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NINETEENTH YEAR OF PUBLICATION

CANADIAN MINING REVIEW

Established 1882

Vol. XX—No. III. OTTAWA, MARCH 31st, 1901. Vol. XX—No. III.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE HON. THE COMMISSIONER OF COLONIZATION AND MINES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents anuually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

5-STAMP MILL

New and complete; built by a well known maker. Will be sold at a bargain. Apply

A. R. WILLIAMS & CO.,
Montreal.

Chemical and Assay Apparatus

ZINC, CYANIDE and SULPHURIC ACID
FOR CYANIDE PROCESS.

COMPLETE ASSAY OUTFITS.

THE HAMILTON-MERRITT PROSPECTOR'S OUTFITS.....

Becker's Balances and Weights.
Battersea Crucibles and Muffles.
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Kavalier's Bohemian Glassware.
Munktell's Swedish Filters.

OUR 1897 CATALOGUE ON APPLICATION

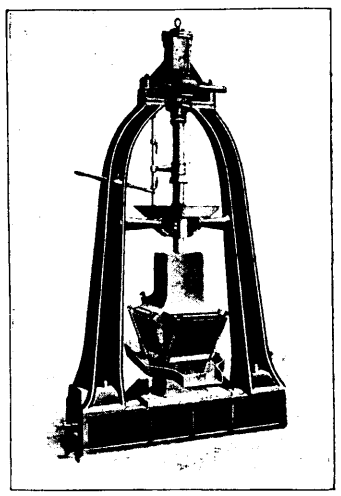
Lyman, Sons & Company

380, 382, 384, and 386 ST. PAUL STREET,
MONTREAL.

A PAYING COMBINATION

A Prospect Showing Free Gold Values.

A Wide-awake Owner or Superintendent.



A Steam Stamp

There are hundreds of prospects which will pay for their own development into large and valuable mines if equipped with a Stamp Mill. Gravity Stamps would be an expensive experiment. One or more Steam Stamps can be installed, and give maximum results at minimum expense.

The AMERICAN STEAM STAMP

IS THE BEST, BECAUSE

It is not necessary to stop the operation of the Mill in order to
Change the number of strokes per minute.
Change the force of the blows.
"Take-up" on account of wear of shoe and die.

The last consideration is the most important. In other designs of Steam Stamps fully one-third of capacity is lost owing to the blows not being uniform on account of the wear of the shoes and dies and to the necessity of stopping the mill to lower the cylinders. In the American Steam Stamp the mortar is supported on heavy cast steel wedges, so connected that a slight turn of a screw, while the mill is running, will compensate for wear of shoes and dies.

AMERICAN ENGINEERING WORKS

204 Dearborn St. CHICAGO, ILLS.

MINERS WANTED.

Good Machine Miners and general mine workmen, also one first-class all-round timberman, for gold mine Central Ontario. Good prices paid for contract work, sinking, drifting, and stoping. None but good men wanted, and musicians will have the preference. Apply

CANADIAM MINING REVIEW.

Miners Wanted.

Fifty first-class Miners and Machine Men.

Machine Men $2.10 per day.

Helpers $1.75 per day.

The Bruce Copper Mines,
Limited
BRUCE MINES, Ontario.

Valuable Nickel, Copper, Platinum Mines

Public Sale of Valuable Mineral Lands.

The following mineral lands, situate in the District of Algoma, Province of Ontario, numely:

	Acres
Lot 7, Con. 2, Denison Township, containing	290
Lot 1, Con. 4, " " "	263
Lot 2, Con. 4, " " "	315
Lot 3, Con. 4, " " "	315
Lot 4. Con. 4, " " "	315
Lot 5, Con. 4, " " "	319
Lot 6, Con. 4, " " "	318
Lot 12, Con. 3, Graham " "	274
Lot 12. Con. 4, " " "	290
Total	2,699

belonging to The Vermillion Mining Company of Ontario, will be sold at public auction, en bloc, at the Auction Room of C. J. Townsend, Toronto, Ontario, on the 14th day of May, 1901, at the hour of 12.00 o'clock noon, to the highest bidder. Terms of sale 10 per cent. cash, 15 per cent. in thirty days, 25 per cent. in four months, 25 per cent. in nine months, and 25 per cent. in eighteen months, the unpaid purchase money to be secured by mortgages bearing interest at five per cent. per annum. The Mortgage to be settled in case of dispute by the Junior Registrar of the High Court of Justice, subject to Appeal to a Judge of the High Court.

Possession not to be given until the first 25% of the purchase money shall have been paid.

The purchaser may pay the whole of the purchase money in cash if he desires.

Premises may at any time be inspected on behalf of the intending purchasers, and samples of ore for the purpose of assays taken away up to the limit of 500 pounds upon the production of the written permission of Messrs. McCarthy, Osler, Hoskin & Creelman, or of Messrs. Beatty, Blackstock, Nesbitt, Chadwick & Riddell, both of Toronto, Ontario.

References may be had for particulars of samples and analyses of ore to the Director of Mines, Toronto.

The said mineral lands are very valuable, being rich in copper, nickel and platinum.

The Vermillion Mining Company of Ontario,

Per H. P. McINTOSH, Secretary,
Perry-Payne Building, Cleveland, Ohio.

19th YEAR OF PUBLICATION.

The CANADIAN MINING REVIEW

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

B. T. A. BELL, Editor and Proprietor.
Secretary, Canadian Mining Institute, etc.

Published Monthly.

OFFICES { Slater Building, Ottawa; Windsor Hotel, Montreal.

VOL. XX., No. 3. MARCH, 1901. VOL. XX., No. 3.

British Aid in Developing Canadian Mines.

An interesting discussion concerning the capitalization of Canadian mining companies, with special reference to the custom of selling stock below its face value, took place at the March meetings of the Canadian Mining Institute in Montreal. The point was made that this practice rendered the sale of Canadian mining shares in the London market a difficult matter, inducing a prejudice against them. The English law requires that company shares shall be fully paid up, and of course it is easy to see that British investors, unused to Canadian methods, might not readily comprehend the true significance of the wide difference between the market value and the face value of such stocks. Though not directly so stated, the implication in the criticisms made was that the Canadian system favored a speculative tendency, inimical to the conduct of mining operations on a sound business basis. If such opinions as these are held in England it is time that the error in the conception should be explained. In the first place it makes little difference to the purchaser of a share what sum may have been paid for it in the beginning. Its value is, or should be, determined by its earning power. If the mine is one that promises large returns, the future productivity is sure to be anticipated, causing a rise in the value of the stock. If the mine offers no such speculative feature, but is well proven and recognized as a steady producer of ores of even grade, the price of shares will seek a fixed level, fluctuating chiefly with the condition of the money market.

On the other hand, the custom of issuing stock below par, sanctioned by Canadian law, finds its justification in the pioneer conditions of the country. The burden of proving the resources of a new country rests primarily upon its own people. In such a country the bulk of the capital is remuneratively employed, and usually is insufficient for the enterprises in hand. It would be difficult to obtain support for new ventures unless inducements were held out to investors of small means. In this way funds may be obtained from a large number of small individuals, when it might be wholly impossible to secure them from a few only. It must be understood that these special inducements are extended only when the mine is still in the development stage, while the chances of success are still largely problematical. Under the circumstances a system of this kind is not only warrantable, but practically necessary, if the available resources of the country are not to lie dormant. We cannot expect foreign capitalists to come in and do this pioneer work. It is one of the prerogatives of pioneers to take chances in a small way for the sake of possible rewards of large size. This is one of the ways in which large fortunes are quickly amassed in a new country, and we cannot see wherein the method is objectionable.

If the London investor wishes to share in these advantages he is at liberty to do so. We are aware that many so-called development companies organized abroad have ventured into this attractive field, and usually with disastrous results. That these should fail when those native to the soil so often succeed would seem to argue some peculiar merit in the pioneer which the old world investor does not possess.

The advantages of fully paid up capital may be on the side of the foreigner, but he is not as well able to conduct enterprises unaided in a new country. He puts his confidence in engineers and managing directors who lack the experience needed to operate cheaply under the conditions found in Canada. His scheme from first to last is conducted generally on too magnificent and costly a basis. We insist that the poor native knows best how to exploit his resources, and could show his friends from over-seas many novel and inexpensive short cuts to success. But he needs capital, nevertheless, and accessions from London, applied in the right way, would be productive of good results to both. If some of the large British development companies were to pursue the policy of co-operating with local development companies, important mutual benefits would be conferred. Local capitalists would thus find the aid which they need to develop promising properties, and the metropolitan companies could operate over a larger field with the same amount of capital which, concentrated at a few points only, would increase their chance of loss and limit their possibilities of bringing out many good enterprises. In some such way as this all the difficulties in the case should be removed. The local development company would stand for what it was and nothing more, until the parent or auxiliary corporation was justified in organizing a full fledged mining company in the home market, to take over the enterprise, where the capitalization could be carried out in accordance with the methods there in vogue. We recommend this plan to our friends across the water as one in which they may profitably use their capital, and assist in promoting the prosperity of Canadian mining. At the same time they may share in the advantages of the pioneer with comparatively little risk. We firmly believe it would improve the prestige of Canadian mines if the initial stages were under control of development companies, making no pretense to stand as yet upon a productive footing, organizing a mining company only when the property had fully passed the doubtful period, when it might be regarded as a truly sound business venture.

The annual general meetings of The Mining Society of Nova Scotia will be held in Halifax on 10th proximo.

Exportation of Natural Gas.

It is reported that the Ontario government contemplates interference in the matter of exportation of natural gas from Essex county to Detroit. The Ontario government, by virtue of its rights over the land and water through which the pipes are laid which conduct the gas across the Detroit river, proposes to cancel the lease to the Interior Construction Co., the present owner of the pipe line. The case, however, seems to offer some difficulties. The original Ontario Natural Gas and Oil Co., acting within its legal powers, entered into a contract with the Interior Construction Co. to furnish it with gas for export while the field continued a producer, and on the strength of this the pipes were laid, and the Detroit Gas Co. made the necessary provision for supplying its customers. Under these circumstances it would apparently work an unwarrantable hardship upon these corporations to infringe upon their enjoyment of rights which they acquired in good faith, and in a legal manner. In principle we think any interference by government in the exportation of the natural products of a country is unwise, and apt to be productive of more evil than good. There is something to be said, however, in favor of the position taken by the Ontario government. The contract with the Interior Construction Co. does not give it any exclusive privileges against the consumers on the Canadian side of the line, and it appears that gas is being sold in Detroit very largely to manufacturers for steam raising purposes, while at the same time the supply is so limited that Canadian manufacturers formerly using the gas have been obliged to abandon it. This is manifestly unfair. Consumers on both sides of the line should at least be placed on the same footing. The employment of gas for manufacturing is certainly improvident in view of a declining yield from the wells. It should be limited to the use of household consumers as is done in the case of the Welland county field.

A Free Welland Canal.

The tolls from the Welland Canal for 1900 amounted to only $100,000, a fact which was pointed out with some trenchant remarks on the inexpediency of burdening and obstructing commerce for so small return, by Mr. H. A. Calvin, M.P. in the recent debate in the House of Commons at Ottawa on the proposals of the ministers of Public Works and Marine and Fisheries, regarding aids to transportation. The discussion chiefly turned upon the effect which the abolition of tolls would have on the grain trade, and was coupled with the consideration of deepening the Welland canal so as to make it a link in the chain of lake navigation instead of a part of the river and canal system.

