d'Alene district, Idaho, which is within easy reach of Spokane.

Mr. Ernest Levy, representative in British Columbia of Messrs. Hill & Stewart, managers for the Le Roi No. 2, Ltd., operating the Josie group of mines near Rossland, has returned from a visit to England. Mr. Douglas Lay, who was in charge at Rossland during Mr. Levy's absence, plans to do consulting engineering work, with Nelson B.C., as his headquarters.

Mr. R. G. McConnell, Dominion Deputy Minister of Mines, is expected to shortly visit British Columbia.

Mr. Robert E. Palmer, who was at Rossland with Mr. W. A. Carlyle and afterward went to the Rio Tinto mines, Huelva, Spain, when Mr. Carlyle became general manager for the Rio Tinto Co., is reported to now be in that company's London offices, as one of its consulting engineers.

Mr. A. W. McCune, Jr., of Salt Lake City, Utah, is at Ainsworth, B.C., to spend some time on mining properties in that camp in which he and his father are largely interested.

Mr. T. A. Rickard has arrived in San Francisco from England, and is again editor of Mining Press. Mr. H. Foster Bain has gone to London to there assume the editorship of the Mining Magazine.

Mr. J. V. Rittenhouse, of New York, who is interested in mining properties along the line of the Grand Trunk Pacific Railway in British Columbia, is again in that province.

Mr. Milnor Roberts, of Seattle, Washington, dean of the College of Mining, University of Washington, who spent last summer directing prospecting and exploratory work on coal lands on Graham island of the Queen Charlotte group, British Columbia, was recently at Goldfield, Nevada, on professional business.

Mr. M. H. Sullivan, assistant metallurgist at the Consolidated Mining and Smelting Co.'s smeltery at Trail, British Columbia, has been nominated by the Liberals of that constituency as their candidate at the election for the Provincial Legislature expected to take place shortly.

Mr. Oscar V. White, superintendent for the Slocan Star Mines, Ltd., has returned to Sandon, Slocan, from a visit to Spokane, Washington, where his brother, Mr. Byron H. White, has been very ill. It is announced that the Slocan Star concentrating mill, which was closed last summer when the war upset the silver and lead markets, will be put in operation again in April.

The Yukon mounted gun section, known as Boyle's troop, after Mr. J. M. Boyle, of Dawson, Yukon Territory, who is financing it, has been transferred from Vancouver to Victoria, B.C., to join the 2nd Regiment of the Canadian Mounted Rifles, which is expected shortly to be sent to the front. There are 52 men in Boyle's troop, which is commanded by Captain Knott.

SPECIAL CORRESPONDENCE

COBALT, SWASTIKA AND SOUTH LORRAINE

The power situation in Northern Ontario has been of very serious importance; but the situation should be relieved by the middle of this month. The water has not come above the ice yet. Usually April 17 sees the water to rise. This year the season is a little earlier than usual and in a few days all mines and mills should be running with full power.

But there is considerable apprehension as to the future. The position in regard to power has been steadily growing worse every year in spite of the efforts to cope with the situation. This year the company states that, with better storage at Matabitchouan Falls, and an opportunity to raise storage on the Montreal river never afforded to them before, they have no fear that there will again be a shortage, no matter how dry the summer and fall may be. But for the past three months the shutting down of the mills in rotation has lessened the output and raised the cost, when to many mines in the district the cost per ounce is a very serious matter indeed. One company did actually close down until such time as continuous power could be assured them.

Development on the Temiskaming mine still continues to be most satisfactory. The same vein, which has been yielding such rich ore from the drifts and stopes on the Beaver line has now been opened up at the 400 ft. level of the Temiskaming. The vein had already been cut from the Temiskaming shaft on the 530 ft. level, where it showed bonanza ore. On the 400 ft. it is six inches wide of high grade ore, though it is not as spectacular as on the 530 ft. level. As the

crosscut found the ore a good deal further south than on the 530 ft. level, there is a prospect of obtaining a longer ore body than was anticipated between the Beaver line and the Temiskaming crosscut.