This is all important enough, and in itself should stimulate the government to take measures that will realize to the full the opportunities for attracting a larger commerce into the lower lake, which is now cut off from any extensive participation in the lake-borne traffic. But Mr. Calvin might have gone farther, and have strengthened his argument by pointing out how the removal of tolls would facilitate the growth of manufacturing by admitting cheaper fuel to the large and populous belt tributary to Lake Ontario. At present coal passing the Welland canal—if any should offer—must pay 20 cents per ton for the privilege, with an additional 5 cents per ton on the tonnage rating of the vessel. This amounts virtually to an embargo, and forces the Lake Ontario ports to depend entirely upon coal brought from the Reynoldsville district to Charlotte. The result is that a larger price is demanded for this coal than for similar or better coal from western Pennsylvania, West Virginia, or Ohio, laid down at Ashtabula, Cleveland, and Sandusky. If these latter coals attempt to compete with the Reynoldsville product on Lake Ontario they can be driven out of the field by a lowering of the price, having this margin of tolls as a protection against close competition. The lower lake cities are thus left at the mercy of the vendors of Reynoldsville coal and coke, which means that industry is so far impeded. There is nothing more vital to the commercial life of any people than its motive power, and one of the chief concerns of the government should be to do all in its power to admit of this being obtained at the lowest possible cost. The difference between the condition of the Ontario ports and those on the upper lakes is seen from the fact that slack coal at Windsor and Sarnia can be bought at prices ranging from $1 90 to $2.00 per ton, while on Lake Ontario it cannot be had for less than $2.65. At least 75 cents per ton could be saved to Lake Ontario consumers if free competition were possible.

In the same connection it may be pointed out that the tariff on coal works a wholly unjustifiable disability upon all classes of industry in which steam generation is essential. For the sake of protecting the coal fields in the extreme eastern and western portions of the country —a protection or prohibition by the way which is not effective—a duty is levied upon slack of 20 per cent. *ad valorem*, or not to exceed 13 cents per ton of 2,000 lbs., and upon bituminous coal of all other grades of 53 cents per short ton, so that the great bulk of the population of the country is taxed on this prime necessary of progress in a vain effort to keep coal at home which they could not obtain within reasonable limits of cost, owing to transportation difficulties, even if it did remain. If the object of the tariff is, as it appears to be in part, to force a more unrestricted market in the United States, the injustice is all the greater, since the country as a whole is burdened for the prospective advantage of a few mine owners, who seem to flourish in spite of the American tariff. The metallurgical industry, so far as it depends upon coke, is less hampered, since this product is on the free list, but still there stand the Welland Canal tolls, giving the Reynoldsville ovens the monopoly of the Lake Ontario field, or forcing the purchasers of Connellsville and West Virginia cokes to pay more than they should for it, rendering their efforts to compete in the iron trade just so much the more difficult.

These taxes on fuel are wholly irrational, and the sooner this article is rendered as free as may be, the better will it be for the prosperity of Canada.

Mining Progress in B.C.

From the returns of the mineral production of the Province of British Columbia for the year 1900, submitted to the local Legislature by the Provincial Minister of Mines, it is gathered that there was during the year an increase in the value of the output of the lode mines of the Province of $3,310,428 and a decrease in that of placer gold of $66,176, leaving a net increase in metallic minerals for the year of $3,244,252. There was also an increase of $1,013,238 in the value of coal and coke. No returns are yet available of the value of other non-metallic minerals so these cannot now be taken into account. The foregoing figures, though, exhibit practically last year's net increase, which was $4,257,490., as shown in detail in following table:

	1898.	1899.	Increase.	Decrease.
Placer gold.....	$1,344,900	$1,278,714	$ 603,494	$66,176
Lode gold.....	2,857,573	3,461,067	531,391	
Silver.....	1,663,708	2,295,097	531,291	
Copper.....	1,352.453	1,615,289	263.836	
Lead.....	878,870	2,690,577	1,811,707	
Coal, Coke.....	4,053,651	5,066,899	1,013,238	
Total.....	$12,150,155	$16,407,645	$4,323,666	$66,176

The Late Dr. Dawson.

It is our melancholy duty to record this month the sudden and untimely demise of the distinguished Director of our Geological Survey, Dr. George M. Dawson, C.M.G., who expired after a very brief illness at his apartments in the Victoria Chambers, Ottawa, on Saturday, 2nd inst. Dr. Dawson, it may be said, was in his office on Thursday, when he supplied the editor of the REVIEW with some valuable commercial data on the subject of Mica, and he dined at his club in the evening. On Friday he was confined to his room with what was regarded as a mild attack of bronchitis, which, however, assumed an acute form on Saturday afternoon, and the eminent Canadian geologist and scientist passed away shortly after six o'clock. Only an hour before, an old time British Columbia friend, Mr. John B. Hobson, M.E., of the Con. Cariboo Hydraulic, in company with the editor of the REVIEW, had called at the Chambers to consult the Doctor about a shipment of gold to the Glasgow exhibition, but while unable to see him, no-one then anticipated that his end was so near.

The death of Dr. Daw-Dawson is a national loss, and is deplored by none more sincerely than the mining profession in Canada, for whom he has rendered incalculable service.

George Mercer Dawson was born in Pictou, Nova Scotia, on August 1st, 1849, and at the time of his death was the eldest surviving son of the late Sir William Dawson, ex-Principal of McGill University, Montreal, whose eminence as a geologist and an educationalist will always be remembered in Canada. His technical education began at McGill College and was completed at the Royal School of Mines, at each of which he obtained his degree. At the latter he held the Duke of Cornwall's scholarship, given by the Prince of Wales; he also took the Edward Forbes medal in palæontology, and the Murchison medal in geology.

The first work of any importance in which he was engaged was in 1873, when in the capacity of geologist and naturalist to Her Majesty's North American Boundary Commission he investigated the country in the vicinity of the boundary line between Canada and the United States from the Lake of the Woods to the Rocky Mountains. The information thus gathered was, at the end of the Commission's work in 1875, published in the form of a report entitled "Geology and Resources of the Forty-ninth Parallel," and this amongst other things gave the first detailed account of the Souris coal fields, though some of the sections along the Souris bed had previously been visited by Dr., afterwards Sir, James Hector. The economic results of this were important, as setting at rest the question of a fuel supply for the prairie country. In July of the same year began his connection with the Geological Survey, with which he has ever since been identified. His first important trip in his new appointment was to British Columbia, where, until 1879, he was engaged in the exploration and geological survey of the Province. This has been the scene of his labors ever since, with very little exception, and the knowledge obtained of the geological structure, and the geological mapping of British Columbia, so far as it has gone, is almost entirely due to the energetic work of Dr. Dawson. From that time until 1882, he continued his labours in that Province and the North-west Territories. In the latter year he went to Europe, where he travelled extensively, visiting mines, metallurgical works, museums, etc. His most ardous journey after his return was with the Yukon expedition, of which he was selected by the late Hon. Thos. White to take charge; a very complete report of which has been published by the Geological Survey. The route he chose for himself, although of a most difficult nature, was taken as that most likely to afford the most information regarding the geology of the vast and virtually unknown tract of country he was about to explore. His journey was 1,300 miles in length from the mouth of the Stikeen River, by way of the Dease, Upper Liard, Pelly, and Lewis Rivers back to the coast. Nearly the whole distance was traversed by following the rivers; some of these had in former years been used by the Hudson's Bay Company, but they had long been abandoned as a trade route, and were at the time of his expedition almost unknown geographically. The difficulties encountered were

very great—boats had to be built at several points, and one portage of fifty miles was made through the woods in crossing from the drainage basin of the Liard to that of the Yukon—but all were surmounted and the expedition successfully accomplished its work.

Details of Dr. Dawson's travels throughout British Columbia and the North-west will be found in the reports of the Geological Survey. He is the author of fifteen separate reports, of which the following may be referred to as of most importance: "On the Queen Charlotte Islands," including as an appendix a monograph on the Haida Indians (1878); "On an Exploration from Port Simpson, on the Pacific Coast, to Edmonton, on the Saskatchewan," 1879; "On the Region in the vicinity of the Bow and Belly Rivers," 1882–4; "On the Physical and Geological Features of part of the Rocky Mountains," 1885; "Notes to accompany a Geological Map of the Northern portion of the Dominion of Canada," 1886; author (with Dr. Selwyn) of "Descriptive Sketch of the Physical Geography and Geology of Canada," 1884; author (with Dr W. F. Tolmie) of "Comparative Vocabularies of the Indian tribes of British Columbia, with an Ethnological Map," 1884. Perhaps one of his most valuable publications, from a mining standpoint, was his exhaustive "Report on mineral wealth of British Columbia," published in 1887. It is unnecessary to particularize the numerous and valuable original scientific papers on the geological, geographical, and ethnological observations made in the course of his explorations and contributed to various scientific journals; their value is well known and fully appreciated.

One of the most important of his public services was in connection with the Behring Sea arbitration. As one of the British Commissioners he spent the summer of 1892 in the Behring Sea region for the purpose of inquiring into the conditions and facts of seal life. The report of the Commissioners constituted the report of Her Majesty's Government on this branch of the subject, and was of great service. For his services on this occasion he received the thanks of His Excellency, the Governor-General in Council, and the C.M.G. from Her late Majesty.

He received the degree of LL.D. from Queen's University in 1890, and from McGill University in 1891. In the same year he was awarded the Bigsby gold medal by the London Geological Society for his services to the science of geology, and he was elected a Fellow of the Royal Society. In 1893 he was elected President of the Royal Society of Canada; in 1894 he was elected a corresponding member of the Zoological Society of London; in 1895 a Fellow of the American Association for the Advance of Science; in 1896 he was appointed by the Council of the British Association, President of the Geological Section for the Toronto meeting of the Association; and in 1897 he was awarded the yearly gold medal of the Royal Geographical Society for his work as a whole.

During 1898 and 1899 he officiated as a Vice-President of the Canadian Mining Institute, an organization in which he took the liveliest interest, and whose annual meetings he regularly attended.

Dr. Dawson was appointed Director of the Survey in 1895, on the resignation of Dr. Selwyn.

Perhaps we cannot do better than complete this bald outline of a distinguished career than by quoting from the sketch of his life, contributed by Mr. R. W. Shannon, in the *Commonwealth*:

"In private life Dr. Dawson was the most genial and charming of men. A careless nurse let him fall in childhood, and the fall broke his back. Keenly sensitive as he was by nature, he felt the deformity deeply and abstained from going into that society which his mental gifts and graces well fitted him to adorn. Notwithstanding that he was bereft of the fair proportions of noble manhood, and was, like the royal hunchback, sent into this breathing world but half made up, he displayed great vitality in early life, and often astonished the companions of his exploring expeditions by the vigour and endurance he showed in walking and riding. But the malformation of his chest prevented proper expansion of the lungs, and this fact, coupled with a more sedentary life, gradually impaired his active powers and rendered him liable to a dangerous onset of pulmonary or bronchial trouble. The end came in that way after years of suffering.

"Yet physical weakness and disease never depressed his bright spirits. His constant cheerfulness was a source of surprise to all who knew him, more especially to those who reflected upon the fortitude required to bear his bodily infirmities with patience. In conversation he was witty and humorous to a degree, while at the club, or at a public dinner, his sallies were wont to keep the table in a roar. A quick wise smile lit up his countenance when indulging in good-natured badinage, of which he was very fond; and when talking upon serious subjects his eye flashed with the intelligence which made his most trivial discourse luminous. Rare and beautiful spirit, we shall not soon look upon your like!"

COAL MINING AND TRADE.

Undoubtedly the feature of the moment in the coal trade is the unprecedented activity in the Maritime Provinces, and the consequent stimulus to development work both in Nova Scotia and New Brunswick. The most sanguine person could never have anticipated such a rush for coal areas as is to be seen in Cape Breton, where every available section has been taken up, and holders who a few years ago were hawking their areas at $12,000 a square mile, are now sitting tight at $20,000 to $25,000. This may not be an unmixed evil, as it will have a tendency to check development and keep production within reasonable limits. It is a great mistake to assume that there is a market for all the coal that can be produced in Eastern Canada. The abnormal demand of last year is no criterion by which to judge of an average demand. Coal was scarce and dear all the world over, but that condition is already passing, and in England and the States prices are rapidly finding their normal level. In Canada, owing to the small margin hitherto existing between supply and consumption, and to the starting of the Dominion Iron and Steel Co., prices are being still maintained, and mines are being double-shifted to meet the requirements of the trade, but this will not last longer than it takes the new enterprises to get their coal on the market. If, as is predicted, the Port Hood Coal Co., the Inverness and Richmond Coal Co., and the Gowrie and Blockhouse Co., ship between them 250.000 tons during the present year, and the new mines of the Dominion Coal Co. produce 400,000, it is certain that an equilibrium will be established between supply and demand, with the inevitable result that prices will fall to about $2.00 f.o.b., which is the average for many years past. These remarks are not intended to discourage legitimate enterprise, but to suggest considerations which should weigh with every intending investor in coal mining, and so prevent in Canada what has been the curse of other countries—over-production, with the consequence of unreasoning competition and loss of capital.

The only outlet for an annual production of coal in Nova Scotia in excess of say 4,000,000 tons is the export trade. This does not refer to the U.S., where with the exception of the New England Gas and Coke Co., which has a long-term contract with the D.C. Company, the market will be merely nominal as long as a tariff is maintained, but the possibilities of a profitable trade with the West Indies, South America, and Europe. There has been no necessity for the D.C. Co. to seek a foreign market yet. And with the demand from the steel

MR. CHARLES FERGIE, M.E.,

WESTVILLE, N.S.

Vice-President and General Manager of the Intercolonial Coal Company, and Consulting Engineer to the Inverness and Richmond Collieries, Limited, elected President of The Canadian Mining Institute.

works and the gas company it is not likely that they will have a surplus for exportation during the next five years. Unless, however, we are very much mistaken, some of the newer concerns will be driven to seek foreign markets, and if so we may find a solution of this question sooner than seemed likely a year ago. We have always maintained that with special facilities for transportation Cape Breton coal can be laid down in British ports, at a net cost of $3 a ton, which is 50 cents below the minimum price on the Thames, and $1.50 below the average price for twenty years. This does not take into account the West Indian and South American market for briquettes, of which over 21,000 tons were shipped for those points from Cardiff, Newport, and Swansea in January. Now that coking on a large scale is being carried on at Sydney it would pay well to manufacture briquettes near the coke ovens, where tar is produced, and a and a percentage of coke-dust, which conduces to firmness, is at hand.

Our friends in the Maritime Provinces are "kicking" becanse the Government has purchased 100,000 tons of coal from the U.S. for the Intercolonial Railway. Surely this is a little unreasonable, in view of the fact that mines are working double shift to supply arrears of orders and coal is realising at least $1 a ton more than the Government would pay. The fact is that such a boom in coal as we have recently had upsets all calculations, and no-one was ready for it. Judging, however, from the feverish activity which now prevails, there will be little liklihood of a repetition.

Apropos of the development in Cape Breton, it is interesting to note the resuscitation of an old friend at Caribou Cove, adjoining the once notorious Terminal city. We wish the new-comers better luck, at the same time we are sceptical as to the existence of sufficient workable coal to warrant any large outlay.

On the opposite side of the Straits, a new combination, rejoicing in the title of the North American Coal Co.. is to exploit areas in Richmond County. They have the usual nominal capital of $1,000,000; we shall be glad to hear that it is all subscribed and that they mean business. There are some favourable outcrops near by, and as the shipping facilities are superior to those possessed by any other property on the island, there is no reason why, with competent management, they should not establish a good mine.

Evidently the Port Hood Coal Co. expect to do business this season, as they have made a contract with the I.C.R. for 20,000 tons. This is their first transaction, and a very promising one.

The coal outcrops at Chimney Corner reported on many years ago by Mr. John Rutherford are receiving attention and efforts are being made to get a railway connection. Areas are held at a ridiculously high figure and it is evident that the holders think they have a bonanza. Investors would do well to wait a bit and see how the Port Hood and Inverness ventures turn out. The extent and condition of the seams at Chimney Corner are not matters of certainty.

There has been an unexpected delay in commencing to bore on the McVey areas owing to the machinery not having arrived We are looking for interesting developments on these areas and shall be greatly surprised if even the most sceptical do not have their eyes opened. It is not a little singular that the persons who have always been the most pessimistic in regard to the prospect of finding a good seam of coal here should be most prominently identified with the prospective purchasers. Perhaps, however, it is another case of "'tis nought saith the buyer." Judging from the splendid Core—10 inches in dia., which Mr. James Lewis exhibited at the recent meeting of the Canadian Mining Institute, the Calyx drill is far ahead of any instrument yet invented for boring and is not liable to break down through a similar mishap to that which put an end to boring in these areas in 1896.

CORRESPONDENCE.

A Rainy River Fake.

To the Editor:

SIR—Will you allow me to take np a portion of your valuable space to warn your readers against the most dangerous scheme that has yet been floated on a Rainy River property. The prospectus is a mass of misrepresentation, in which my name appears as mining superintendent, with quotations from a report which I have not made on a property that I have never seen.

The company is capitalized at $25,000,000, and owns as its total assets two undeveloped properties, and a hole in the ground once owned by the Boulder Company. The company make the statement that they have enough ore in sight "on the Boulder property than we will be able to mine in the next five hundred years." They are selling stock for the alleged purpose of putting up a 40-stamp mill, and promise immediate dividends as soon as this mill starts, and prophesy that the stock (now selling at 4c. to 5c.) will at once go up to par. Another quotation from this prospectus—"This mill will be only a starter. We have enough ore in sight to keep 1000 stamps busy continuously for the next hundred years." The facts are these:—There is a shaft on the Boulder 300 feet deep, with short levels at the 200 foot level. No payable ore has been struck. Another shaft, said to be 75 feet deep, shows a little ore. Other shallow pits have also shown streaks and stringers of good ore. There is practically no ore on the location as far as known, although it is possible that further development may open up payable ore-bodies.

We think that we have a district on the Lake of the Woods that will become one of the greatest gold producers of the world, but we need capital, and plenty of it, as it has become manifest to everyone that it is not a "poor man's country," and "grass-root propositions" are few and far between. How can we expect to get the capital necessary to develop our mines when such "wild cats" as the Ash Rapids Co are absorbing the capital which otherwise would go to nourish some legitimate mining enterprise? Trusting you will pardon me for writing at such length,

CHARLES BRENT.

Detroit, Mich., 21st March.

Treatment of Auriferous Mispickel Ores.

By P. KIRKEGAARD, Deloro, Ont.

[Paper read before the March meeting of the Canadian Mining Institute.]

INTRODUCTION.

The ores of the Deloro Mine consist generally of quartz more or less heavily impregnated with arseno pyrite, "mispickel," with occasional copper pyrite and frequently a large percentage of iron sulphide.

These ores are worked for their gold and arsenic contents.

Above description applies to the Gatling or main lode, and also the Tuttle lode.

Other veins are being worked, which are quite different in composition, in that they contain large percentage of both oxide and hematite of iron, and in one case a great deal of graphite, and these latter ores require different treatment from the former to get best results.

This paper is only intended to cover the treatment of the mispickel ores.

These ores are mined in the usual manner. Where possible, the shafts are sunk to follow the lode on the incline and levels are driven north and south.

The strike is nearly north and south, and the dip varies from 45° to 63° to the horizontal.

The lode is irregular, varying in size from 4 to 5 feet, "the average," to 25 feet in places.

There are no defined walls; as a rule the quartz is merging into the wall rock, which is in some places taicose schist—in others diorite, the latter being the country rock.

The Gatling lode is now being worked to 4th level, being a depth of 310 feet on the lode, and sinking a further 100 feet is now being done, to open a 5th level.

Hoisting and Sorting.

The ore is hoisted to the shaft house in skips, dumped over a grizzley, the fines going direct to storage bins and the coarse carefully culled.

As a rule the white quartz carries little value,—hence this and all country rock is returned through a chute to the mine, where it serves a useful purpose as filling in the stopes.

Transportation.

All milling ore is passed to storage bins; from here it is filled into cars and transported to mill, over an inclined three rail tramway, 800 feet long.

Crushing.

Arriving at mill the ore is again dumped over a grizzley, fines going to bins, of which there are two, and the coarse to the rock breakers; the latter being set to crush to one inch ring. The feeders are the usual Challenge pattern, two ordinary in wood frame and two suspended.

The stamps, of which there are twenty, weigh 850 pounds each when newly shod

Ten stamps were erected in 1898; the other ten have been added recently.

The old ten stamps drop 100 times per minute and are given 7 to 8" drop; the discharge is from 6 to 8".

After running a mill two years on any ore, improvements naturally suggest themselves, so in this case, when the last ten stamps were added, they were set to drop 110 times a minute with 6" to 7" drop, and corresponding discharge. This has proved to be a move in the right direction, and has increased the efficiency above the old ten stamps; these latter will be set to the same speed shortly.

Water Feed to the Mortars.

The water feed as described by Mr. Bernard MacDonald, before the Canadian Mining Institute, has been introduced, and this, at least for these ores, is an advantage.

Mr. MacDonald's description of this method of feeding water to stamps has been followed in all the main features,—the only real deviation therefrom being that the inlet is raised 3" higher than he describes.

The writer is aware that this method of water feed has been criticised severely by some very able contemporaries, yet in the face of this he does not hesitate in stating that for an ore similar to the one in question it has much to recommend it, nor can he see any reason why it should not give continued satisfaction, and even less trouble than the old method of feeding the water above the stamps. Mr. MacDonald deserves the thanks of the fraternity for having so ably and fully described this stamp battery water feed.

Screens.

The screens used are 40 inch bur slot. These are watched closely as soon as they begin to open other screens are put on, and those taken off are closed with a little hammer specially made for this purpose, and in this way the same screen will do five to six turns of two and three days each, giving a fairly uniform product, well suited for leaching. Crushing through 40 mesh has been found to give best results; taking a sample of the battery pulp, nearly all the mineral will pass through a 60 mesh screen leaving the quartz on the screen.

The crushing capacity of this mill has been with the first ten stamps a little over 3 tons per stamp per 24 hours, or an average of 800 tons per month. The improvements on the new stamps have brought the capacity up to 4 tons per stamp.

Amalgamation.

Amalgamation inside of mortars is done on back plates and front chuck; the former is kept partially under the pulp and is protected by another plate 1½" above it, the chuck block is the usual shape.

Most of the amalgam is caught on the back plate, where it forms into hard lumps and ridges.

Very little loose amalgam is found on the mortars on clean up, and no coarse gold worth considering.

Great care is necessary in feeding mercury to the mortars,—a slight excess will soften the amalgam, when it is quickly scoured off by the very dense pulp, is broken up, and then issues through the screen in a very dirty state and is lost as far as amalgamation is concerned; in such cases it is, however, caught with the concentrates either in the trap or on the concentrators and finally saved in the leaching.

Too little mercury soon allows the amalgam on inside plates to become dry and hard, and a dirty film forms, when all further amalgamation ceases.

Owing to the extreme care necessary as above described, and the varying character of the ore as regards per cent. of Mispickel, and quantity of gold amenable to this method of amalgamation, no exact data can be giveu as to per cent. saved inside the mortars; but 20 per cent of the total assay value in the ore is fairly approximate.

Amalgamation on the apron plates must also be watched with unusual care, or the plates will soon show a dirty film, due in part to the fine Mispickel, which inclines to adhere to the plate like a paint, and which requires force to remove it.

The plates are six in number,—each 24" in length by the full width of the mortars and there is one inch drop between them.