Last week two cars of ore were shipped. One of these consisted of thirty tons, running about 6,100 oz. to the ton and being worth to the company approximately $100,000. The other was of concentrates, but these ran so high that a valuation of nō less than $34,000 was placed on the car.

The Beaver Consolidated Mines, Ltd., has announced an interim dividend of three per cent., payable on April 27th. This is the Beaver's usual rate of dividend. Development on the Beaver mine has been very satisfactory of late. The vein system, which has produced such remarkable ore on the Temiskaming side of the line, was first developed on the Beaver, and it has been opened up here on three levels. It is probably the richest and longest and most consistent ore shoot on any property in the southeastern portion of Coleman township.

Shamrock.—It is understood that there is every prospect that the Shamrock mine will be reopened very shortly. Mr. A. M. Bilsky paid a visit to the Cobalt camp last week and stated that the company was being refinanced with a view to starting operations again. The Shamrock adjoins the Beaver, and a good deal of work was done at the property some years ago by the interests associated with the Nova Scotia Cobalt Mining Company.

Crown Reserve.—Good reports continue to be heard of the Nicaraguan property which the Crown Reserve Mining Company is now sampling. It is stated to be a low grade property, with a million tons of ore in sight, which has not been worked consistently before because of lack of transportation. A railway is now being built within a few miles of the deposit, and it will therefore be possible to cut down costs in this respect.

Trethewey.—There are well established reports that the diamond drilling of the Trethewey on their optioned claims next to the Huronia mine is yielding good results. One hole has been put down 500 ft. and another has been started.

An interesting experiment is being tried by an Ohio firm with pebble mills. They have manufactured small manganese steel balls to replace the pebbles in the tube mills. It is claimed that it will greatly increase the capacity of the mills and that their greater cost is more than offset by their length of service.

PORCUPINE AND KIRKLAND LAKE

Tough-Oakes—Though there has been a scarcity of power in the Kirkland Lake camp, as everywhere else, it has been possible to start the new mill. At first there was so little power available from Charlton that all was required to run the mill at 50 per cent. capacity; but now there are two to three drills operating underground. The mill has already proved to be a metallurgical success, and an extraction of 94 and 95 per cent. has been made from ore running around $40 a ton. The ore to the mill is coming partly from the stopes and partly from the dump.

Acme.—There was some delay in getting the second twenty stamps of the Acme mill running. The big buckets on the aerial tramway from the shaft to the top of the mill developed a defect which, while it did not prevent entire operation, cut down capacity very largely indeed. There should be no further delay in getting the entire battery running when the balance wheels on the cars are definitely and satisfactorily replaced.

Hollinger mill and mine are now in exactly the reverse position to that they occupitd a year ago. Twelve months ago it was as much as the mine could do to supply the mill with all the ore it required; but the new big plant is now working to such good effect that there is already 80,000 tons of rock broken in the mine ahead of the mill, and it is gaining very rapidly, so that mill extension of the Hollinger itself cannot be very long delayed.

Imperial.—Some machinery is being taken into the Porcupine Imperial before the snow goes; but there is little probability that work will start at the property for a month or two. There is also a report that work is to commence on the Apex, which is in the same section of the gold field, adjoining the Dome Lake.

McIntyre.—At the McIntyre the diamond drill operating from the 400 ft. level has struck another vein. It is seven ft. wide, as the core shows it and the assay gave $12.80 to the ton. While there is no certainty that the drill core gives a correct idea of vein values, as a general rule in the Porcupine camp the values as actually shown in the drift are higher than would be indicated by the core. On the No. 5 vein there has now been opened up 200 ft. of an ore body, which will average 18 ft. wide.

The Porcupine Pet has closed down and the company has made a voluntary assignment. The company has been operating a small five stamp mill for the past year.