The plates are set with an incline of 2¼" per foot; this is necessary to keep them clear, and even at this steep angle they will frequently clog.

As little water as possible is used so as to obviate the rapid motion of the pulp that naturally would occur over such a steep plate, and also to save the concentrators from an unnecessary amount of water.

The amount of water as compared with ore is necessarily greater for an ore of this kind than would be needed for an ordinary free milling ore. Heavy silver plating is best for this kind of ore; it has been found, that as soon as the silver is worn thin, the copper will show tarnish. This can be counteracted by building over it with gold; but gold in this case does not form as desirable an amalgamating surface as silver; the former will become hard and dry and soon ceases to work, whereas silver will retain a plastic surface. Owing to this, 4 oz. of silver per square foot of plate has been adopted, and with care in dressing the plates, this coating will last almost indefinitely. No cyanide is used except in extreme cases, such as after a long stop or when ores containing much free iron is being milled, in which case spots very much resembling grease will form all over the plates; these are best removed either by a weak solution of cyanide or preferably a little caustic soda. The plates are dressed every two or three hours, according to need; this dressing being done with a rubber

consisting of several layers of soft wool blanket fastened on a wooden paddle, and this rubbing is followed by a brushing with a whisk.

Under normal conditions, *i. e.*—when milling the regular Mispickel ores, a saving of from 50 to 62% is effected by amalgamation in mortar and on plates; the average for several months being 57% of assay value.

The gold is occasionally found free and fairly coarse, but this is the exception, close investigation having shown, that the gold is locked up in the Mispickel and in a very finely divided state; it is therefore necessary to crush fine to at least partially liberate this fine gold to fit it for amalgamation and subsequent leaching by Bromo-Cyanide.

Concentration.

The pulp on leaving the plates is passed through a suspended screen, hanging under lower end of table; here all stray pieces of coarse pulp that might escape from the mortars, when changing screens, are caught.

Below the screen and before reaching the concentrators, the pulp is made to flow through a trap; here any stray amalgam is caught.

These traps "one for each battery" of 5 stamps are cleaned out every 12 hours, the contents panned down and closely observed, and this serves as a good indicator of the work done in Mortars and on plates, and precautions are taken accordingly.

This may, in fact, be compared with a doctor feeling the pulse of his patient. The pulp from the old stamps passes over 6 feet corrugated belt Frue Vanners, one for each 5 stamps.

The tails from these two Vanners join in one launder and are allowed to flow into a series of hydraulic classifiers, 3 in all; here a partial separation is effected, and three grades of pulp are thus obtained, viz: coarse, medium and fines. Each of these products is run over a 6 foot smooth belt Vanner, and each of these Vanners is adjusted as to speed, inclination, travel and wash water, to suit the particular pulp flowing over it; in this way a very close saving is effected.

The average tailings from these second set of Vanners carry only 2 to 2½% of the original gold, and 0.5% of the Mispickel contents of the milling ore. The concentrates from the first two Vanners forming the bulk or approximately 75% of all concentrates produced, are shovelled into cars, together with those produced by the second set of vanners and thus become mixed.

The concentrates from two of the last named Vanners are very fine slimes. No water is allowed to leave the Mill, except what has passed over the Vanners. It was soon found, when stamps were first adopted under the present system, that the water, even when apparently free from sand, still carried a high value both in gold and per cent of Mispickel.

This loss has been checked very effectually by classification as above described, and by carefully adjusting each Vanner to suit the class of pulp passed over it. For the new section of the mill, Wilfley tables have been adopted,—one for each 5 stamps; the tails from these flow through one classifying cone, where all coarse sand is extracted and with a limited amount of water flows to a three deck Bartlett Table.

The surplus water from the classifier, still carrying some fine sand and all the slimes, flows to the three compartment classifiers and is treated with similar pulp on the smooth belt Vanners.

All concentrates are transported in side-dumping cars, to the leaching plant, where they are treated by the Bromo-Cyanide Process.

This part of the treatment I shall leave for my colleague, Mr. S. B. Wright, to describe, he being the chemist in charge of this department.

Special Features.

As special features or innovations from ordinary practice in milling of ores by stamps, the following may be cited:—

A high speed engine "Robb-Armstrong" tandem compound, is used, running at 235 rev. per minute.

This engine, together with the boilers, are in a separate building, and 40 feet from the mill building proper. The power is transmitted by a 4 inch shaft to the outside of the mill building, alongside which is a tunnel, through which runs the main belt connecting with the main countershaft of the mill.

The advantage of a high speed engine is a constant uniform speed for the stamps, which is a most important point. In the same building with this engine is another but smaller Robb-Armstrong engine, driving an alternating current generator, which is furnishing light for the whole plant.

All the concentrators are driven by a separate engine, and are thus independent of the rest of the mill machinery.

Starting at the top of the mill, may be mentioned the rock breakers, being set to crush very fine, thereby greatly aiding the stamps.

The high speed of the stamps with comparative short drop, gives a lively and continuous wave in the mortars and greatly assists the discharge of the heavy mineral.

The water being fed from the back and on a level with the dies also aids the discharge. Protecting the back plate may also be worth noting.

Using burr slot screens for greatest output which the writer believes is contrary to what is generally conceded.

The explanation in this case is that the pulp being very heavy, will keep the mineral particles suspended when thick, and will discharge uniformly when partially checked by a burr screen, hence the mineral has less chance of settling below discharge level, than if a free discharge was given such as a wire screen would afford.

Through the latter the thin pulp would flow more readily but would leave the heavy mineral behind to be still further crushed under the stamps.

Passing all pulp from the plates through a screen has an important bearing on the subsequent results of concentration.

The traps are not of much importance as amalgam savers—their chief value is as indicators of the work that has been done before the pulp has reached that point. This may only be true on ores of this class.

When pulp is normally of even mesh, say 40 mesh down to fines, the particles will concentrate together fairly well, but if a few particles of coarse material, such as will escape from the mortar when a screen is removed, be present also, each of these particles will stir up a turmoil on the concentrator and continue the agitation immediately around itself throughout its whole travel to the tail end, and will carry a corresponding amount of mineral with it, which would, had there been no such agitation, have been saved with the heads.

The importance of avoiding undue agitation when concentrating an ore much inclined to form slimes carrying high values is self evident.

Double concentration is very essential on these ores, no single concentrator would give clean tails.

Classification of the pulp between 1st and 2nd set of concentrators has a most important bearing on this after-treatment, in that it permits different adjustment to suit the pulp flowing over each particular machine, which could not be done to advantage on a mixed pulp.

The tailings from the second set of concentrators joins in one launder for each section of the mill leading out of the mill, but just before leaving the building these tailings are sampled by an automatic sampling machine acting as follows:—

The flowing pulp gives impulse to a little breast wheel suspended over the launder, this motion is communicated through gearing to a reciprocating arm, upon the end of which is a cup or spout.

This cup is made to pass across the stream automatically at regular intervals, "every 10 minutes," when it cuts out a very small but absolutely representative portion of the whole stream; this forming the sample, is led into a tub and allowed to accumulate for 12 hours or the full shift.

This sample is collected for assay at the end of each shift, and thus serves as a check on the work done by the concentrators.

There is a sampler for each ten stamps—any trouble or careless work being thereby readily located.

It will readily be seen that careless work on the part of the workmen in the mill is at once detected, and taking the average of the tails sample, together with that of the ore sent to mill, it becomes easy to calculate what the mill is doing.

Construction.

As special features in construction may be mentioned the A battery frame.

This was ably described by Mr. R. W. Barrell in *Mines and Minerals* for November, 1899.

Mr. Barrell, however, failed to give the writer due credit for having developed this battery frame to its present state of perfection.

The writer has built this style of battery frame on several occasions, and can say without hesitation that it forms a most excellent frame, one that will stand the continued vibration of the stamps without detriment to itself.

The tables are 12 feet long and made in six steps of one inch drop between each.

These tables are securely fastened under the lip of the mortars and held to the battery frame by angle irons; the lower ends of the tables are resting in the tail box, which in turn is hung from the floor.

There is no intermediate support. This long span without supports is purposely made to permit the vibration from the stamps to be communicated to the plates, which is an advantage where pulp is made to flow rapidly over copper plates.

The milling plant is built in four distinct and separate buildings, viz: the power house built of brick and as already referred to, 40 feet away from the mill.

The stamp mill with its ore bins, and all concentrators.

The leaching plant below the stamp mill, but separated by 20 feet; this was done to prevent any vibration from the mill being communicated to the leaching tanks, the ore being very heavy and dense, could not stand anything that would tend to further compact it in the vats.

And finally the assay office and laboratory, which is 40 feet from the leaching mill and 20 feet from the power house—the four buildings forming a square.

This makes a very compact and convenient plant, and at the same time keeps each department distinctly to itself.

By Product.

The concentrates, after the extraction of their gold contents, are sent to the Arsenic works, where they are calcined for the Arsenic they contain.

The crude arsenic resulting from the calcination is in turn refined and produces white arsenic, "arsenious oxide" analyses—of which show 99 4 per cent. to 100 per cent. pure $As_2 O_3$ and is of a pure white color.

This is the only arsenic producing plant on the American Continent, manufacturing arsenic on a commercial scale. The production is 40 to 50 tons per month and this will be further increased shortly.

To fully describe all that has been tried and the many difficulties that have been overcome, one after the other, would be too lengthy and would not interest anyone—suffice it to state that, many of the little schemes seemingly trifling in themselves nevertheless when taken as a whole and in conjunction with the Bromo-Cyanide Process constitute the secret of the successful treatment of these very refractory ores to-day.

The Treatment of Auriferous Mispickel Ores at Deloro, Ontario.

By Sydney B. Wright, Deloro, Ont.

Before proceeding with particulars as to the actual treatment of the concentrates mentioned by Mr. Kirkegaard, a few words on the chemistry of the process adopted will the writer thinks, be in order although already fully gone into by Messrs. Sulman and Teed in papers communicated to the Society of Chemical Industry.

Briefly the process consists in:

(1). The "Extraction" of the Gold by the leaching of the finely ground ore with a dilute solution of Potassium Cyanide, to which is added a small quantity of a solution of a "haloid" salt of Cyanogen—Cyanogen Bromide.

(2). The "Precipitation" of the precious metal from this Bromo-Cyanide "liquor" by means of metallic Zinc.

(3). The "Clean-up" of the Zinc-Gold Slimes thus obtained.

In comparing the equation representing the solution of metallic Gold by the Bromo-Cyanide solution, viz: $3\ K\ Cy + Au_2 + Cy\ Br = 2\ (K\ Au\ Cy_2) + K\ Br$, with Elsner's well-known equation for the solution by Potassium Cyanide, $4\ K\ Cy + Au_2 + H_2\ O + O = 2\ (K\ Au\ Cy_2) + 2\ K\ O\ H$, it will be readily seen that whereas in the former case the reaction is one of "Cyanidation" only, the latter, as is now generally admitted, involves oxidation, a reaction, the disadvantages of which in the treatment of ores rich in Sulphur, Arsenic, etc., are apparent.

On this point and on the extreme activity of the Bromo-Cyanide solvent on the precious metals together with the method of application of the process, depends the successful treatment of these dense concentrates.

Plant.—The plant now in use, and which is placed in a two-story building below the Mill, consists of:—

Four Leaching Vats fitted with sand and pebble filter bottoms, and bottom discharge-gates.

Four Solution or "Liquor" tanks—on the floor above the leaching vats.

Three small Northey Duplex Steam Pumps for pumping liquors.

Three small "sump tanks," 40 gallon barrels, over which the steam pumps are so placed that by means of a float connected by a rod to a lever on a special type of throttle-valve the speed of the pumps is regulated automatically by the rise and fall in level of the liquors flowing into the sumps. Two 50 gallon barrels holding the Stock Solution of Cyanogen Bromide.