Power.—All the mines in camp are still running only 50 per cent. of the time. A foot of snow fell last week and there has been very warm weather since, so that it should not be long before there is relief. The dam which the power company has built across the Mattagami river was completed last fall, too late to secure any storage. The power company believes that with this means of regulating the flow it will be possible to meet all demands for power for some time to come; but so rapidly is the demand growing that this opinion is not generally shared by the mining companies themselves. However, there is little doubt that it will tide over the next year.

Vipond.—There was delay in shipping the 6 ft. ball mill to the Vipond and it had not arrived at the end of the second week in April. Consequently the increase in production of the mill has been delayed. This is the less to be regretted in as much as power is still short and no work is being done at present on the 300 ft. level at all.

Dome.—The production of the Dome for the month of March will run $95,000. The grade is approximately the same as for the previous two or three months, $4.14 a ton. Since the issuance of the last annual report, costs have been cut down $1.25 a ton. This has been effected by an all round reduction in mine, mill and general expenses. In transportation perhaps there has been a larger cut than in any other department. The big ore cars are now in use, and in consequence it has been possible to cut down from two shifts to one shift and still handle more ore than previously. A Buchanan Blake crusher is to be installed at the 500 ft. level for primary crushing. The ore is to be hauled to the shaft by electric locomotives and raised to the surface from the ore pocket.

MARKETS

TORONTO MARKETS.

April 8—(Quotations from Canada Metal Co., Toronto).
Spelter, 13 cents per lb.
Lead, 5½ cents per lb.
Tin, 56 cents per lb.
Antimony, 25 cents per lb.
Copper casting, 17 cents per lb.
Electrolytic, 17 cents per lb.
Ingot brass, yellow, 10c.; red, 12 cents per lb.
April 8.—(Quotations from Elias Rogers Co., Toronto).
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

April 6—Connellsville coke, (f.o.b. ovens).
Furnace coke, prompt, $1.50 to $1.60 per ton.
Foundry coke, prompt, $2.00 to $2.50 per ton.
April 6—Tin, straits, 47.50 cents.
Copper, Prime Lake, 16.50 cents.
Electrolytic copper, 15.80 cents.
Copper wire, 17.00 cents.
Lead, 4.12½ to 4.15 cents.
Spelter, 9.50 cents.
Sheet zinc (f.o.b. smelter), 13.50 cents.
Antimony, Cookson's, 30.00 cents.
Aluminum, 18.75 cents.
Nickel, 42.00 to 45.00 cents.
Platinum, soft, $41.00 per ounce.
Platinum, hard, 10 per cent., $44.00 per ounce.
Bismuth, $2.75 to $3.00 per pound.
Quicksilver, $67.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
March—		
23	50⅜	23 5/16
24	50⅜	23 5/16
25	50½	23 13/16
26	50½	23¾
27	49½	23⅜
29	50⅛	23⅝
30	50⅜	23¾
31	49⅞	23½
April—		
1	50	23 5/16
3	49⅞	Holiday
5	50	23 5/16
6	50¼	23 11/16

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.).

April 8, 1915.

New York Curb.

	Bid.	Ask.
American Marconi	.02½	.02¾
Alaska Gold	.35¼	.35¾
British Copper	.00⅝	.01
Braden Copper	.08⅛	.08¼
Chino Copper	.39¾	.40½
Giroux Copper	.00½	.01
Green Can.	.29	.30
Granby	.73	.74
Miami Copper	.24	.25
Nevada Copper	.13	.13¾
Ohio Oil	141.00	143.00
Ray Cons. Copper	.20⅞	.21¼
Standard Oil of N. Y.	185.00	187.00
Standard Oil of N. J.	395.00	397.00
Standard Oil (old)	1290.00	.....
Standard Oil (subs)	890.00	.....
Tonopah Mining	.07¼	.07½
Tonopah Belmont	.45	.45¾
Tonopah Merger	.29	.30
Inspiration Copper	.28½	.28⅝
Goldfield Cons.	.01½	.01⅝
Yukon Gold	.02⅝	.02⅞

Porcupine Stocks.