Precipitation.—One Sulman's patent "Cone" for the use of Zinc Fume or "Dust" as the precipitant.

One Settling box connected with same, but which will shortly be replaced by a small filter-press or other form of filter.

One Zinc box through which all drainings only from the vat charges are run.

Pipe Systems.—The pipe systems employed are so arranged that the liquor from each tank may be run to any leaching vat independently, similarly the systems fitted to the bottoms of the leaching vats run to the small sumps from which the liquors having percolated through the charge of ore, may be pumped to any of the liquor tanks desired.

In this connection it may be mentioned that each pipe-line run is painted with a different colour in order to obviate any chance of a mistake being made in opening or closing the cocks, for any particular run. Asbestos-packed cocks are used in all these pipe systems and have proved a great advance on the old iron "plug" cock for this work.

Clean up.—The clean-up plant in which the Zinc-Gold Slimes, obtained in the precipitation of the Gold from the liquors by means of metallic Zinc, are treated, consists of:—

One "Acid-Treatment" Tank fitted with a hood and stack by which the obnoxious gases evolved during the acid-treatment are carried immediately out of the building.

One Settling-Tank, and *One* Filter-Tub into which the Slimes are run after acid-treatment and washing.

This, briefly comprises the whole of the plant used in the "Extraction" building and since the final smelting of the "Slimes" is carried out in the Bullion-Room attached to the Laboratory, the furnaces employed there will be described further on.

The actual treatment of the Vat charges may now be taken.

Treatment.—The wet concentrates, as received from the Mill, consist principally of Mispickel, some Iron Pyrites carrying small but varying quantities of Copper, and 15 per cent. to 20 per cent. of Quartz-sands The latter is taken over purposely on the "Concentrators" and plays an important part in rendering these dense concentrates leachable. In this connection it may be mentioned that experiments were made by the writer on the separate treatment of *three* grades of the "sized" concentrates but the results obtained were inferior to those which the mixed products gave.

The wet mass of concentrates, mixed to some extent in the concentrator room and transferred in side-dumping cars to the leaching vats, is therefore dumped direct into the latter and a small quantity of Caustic-Lime added.

Here a further slight mixing is given by shovelling and spreading occasionally until the vat contains a charge about three feet deep, or approximately 40 tons of concentrates.

The surface is now levelled off and the charge sampled.

The sample obtained by the usual method, viz., that of withdrawing a small quantity from each car-load by means of a pipe was soon found to be unreliable and was therefore abandoned The method now adopted consists in taking drillings by means of a 2 inch auger—3 feet long—the entire depth of the vat charge.

The pulp thus obtained from twenty to thirty drill-holes is then well mixed, quartered down in the usual way, and is found to constitute a very accurate sample.

The charge is now submitted to a short Water Wash in order to get rid of the soluble "cyanicides" formed by the exposure of the moist concentrates to the action of the air during the filling of the vats, and this is the only preliminary treatment given

After partial draining, or as soon as the water has disappeared below the surface of the ore, the cyanide solution or "liquor" is run on together with the requisite quantity of Cyanogen Bromide Solution. The original quantity of solution or "liquor," which for convenience may be called the "Strong" liquor, run on is, in all, approximately one third of the weight of the ore-charge—or thirteen tons. Formerly a Weak Cyanide Solution was run on previous to the above-mentioned liquor with the idea of reducing cyanide consumption. This weak liquor, however, was found to exert practically no influence in the latter respect and at the same time dissolved only a very small quantity of Gold. It was therefore abandoned and the length of treatment materially reduced in consequence.

The first mentioned liquor having been run on to the charge the water remaining from the preliminary wash, and now being replaced by the Bromo-Cyanide Solution, is run out through the Zinc boxes.

At this stage a somewhat radical departure from ordinary practice is made, and one which has proved a necessity in treating this refractory material.

It being the fact as in nearly all leaching operations that the first portion of the liquor to pass through the ore charge is extremely rich, comparatively, in the dissolved metal, a rapid and easy means of ascertaining the correct point at which to "switch" to the liquor tanks becomes necessary.

The usual "Silver Nitrate" test, though applicable in the treatment of most ores was found unsatisfactory in this case even in skilled hands, and since it frequently happens that such tests must be made by the workman in charge of the vats it will be readily understood that a simple and decisive test is an absolute necessity. It was found on examination that the very dilute solution first appearing through the charge, although extremely weak in free K Cy, contained an appreciable quantity of soluble "Ferrocyanides."

Advantage was therefore taken of this fact to apply the delicate "Prussian Blue" test, by adding "Ferric Chloride" solution to running samples drawn from the Zinc boxes. By this means on the first appearance of Gold-bearing solution a distinct Prussian Blue coloration is obtained and the operator knows at once when to switch to the liquor tanks.

The departure from ordinary practice mentioned above now takes place.

It consists in switching this very dilute (in K Cy) solution *not* to the *Weak* but to the *Strong* tank and as a further distinguishing point between Bromo-Cyanide treatment generally and ordinary Cyanide practice it may here be mentioned that this "Strong" liquor may be used, without any precipitation of the Gold by Zinc or other means, until it contains as much as 6 to 7 ozs. of Gold per ton of liquor if desired.

This practice although considered unsafe in many cases in ordinary cyanide work is perfectly free from danger in the Bromo-Cyanide treatment of this ore.

On the latter case it is also advantageous to precipitate the "Strong" liquor as seldom as possible, within the above-mentioned limits on account of the fact that by contact with metallic Zinc the Cyanogen Bromide is decomposed and the liquor thus rendered much less active.

To revert to the actual treatment of the charge—the "blue" coloration having been obtained and all the liquor having been run on, the solution now percolating through the charge is run to the "Strong" tank and is brought up to correct strength by the addition of the requisite quantity of K Cy.

Constant slow percolation of the liquor through the ore is found to render the solution of the Gold much more rapid than if soaking and percolation be adopted and for this reason the liquor is run back to the Strong tank, as stated previously, and is run on to the charge at intervals with the requisite quantity of Cy Br solution.

After twenty four hours' leaching it is found that 60 per cent. to 70 per cent. of the gold contents have been extracted and at this point it is advantageous to drain the charge, and turn the mass by shoveling in order to break up and mix any clots of fine mispickel which may be present, and thus expose fresh surfaces to the action of the Bromo-Cyanide liquor. The latter is now again run on and the leaching continued until assays of samples of the liquor show that the extraction is completed.

A weak "Wash" liquor is now run on to replace the "Strong" solution, the latter being run off at full bore of the pipe. As soon as the original 13 tons of Strong liquor have been collected the stream is switched to the "Weak" tank and a water wash run on to the ore.

The original quantity of "Weak" liquor used is collected and this collection is continued until a running sample of the washings shows on testing that the stream may be run out through the Zinc boxes In this way it will be noticed, the quantity of Strong liquor in use is retained at the original 13 tons, while the Weak or Wash liquor is allowed to increase in bulk with each leach.

By this method the Strong liquor is refreshed with clean solution in each charge treated, and on the great activity of the Bromo-Cyanide solvent in conjunction with this retaining of the working solution in a clean condition depends largely, in the writer's opinion, the successful treatment of these concentrates.

The Weak Wash liquor, accumulated as above-mentioned, is used to wash several charges and is always precipitated ahead of the Strong solution so that when the latter is rich the former is practically free from Gold.

Precipitation of the Gold.—For this purpose Zinc Fume or "Dust" a bye-product obtained during the operation of Zinc smelting, is employed.

The Plant consists of an inverted cone of sheet iron 4 feet 6 inches in diameter and of the same depth. This is fitted at its apex with a three-way cock and a small perforated cone or *rose*, which serves to distribute the stream uniformly, thus ensuring thorough admixture of the liquor with the Zinc Fume which is run in at intervals through a central funnel and pipe.

The latter is expanded at its lower end into an inverted funnel and by deflecting the stream of liquor helps to mix the "fume" and liquor still more thoroughly.

The liquor to be precipitated is run from the storage tanks into a 40 gallon barrel the delivery into which is fitted with a ball-cock in order to obviate any chance of overflow.

This barrel is connected with the three-way at the apex of the cone by a pipe and, being placed above the top rim of cone, serves to maintain a constant head. The liquor thus runs direct into the bottom of the cone and meets the Zinc fume just above the distributing rose. In the upward travel, however, of the solution the Zinc and Zinc-Gold particles descend again into the precipitation "Zone" by reason of the decrease in velocity of the currents with the increasing area; thus a *small* quantity of the "Fume" exposing, in proportion, an enormous surface of metallic Zinc to contact with the liquors serves to precipitate the Gold from a large quantity of liquor.

The precipitated liquor which, by the time it reaches the rim of the cone carries only a small quantity of suspended matter, now overflows into a peripheral gutter and thence to a wooden settling-box containing two compartments in which a number of glass plates 24 in. x 18 in. are placed at an angle of 45°.

Thence the perfectly clear liquor flows to the sumps and is again ready for use on the ore charge

It may here be mentioned that the "settling-box" will shortly be replaced by a small filter-press or other convenient form of filter which will be used firstly, as a means of separating the small quantity of suspended slimes from the flowing liquors and secondly as a receptacle for the slimes withdrawn from the bottom of the "cone" when the precipitation "run" is completed.

The advantages obtained by adopting Zinc Fume as the precipitant, as compared with the older Zinc "Shavings," are briefly:—

(*a*). A closer and more uniform precipitation of the precious metal from the solutions, 99 per cent. of the original contents being the regular proportion thus obtained.

(*b*). The production of rich Zinc-Gold Slimes.

(*c*). Ease and rapidity of manipulation in clean-up.

(*d*). The rapid conversion of all the Gold extracted by the liquors into marketable bullion.

(*e*). The low cost for Zinc consumption.

Clean-up.—The Gold bearing precipitate, whether obtained from the Zinc-boxes or from the "Fume" cone is now treated with Sulphuric Acid in order to get rid of the Zinc present. This is carried out in a room adjacent to the Extraction building, all the precipitate collected during the month being treated in one lot in the Acid tank.

The strength of Acid used is approximately one part in ten parts of water.

The moist precipitate is placed in the Acid tank the requisite quantity of water added, the hood which is fitted with a small glass window front and back so that the action may be observed, closed down and the Acid run in through a leaden funnel.

The mass is stirred with a wooden paddle, the handle of which projects through a small opening in the front of the hood, and as soon as the first violent evolution of gas has subsided somewhat, more acid is run in. The stirring and additions of acid are continued until the reaction is seen to be complete. The tank is now filled with *cold* water, stirred well and allowed to settle. By using *cold* rather than *hot* water a more rapid settling of the Gold slimes is effected and after two further decantation washings the slimes are obtained free from Zinc Sulphate. All the washings from this are run into the Settling *tank* in which they are allowed to stand until thoroughly settled; the clear solution, which on assay shows only traces of Gold, is then run off and the small quantity of fine precipitate on the bottom of the tank collected.

The Gold-slimes in the acid tank are rinsed into the filter-tub as soon as the third "wash" has been run off and, after draining, are transferred to shallow sheet-iron trays These are placed in a special form of oven-furnace in which the contents are first dried and finally heated to a dull red heat.

The furnace itself consists of a small wind-furnace, which is used for the melting of bullion and which is fitted with a hinged damper so that when required the trays containing precipitate may be heated by the *waste* heat from the furnace. This is effected by placing the trays on shelves in the oven one above another in such a way that the spaces between them form the flue through which the furnace gases pass to the stack.

By this means the objectionable vapours evolved during the roasting of the slimes are carried away and at the same time no loss by dusting is experienced on account of the large flue area allowed between the trays.