	Bid.	Ask.
Apex	.02⅞	.03
Dome Extension	.10½	.10¾
Dome Lake	.23¼	.23½
Dome Mines	12.15	12.50
Foley O'Brien	.25	.30
Hollinger	23.75	24.25
Jupiter	.12	.12½
McIntyre	.40	.40½
Pearl Lake	.01	.02
Plenaurum	...	.50
Porcupine Gold	.00½	.00⅞
Imperial	.04	.04¼
Preston East Dome	.02¼	.02½
Rea	.15	.21
West Dome	.04	.04¼
Porcupine Pet.	...	.16
Porcupine Vipond	.49½	.50
Teck Hughes	.04¼	.05¼

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02¾	.02⅞
Beaver	.32½	.33½
Buffalo	.45	.70
Chambers Ferland	.19	.19½
Coniagas	4.85	5.00
Crown Reserve	.86	.90
Foster	.02	...
Gifford	.02	.02⅜
Gould	.00½	.00¾
Great Northern	.03¼	.03¾
Hargraves	...	.01
Hudson Bay	.20	.23
Kerr Lake	4.65	4.75
La Rose	.60	.66
McKinley	.34	.35
Nipissing	6.30	6.55
Peterson Lake	.21	.22
Right of Way	.03	.03½
Leaf	.01¾	.02½
Cochrane	...	.10
Silver Queen	...	.02½
Temiskaming	.32¼	.32¾
Trethewey	.17	.18
Wettlaufer	.05	.06
Seneca Superior	1.20	1.30

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

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PRINCE RUPERT, B.C.

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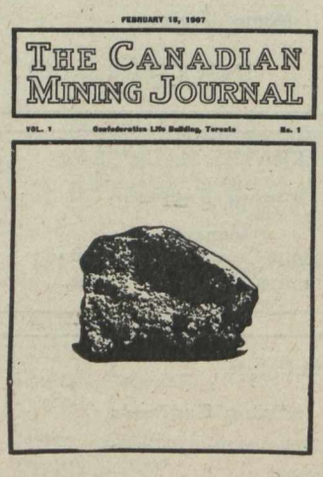

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PUBLICATIONS

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.

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Summary Report of the Geological Survey for the year 1913.
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Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.
QUEBEC
Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.
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Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.
NORTH-WEST PROVINCES
Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.
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.
Memoir 55. Geology of Field Map-Area, B. C., and Alberta, by John A. Allan.
YUKON AND NORTH-WEST TERRITORIES
Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes.

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.
Map 121A. Franey Mine and Vicinity, Victoria County, N.S.
QUEBEC
Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.
ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.
NORTH-WEST PROVINCES
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Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.
Map 136A. Hazelton-Aldermere, Cassiar and Coast Districts, British Columbia.
1321. Diagram Showing the Geology of Texada Island, British Columbia.
Map 106A. Groundhog coal field, British Columbia. Geology.
YUKON AND NORTH-WEST TERRITORIES.
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.
Map 58A. Explored Routes in the Lower Parts of the Drainage Area of Churchill and Nelson Rivers, Manitoba and Saskatchewan. Geology.

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.

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Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