The roasted slimes are now mixed with a suitable flux, smelted in *clay* crucibles which for safety are placed inside graphite pots, and the smelt finally cast in the usual "brick" moulds.

The Slags obtained which are exceptionally clean are allowed to accumulate and are treated at intervals by Caldecott's process.

Although this paper has been confined to the treatment of one particular class of material it may also be mentioned that the writer has had opportunities for making comparative tests of the merits of the Bromo-Cyanide as compared with the ordinary Cyanide process in treating ores and tailings of various descriptions, and has found that with practically all the so-called "refractory" ores treated the best results both as regards cost and extraction have been obtained by using the Bromo-Cyanide process, the difference being sufficient in many cases to convert an uneconomical treatment into a profitable operation.

The following figures representing the chemical consumptions and extraction on the concentrates, in conjunction with the saving effected by amalgamation, speak for themselves:—

Potass. Cyanide per ton of concentrates treated.... 2.0 lb.
Cyanogen Bromide per ton of concentrates treated. 0.5 lb.
Zinc Fume per ton of concentrates treated..... 0.19 lb.
Total length of treatment.... ... .. 80 to 100 hours.
Extraction of Gold from Contentrates 87 per cent. to 94 per cent.
An average of..... 90.5 per cent.

This latter with the values saved by amalgamation gives a *total* saving of 88 per cent. to 90 per cent. of the original Gold contents of the Milling Ore a result which, as an average of two years' steady work, will it is thought be generally admitted to be exceptional on so refractory an ore.

Shipping Coal by the Aerial Wire Rope System at Port Morien, Cape Breton.

By Joseph G. S. Hudson, M.E., Port Morien, C. B.

The designer of the aerial wire rope tramway, Mr. Roe of the Ropeway Syndicate of London, claimed for his system: that it was easily installed, economical in working, simple in operation, easily maintained when erected, and that it could be adapted to almost any practical working condition and that for the tons of material, it was capable of handling, the first cost was very small compared with the usual means of transportation.

In working the system we have found the designer's estimate correct and in the words of a gentleman who visited our works, recently, and who had a similar problem to solve "It is just the thing."

On the map shewing Port Morien harbour and where Gowrie and Block House Collieries, Limited, of Newcastle-on-Tyne ship their coal, it will be seen that the wharf marked Dominion Coal Co. pier extends out from the shore, to a point where the vessel had sufficient water to take in cargo practically one thousand feet from the shore at high water mark.

To attain this mark and build a wharf by the means, customary use in the district, meant at a very conservative estimate $25,000, allowing that the minimum depth of water at low tide was to be 14.0 feet, and from this point the wharf would have to be extended sufficiently for ocean steamers to load.

By adopting the aerial tramway system you commence your shipping pier in the depth of water you wish to obtain for vessels, can place support towers from 325 to 375 feet apart, between given points, and bring your wire ropes to the point where your coal is delivered from the screens, and so save to a very great extent, a large expenditure in labour and material in building.

Commencing at the loading station we have a small Jenckes engine with cylinder 9 inches in diameter and 12 inches stroke with a fly-wheel 42 inches in diameter, on this a four-ply 8 inch rubber belt on a 42 inch Dodge split pulley, which drives a two inch shaft to a geared bevel wheel 5 feet in diameter, which is placed horizontally on a 6 inch perpendicular shaft, immediately below is the rope wheel feet in diameter. The driving shaft making 14 revolutions per minute, this is nominally the motive power. The rope is one inch and one eighth in diameter ordinary Lang laid.

The driving wheel is situated at the near end of the loading station, in order to allow the shunt rail to extend further back than the loading point, so that sufficient room can be obtained to allow the empty buckets to come on the shunt rail, and radiate to the loading point and have enough space for standage room between the empty and full buckets. The terminal stations are built of 4½ inch by 9 inch scantling, uprights in concrete foot blocks. Bents 9.0 feet centres and 7.6 feet high on which is suspended by cast iron hangers a piece of steel 3½ inches deep by ⅝ inch thick; these pieces form the shunt rail. The carrier is so designed that it forms a clip on the rope, and is also provided with two wheels 6 inches in diameter, which come into operation when the buckets leave the rope at the terminal points, and are transmitted with the rope impetus to the shunt rail, both at the loading and unloading stations.

The buckets are of pressed steel and carry 850 lbs. of coal. It has been demonstrated by practical working that an excessive weight in the buckets causes a much heavier and expensive plant, and that the better method is to move a small load quickly and often than a heavy load slowly; for example it was the original idea to have 5-ton loads, but now it can be demonstrated that ten buckets will carry five tons nearly in the same time and can be distributed a bucket every 200 feet along the entire length of rope, and attain the same quantity of material carried in the same given time.

When the bucket is filled at the loading station, the operator simply gives the loaded bucket a shove, the wheels on the carrier running along the shunt rail until it comes in contact with the moving rope, which conveys it along at the same speed as that which the rope is moving. One hundred feet from the loading station is a tower 11.0 feet high with a cross arm of sufficient length to spread the rope apart, so that the loaded bucket going out on the full rope will not come in contact with the empty bucket returning on the other rope travelling in the opposite direction on which the empty bucket runs.

On all these towers are suspended by means of self-moving bracket arms four wheels in line on the full side and two wheels in line on the empty side.

These wheels are so balanced that they dip down to accommodate the sag of the rope when the bucket approaches the support tower, and make a return dip, when the buckets go with the sag of the rope from tower to tower.

When the loaded bucket arrives at the pier, by looking at the side view of the pier, it will be seen that a platform extends out over the end of the pier. On this are arranged a series of receiving wheels in front of the shunt rail.

When the loaded bucket arrives the man operating the pier end runs the loaded bucket on the shunt rail until he comes to the place in the pocket where he dumps the coal, lifts up the latch, the bucket on a gudgeon, tips over, and returns, he then closes the latch, runs the now empty bucket round the radial end of the shunt rail, and gives it a good hard push, the wheels on the carrier run along the shunt rail until they come in contact with the rope (which has gone round the tension wheel) the clip then comes into operation, and the bucket is both suspended on the rope, and is carried along, passing the support towers, and arrives again at the loading station. I mentioned before that the wharf was situated 1,000 feet from the shore, and that the loading station is 200 feet further to the pit mouth and the screens: the time occupied by a loaded bucket leaving the loading station travelling out to the wharf, being unloaded, shoved round the shunt rail on the wharf, and returning to the end of the shoot to be reloaded is ten minutes.

The capacity of the system guaranteed by the makers, is 50 tons per hours, but this I am sure can be exceeded, but when we asked for estimates, that is the quantity we specified, and the makers advocate duplicating the plant, rather than make one to carry twice as much, but this is a matter which can be arranged with the maker. We operate our system having a small boy to watch the engine, in case of any accident occurring, or an uneven distribution of the buckets (the rope having a tendency to race if the loaded rope gets too many loaded buckets placed on it in a short space).

One man at the loading station filling the buckets from the mouth of the screen, and one man on the wharf to unload the buckets, and run them round the shunt rail, and put them on the return rope, as already described, also to see that the wheels are kept greased and running all right.

We weigh the coal in the buckets by one of Fairbanks A scales, suspended on a section of the shunt rail.

The pier is designed as follows, viz.:—The first one hundred feet to contain four pockets of 90 tons capacity each, for loading schooners with a draft of water up to 14 feet at low tide, 200 feet now being built for the steamer section and having a storage capacity of 800 tons, there being from 18 to 20 feet of water at low tide along this section, plus four feet for high tide.

The tension on the ropes is with a capsan and thread bar, the tension weight being three tons, can be multiplied four times, giving a tension if required of 12 tons; but this we have not found necessary the ropes running most satifactorily, having considerable sag in the ropes between the towers.

On this coast we have heavy gales, and I anticipated considerable trouble, thinking that the buckets might swing on the ropes, and strike against the support towers, but in the heaviest gales last autumn, we ran the buckets both empty and loaded, and had no trouble whatever with them.

The whole system realizing our fullest expectations, and obliterating any idea that the shipping of coal by the aerial ropeway had any similitude of an experiment but demonstrating most successfully that it was a sure thing and just what we wanted.

Rope Driven versus Direct Driven, Colliery Ventilating Fans.

By Francis T. Peacock, M.E., Montreal.

There is a difference of opinion among Mining Engineers and Mine Managers as to whether a Colliery Ventilating Fan should be coupled to the Engine direct, or driven through the medium of a Belt, Cotton, or Hemp Ropes, and the writer wishes to call attention to some of the conditions which should determine a selection of the type to be used.

The following may be taken as the principal features requiring careful consideration.

1st. Colliery Ventilating Fans must generally run continuously, night and day, including Sundays, unless of course duplicate plants are installed, enabling one to be stopped for repairs, if necessary, which, however, entails double outlay.

2nd Taking into consideration the continuous running required of this Machinery, it is of the utmost importance that the speed of Driving Engines should be very moderate, to insure freedom from breakdown. Considering the hours worked during the week, Mill Engines run only one-third the time of Fan Engines; or, in other words, each year the work done by Ventilating Engines, represents three years work, as compared with Mill or Factory Engines.

3rd. Ventilating Engines should be of the simplest design with ample wearing surfaces, as being less liable to get out of order; consequently the ordinary Slide Valves provided with adjustable cut off Valves, variable whilst the Engines are running, are particularly adapted for Fan Engines.

4th. The Engines should be arranged in duplicate, so that if a breakdown occurs in one, the other may be quickly coupled up to the Fan, meanwhile the disconnected Engine can be overhauled and again put into good working order.

5th. Both Fan and Engines should be of ample size to effect the required ventilation easily when the Steam Boiler Pressure falls below normal, which even in the best regulated plants, will sometimes occur.

6th. Assuming that the Fan is so designed that it will easily perform its rated duty at a certain speed, the designer must consider whether it is better to install a larger Fan and drive it by means of direct connected Engines, or to install a smaller Fan, and drive by means of Ropes or Belt. This question, however, applies more to Fans of high Water Gauges and large volumes.

7th. The Plant should be an efficient one in Steam consumption, and this fact is now recognized, even at Coal Mines, where fuel is at its cheapest.

DIRECT DRIVEN FANS.

This type of Fan is very often preferred, principally, I believe, on account of its lower first cost. While a Direct Driven Fan may be considered as satisfactory for low Water Gauges and small volumes, it has a number of disadvantages for large installations, which become serious for high Water Gauges, among which the following may be mentioned.

To give the required periphery speed to the Fan, the Engine must either be provided with an abnormally short stroke, or must be run an abnormally high Piston velocity. A high Piston velocity is very objectionable in such continuous running Machinery, and it is found that the destructive effect lies not so much in the speed at which the Piston travels, as in the frequency of its change of direction.

A Direct Driven Fan must often be larger in diameter for a given duty than would be the case if the Fan were geared in order to reduce the number of revolutions and obtain the necessary periphery velocity. This means a heavier Fan, additional Foundations and additional weight on the Bearings.

There is generally considerable vibration in the Shafts of Ventilating Fans, caused in some cases by improper balancing of the Fan, and by reason of each Fan blade as it passes the opening to the outlet or chimney, being suddenly released from pressure or load. Taking the work of one day of 24 hours, and a moderate sized Fan with 8 blades running at 80 revolutions, a load of several hundred pounds, is, as it were, instantaneously removed from the blades 921,600 times.

The Shaft is consequently subjected to continual vibration, which is of course transmitted throughout the Engines, and which principally accounts for the fact that an Engine driving a Fan direct coupled of only moderate size, is almost invariably subjected to a hammering or knocking in its Shaft Bearing, Crank and Crosshead Pins, requiring a frequent adjustment of the working parts.

The breakages of large Fan Shafts, which have occured in Europe, after their elastic limit has been reached and the loosening of Bolts or Rivets in the Fan proper, are attributable to this vibration.

In Direct Driven installations, there are usually three Shaft Bearings, one on each side of the Fan proper, and one for Engine Crank Shaft. There is a difference, not only in the dead weight, which these Bearings have to support, and consequently a difference in the amount of wear, but they tend to wear in different directions, and in consequence it is a most difficult matter, if not practically impossible, to keep all Bearings in proper alignment, and prevent knocking. This feature is not improved by reason of the natural deflection of the Fan Shaft, which is also liable to affect the alignment of Engine Crank Shaft, and consequently, the Crank Pin.

A Single Engine is of course not economical, as compared with a Compound Condensing Engine, and before the introduction of the Rope Driven Fan in England, it was customary in large or important installations, to equip the Fan with a Direct Driving Tandem Compound Engine on one side, and a Single Engine on the opposite side of the same end of Fan Shaft, with its own connecting rod connected at Crosshead end, the Crank end being suspended ready to attach to the Crank Pin in case of an accident to the Compound Engine. The Fan is in this manner provided with two separate Engines, with the exception of the Crank Pin. If this should break or become loose, the Fan must stop.

One of the advantages of the Direct Driven Fan in addition to its lower first cost, is that it requires less room and a smaller Engine

House. This, however, is not always important, for the reason that the Engine House may often with advantage, also contain other Machinery, such for instance, as an Electric Lighting Plant.

As the writer has previously pointed out, Direct Driven Fans are suitable, and often satisfactory, for low Water Gauges and small volumes. When this system is adopted, however, VERTICAL, and not HORIZONTAL Engines are preferable for the reason that the Vertical type of Engine will better withstand the higher Piston velocities, vibrations and strains to which all Direct connected Engines are subjected.

BELT DRIVEN FANS.

Belted Fans are objectionable, except for very small capacities or temporary installations, on account of their liability to give trouble and annoyance with Belts stretching or breaking, when applied to this class of continuous running Machinery.

ROPE DRIVEN FANS.

This system of driving Ventilating Fans, now long in use in England, has for the larger and more important installations of that Country of deep Mines and intricate Ventilating problems, taken the place of the Direct Driven system, especially for high Water Gauges and large volumes. Rope Driven Fans have the following very obvious advantages :—

The Engines can be run at a very moderate speed, and long strokes can be adopted, thus considerably lessening the frequency of change of direction of the reciprocating parts, consequently adding length of life to the Machinery and minimizing the liability to breakdowns or stoppages.

The Fan being driven through the medium of separate Endless Cotton Ropes, (usually 1⅝" or 1¾" dia.) any vibration in the Fan itself, and the somewhat impulsive action of the Engine is practically dissipated through the elastic medium of the cotton ropes. Assuming the installation is geared at about 2½ to 1, the Engine passes over its dead centres only ⅖ as often as in the case of a Direct Coupled Engine, and in the case of Twin or side-by-side Compound Engines, with Cranks set at right angles, the Driven Pulley receives only a comparatively light impulse at each four points in a revolution, instead of a heavy impulse at each two points in a revolution, all of which conduces to very smooth running, long life, and a minimum cost for repairs.

The Fan Shaft runs in its own Bearings, independently of the Engine.

It is sometimes found that after a Fan is installed and has been running for some time, it is very desirable, owing to the varying circumstances of the Mine, to change the velocity of the Fan. Such a change, within certain limits, can readily be affected in Rope Driven Fans by changing the diameter of the Driven Pulley on the Fan Shaft. This is a great advantage of this type of Fan, and has often been taken advantage of by Mine Managers and Engineers.

In the case of Single or Tandem Compound Geared Engines, there is of course only one Crank Pin, as in the case of Direct Driven Fans, but when the Engines are of the Twin or side-by-side Compound type, and they are provided with a system of Valves to allow of the high pressure or low pressure side running alone or independently and of live steam being admitted to the low pressure Cylinder, which is provided with a relief and reducing Valve, we have two Crank Pins and practically two Engines, so that if an accident should happen to the H P. side, the L. P. side will temporarily drive the Fan, and vice versa. It is of course true that one side of the Engine will not drive the Fan to the same capacity or as economically as the Compound Engine, but if the Plant is properly designed, so as to easily perform its rated duty, one side of the Engine will drive the Fan to so nearly its full capacity, that practically little or no convenience results in so driving, temporarily.

It may be considered an objection to introducing the Rope Drive between Fan and Engine in that, by so doing, an additional factor of uncertainty is added in the Ropes, and that some power is wasted in Rope Transmission. In answer to these objections, experience has proved that by carefnl selection of the best makes of Cotton Ropes, and proper attention, they will run continuously for years without giving trouble. If one of the Ropes should give away, (which is a very rare case if the load which each Rope is designed to carry is not too great, and ordinary care is taken), the Fan can be run by the remaining Ropes until such a time as another Rope can be spliced and applied.

With reference to the power wasted in Transmission, with Pulleys of proper size there is practically no slip of the Ropes in the grooves, and with well designed and well finished grooves, the power required to bend the ropes around the pulleys and to pull the Ropes out of the grooves as they leave the Pulley, is so small that it can be practically almost neglected.

One of the advantages of a well designed and well constructed Rope Driven installation is, that on account of the moderate speed of the Engines and comparative freedom from vibration, less expense is required, not only for repairs and adjustments, but also in the smaller amount of lubricating oil used.

The object of this paper is to call attention in a general way to the advantages and disadvantages of the different methods of driving, only, though I hope to supplement this paper with others dealing with Ventilating Machinery, which is of such vital and increasing importance to modern Colliery Plants.

Across the Pitch versus Up the Pitch.

(*Continued.*)

By O. E. S. WHITESIDE, Anthracite, N. W. T.

In concluding a short paper written for our Annual Meeting in March, 1899, and entitled "Across the Pitch versus Up the Pitch" I suggested the possibility of a continuation later on.

Summing up the arguments advanced in this paper, and arriving at a general conclusion, I would say that the former is to be preferred in seams containing any amount of refuse that ought to be gobbed inside the mine; and the latter for seams containing little or no refuse, or where the whole product of the seam is to be shipped to the surface, and more especially if the seam is a thin one. In some instances there will be exceptions to this rule however. If it is absolutely necessary that pillars be left standing, it is possible that a fairly dirty seam should be worked "up the pitch"; while, on the other hand, if it is impossible to get miners used to that class of work, it would then be necessary to work a very clean seam "across the pitch" even though it were a thin one.

A seam containing in descending order:—

	FEET.	INCHES.
Mining	0	6
Coal	2	0
Slate	1	6
Coal	4	0
Mining	0	6
Total	8	6

and pitching at 35° to 50° ought, according to the general rule, to be worked across rather than up the pitch; while one containing in descending order:—

	FEET.	INCHES.
Coal	3	1
Mining	0	3
Total	3	4

ought to be worked more profitably straight up the pitch.

In the first example it would be much better, in the majority of cases, to adopt a system lending itself readily to the gobbing of waste inside, and this could not be done either so well or so cheaply if worked "up the pitch". In the second example the very small amount of waste gives ample mining, and is easily taken care of while driving to the rise, and, furthermore, being so thin it would be impossible to get a breast-car of any size in to work it, by the other system, without shooting rock. This could not be the case in any dirty seam containing enough coal to be workable.

Coming to the work in the broken the first requisite to the successful continuation of "Across the Pitch" work is to follow up immediately by pulling the pillars. If the coal is hard and does not contain many slips, and there does not happen to be another seam close by, these pillars may stand for a considerable period; but before the boundary is reached, even in a very small mine, they are sure to commence dropping coal on the low side, and once this starts it is a very short time before a great deal of coal is buried and lost, and the pillars left in very bad shape for pulling. If the seam is a thick one the effects are more marked, and, if a thin one, the roof and floor come so close together in the breasts worked out that, in order to get a breast -car in on the low side of each pillar, rock work has to be resorted to. This in conjunction with the opening of old chutes caved in, may make the pillars cost more than the work in the solid, while the percentage of waste will be greatly increased if the broken work does not immediately follow the solid.

Pulling the coal advancing requires little or no extra expense on chutes already in for the solid work; the roads are easily gotten in to the back end of each pillar; and the pillars are in an easy and safe condition for mining, but it is of course absolutely necessary that air holes be kept to the surface, or return air way in advance of the pillar pulling, and in troubled ground like that generally met with in the class of mining here referred to, these are often expensive items.

Throughout these operations the pillars should be pulled in regular steps the upper ones in advance of the lower, but not far enough to produce falls of rock that would cover the ends of the lower pillars and thus shut off the ventilating current. The coal from the breasts is of course all dumped into what is termed the outside chute, but that from the pillars should be put in the inside chute.

The track for the breast-car is laid on the high side of each breast on top of the "Gob" and just below the pillar, and, when the end of the pillar is reached, the coal is attacked and taken back, the distance to push the coal becoming less and less until the pillar is completely out.

In badly troubled ground the air-holes kept in advance of the pillar-drawing will not always be straight up the pitch, as it will often happen that the shortest way through the fold will not be directly to the rise, and, on this account, it is often necessary to modify the system previously adopted, in the vicinity of certain folds.

The three systems of work adopted in the thin coal seams of Belgium "gradins renverses", "tailles montantes" and "tailles chassantes", are merely variations of long-wall work adopted on account of the thinness of the seams, but, in so far as the direction of the working face is concerned, they include "Across the Pitch and Up the Pitch" work.

The first and third are across the pitch while the second is to the rise. The second and third cover fully the two systems I have previously described, both as regards the direction of the working face and the pitch of the seams, yet the question of the thickness of the seam, or the amount of waste contained in it, seems to have been a secondary consideration to the degree of pitch in the evolution of systems, probably because their seams are more uniform in thickness and also in the amount of waste they contain. The degree of pitch is certainly a very important feature in the choice of a system, for, if it is heavy, the coal from the face falling on the waste below (if there is any) is lost to a considerable extent, and, as I pointed out before, especially is it important if the miners are not skilled in that class of work.

In the highly inclined seams of Pennsylvania and the Pacific Coast the miners are exceedingly skilled at this class of work, and many of them prefer to drive up the pitch no matter how steep the inclination may be. In the state of Washington they also invariably drive to the rise partially for this reason, and partially on account of the fact that many of their seams (containing enough dirt to recommend "Across the Pitch" work) are so soft, and at the same time lively, that "Across the Pitch" pillars cannot be kept in, even while the solid work progresses.

On a very easy pitch of from 12° to 30° the Belgians drive up the pitch and, as a rule, on slightly heavier pitches of 30° to 45° they drive across although the latter is used in some instances on pitches varying all the way from 0° to 60°. The system entitled "gradins renverses" is similar to overhand-stoping of metal mines and is adopted on the heavier pitches of from 45°to 90°.

In several instances in the state of Washington they have adopted a system for seams pitching from 45° to 90° which is neither across nor up but "half on" and locally termed the "Chute and Pillar" or "Diamond" system.

The gangways are driven first in the direction of the strike, and the chutes straight up the pitch, far enough to form gangway stumps are connected at the top by horizontal cross-cuts. From here up these chutes are continued not straight "up the pitch" but "half on" so that, on a seam pitching at 90°, the pitch of the chutes would be 45°.

These angle-chutes, as they are termed, are connected at intervals by angle-cross-cuts driven at right angles to the angle-chutes, their pitch being also 45° on a seam pitching 90°, but in the opposite direction to the pitch of the chutes. All these places are driven narrow and generally so as to form square pillars diagonally across the pitch, thus getting the name "Diamond" system. While the newer angle-chutes are being driven, the older ones immediately behind are being widened out and cogs placed on both sides, the work being started at the top and continued downwards, and the pillars immediately behind these are being pulled and the upper ones first.