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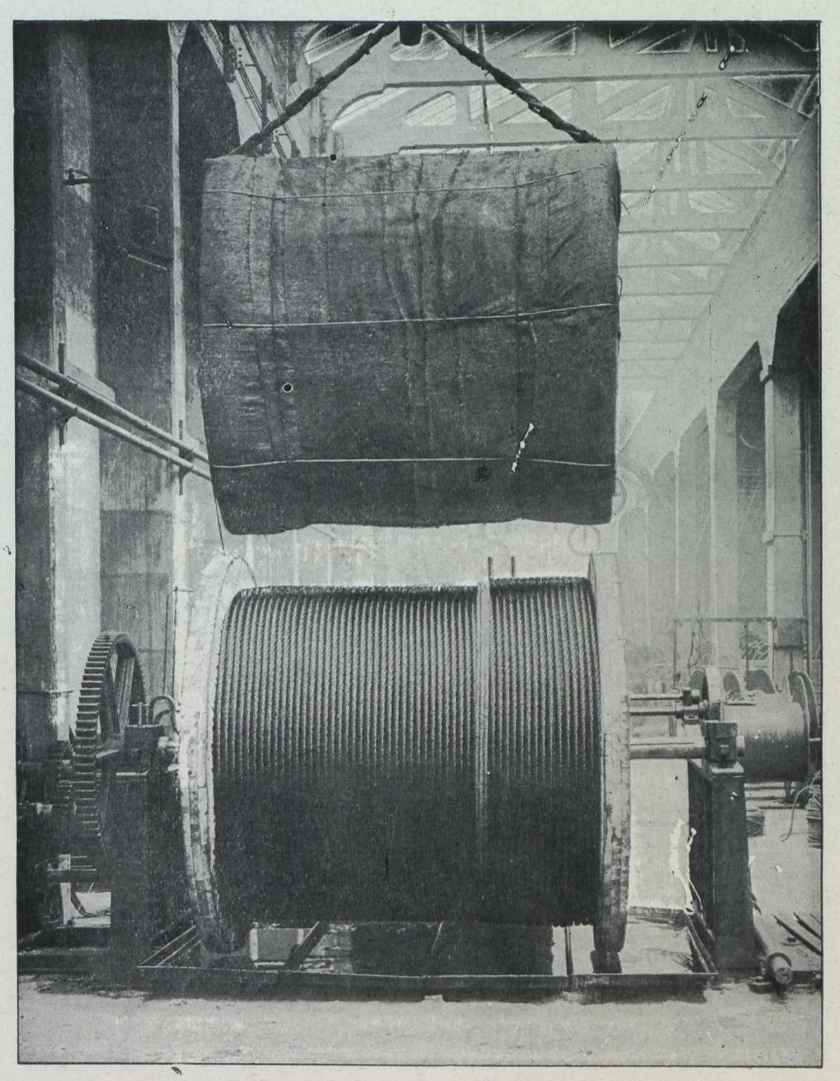

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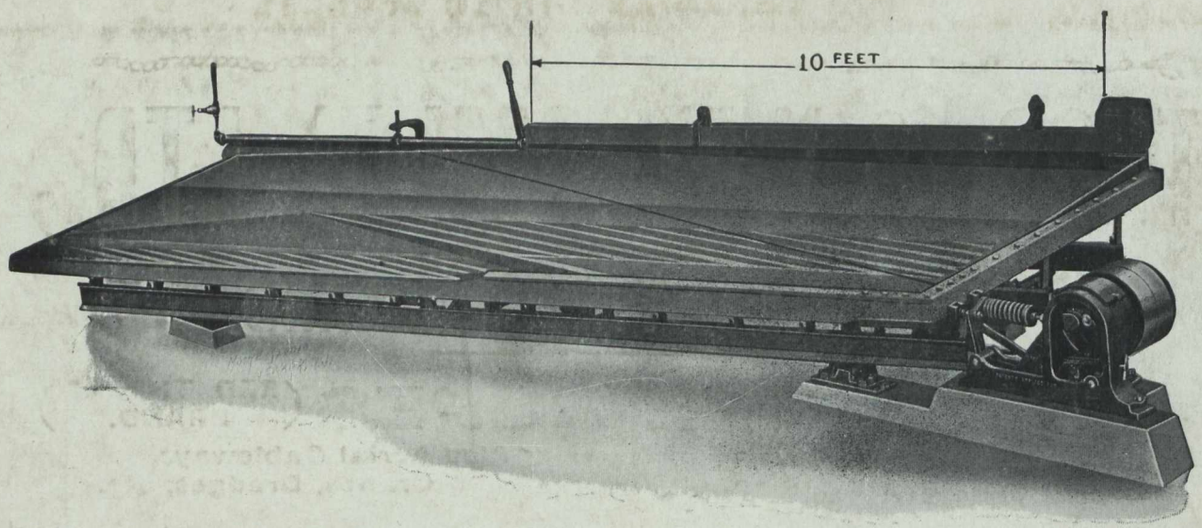

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