The chutes are either driven to the surface or to a counter-gangway and the timber needed is lowered down them. Under certain conditions this system is an excellent one, and the coal gotten out very cheaply; but it can only be used advantageously when the breakage of the coal is of little account and where it is not necessary or feasible to store waste inside the mine.

If the coal is to be converted into coke, and the refuse of such a nature as to be best taken care of by means of a washing plant, it is an exceedingly profitable system.

It is very much safer for the miner than "Up the Pitch" work, and there is no extra labor in the cross-cuts shoveling coal, their pitch being thes ame as that of the chutes, all the coal mined gravitates to the gangways.

The size of the pillars and the number of cogs necessary are mere matters of detail to be determined by local conditions, such as the strength of the walls the thickness of the seams &c., &c.

BRIQUETTE MANUFACTURE.—A new method of manufacturing briquettes has been invented by Mr. Alex. E. Tucker, of Birmingham, and Mr. Colin Cory, of Swansea. The advantages claimed for the process are that it is applicable to every kind of coal, and that when anthracite is used, it produces a fuel absolutely free from smoke. The cost of production is said to be much less than with pitch-made fuel, and the briquettes do not soften when heated. The preliminary trials of this fuel have proved so satisfactory that a syndicate has been formed and works are now being put down in South Wales, after which it is proposed to establish others in Staffordshire and other coal-producing localities.

The Coal Creek Colliery of the Crow's Nest Pass Coal Co.

By C. V. Corless, Montreal.

[Paper read before the March meetings of the Canadian Mining Institute.]

The coal-fields of the Crow's Nest Pass Coal Company lie just beyond the Crow's Nest Pass over the continental divide at a distance of about forty miles from the international boundary. They front on the Elk River, being situated in the most south-easterly mining division of British Columbia, that of Fort Steele.

The mines of the Coal Creek Colliery are situated in Coal Creek Valley, five miles east of Fernie, a town at the confluence of this stream with the Elk River. They are at an altitude of 3,800 feet above sea-level and 525 feet above the town-site of Fernie.

The measures have the usual rolling character of all Rocky Mountain coal seams. Their general line of strike is approximately north and south. Their dip varies from level to about 20 or 25 degrees, the rise being toward the west. The outcrops are, therefore, along the mountain sides to the west, at varying heights.

The mines, Nos. 1 and 2, are situated respectively on the north and south sides of the valley, about 1,000 feet apart. Though relatively on the same level, the mines are not opening up the same seams, as shown in the accompanying geological section.

Old No. 1 Tunnel, on the north side of the valley opened up the lower six-foot seam shown in the sketch, but this seam has been abandoned for the present, the tunnel being used as a return air-course for No. 1 Mine. The new No. 1 Tunnel is working an eight-foot seam of excellent quality. This seam is the top section of the thirty-foot seam, shown in the geological section, and is situated about fifty feet above the original six-foot seam.

No. 2 Tunnel, on the south side of the valley, has opened up the upper portion of the eleven-foot seam shown in the section. The upper six feet is being extracted. The under five feet, constituting the pavement, is alternating bands of coal and shale. This forms, generally, a splendid floor. The roof of this mine is of great strength and regularity.

Geology.—These coal measures occur in the Laramie Formation of the Upper Cretaceous series of rocks. In this district this formation comprises some thousands of feet of alternating bands of conglomerate and sandstone, the single strata varying from a few inches to hundreds of feet in thickness. At frequent intervals in these strata, but always immediately beneath a layer of sandstone, occur the coal seams with their accompanying carbonaceous shales. The enclosed geological section for which the measurements were made by the writer, while engaged at this colliery during the summer of 1900, shows the arrangement and thickness of the near lying strata at the Coal Creek Colliery. It would appear that the strata of conglomerate were laid down along an ancient sea-beach that oscillated back and forth owing to the repeated, alternate elevations and depressions of the Laramie Sea-bottom, the coal-beds marking long periods of small emergence and persistent marshes in the alternating changes of level. The Valley is glacial.

"The cretaceous," says Dana, "was the coal period of western America." To what extent this district was favored during the period of coal making, may be gathered from the following quotation from the December number of *The Colliery Guardian*, 1900 :—

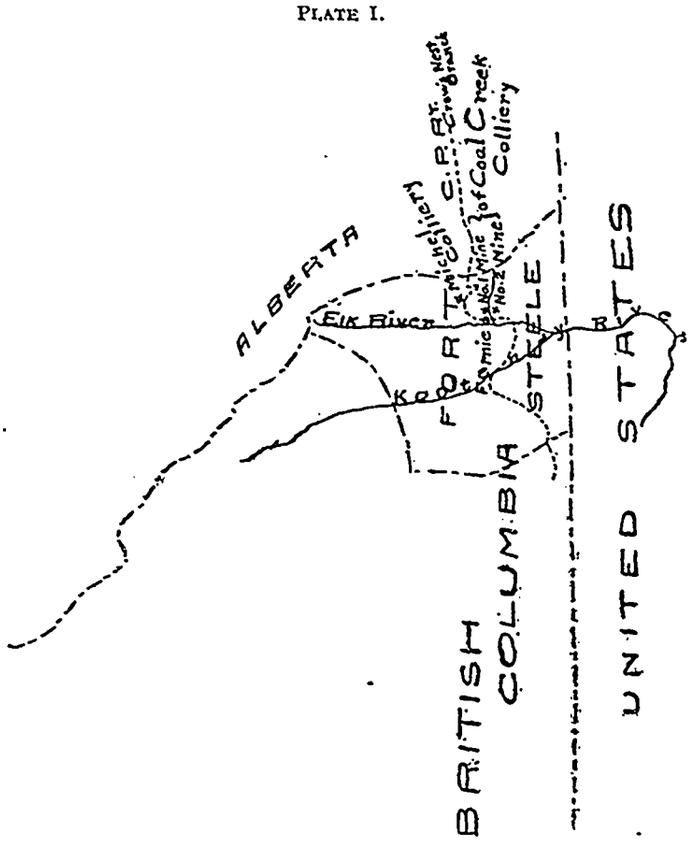
"In Crow's Nest Pass there are twenty seams of bituminous coal, three of which are 15, 20 and 30 feet thick respectively. The aggregate thickness of the seams reaches the large total of 132 feet of coal, and the area of the field is 144 square miles. This area is estimated to yield 50,000,000 tons of coal per mile and promises to be one of the most productive coal-fields of Canada." This estimate is very conservative, as the area is officially reported to be 250,000 acres or about 400 square miles, with seams aggregating 150 feet in thickness. The estimates of some engineers place the quantity of coal within this area at 25 billions of tons, which would admit of an output of 25 million tons a year, or 70,000 tons a day, for 1,000 years. Doubtless, the use of the diamond drill in the valleys, would reveal many as yet undiscovered seams. The coal in the seams exposed up to the present, is very uniform and of excellent quality. It is said to be the best coking coal in America, the coke possessing high Calorific power and great crushing strength, two most important qualities demanded of coke that is to be used for smelting.

The coal mines of the Crow's Nest are well situated for furnishing coke to smelters. But smelting is only in its infancy in southern British Columbia, there being at present 5 establishments, one at Nelson, one at Trail, one at Pilot Bay and two others in the Boundary Country.

Situated as it is, with vast metalliferous deposits to the south, west and north, the importance of this inexhaustible suppiy of smelting fuel, in the development of the "Great West," can hardly be overestimated.

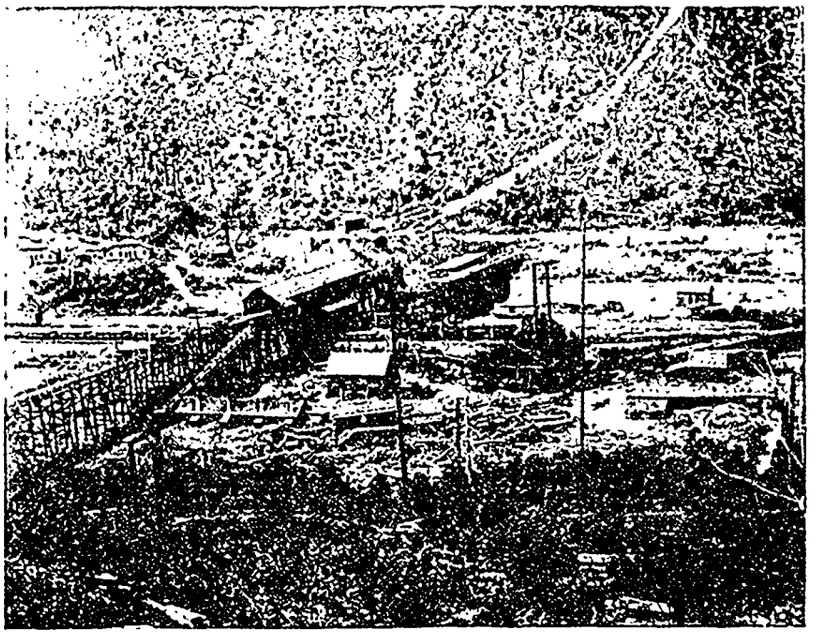
The relative positions of Nos. 1 and 2 Mines, and of each to the surface plant, will be made clear by referring to Photo No. 1 and to

Plate I.

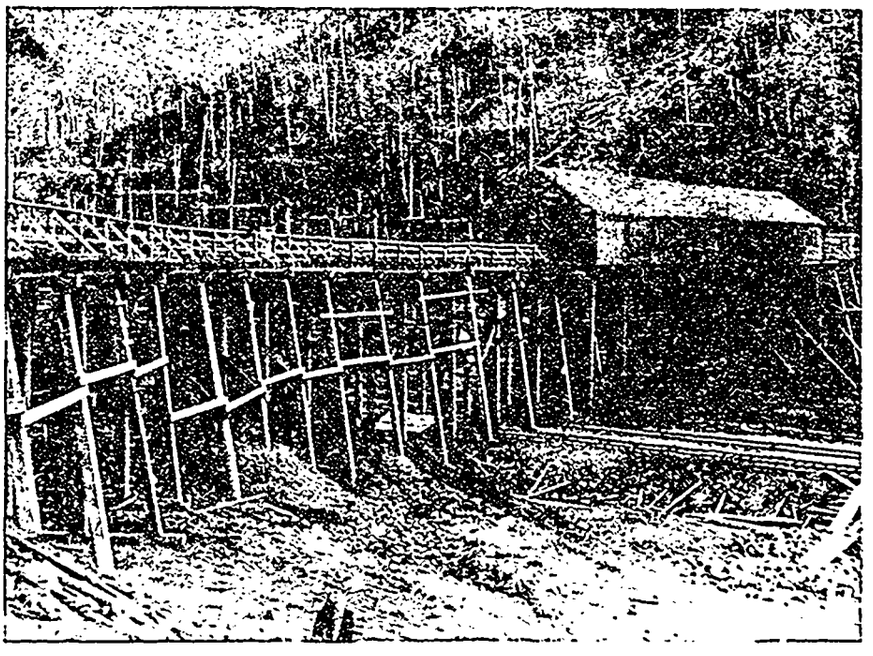


the accompanying plan of the mines. In order to concentrate the surface labor and shipping plant the mine tunnels are connected by a trestle forty-five feet high above Coal Creek. The Weighing and Sorting Building is placed upon the trestle equidistant from the mine entrances. This building contains the scales, Mitchell tippler for dumping the mine-boxes, shaker screens, travelling picking-table, engine for the screens and picking-table, and loading arrangements to facilitate shipment in railway cars (See Photo No. 2).

In both mines the coal is being extracted on the "pillar and stall" system, the seams being too thick to be successfully worked by "long-wall." The main levels and headings are driven 12 to 14 feet wide and the rooms or stalls, about 18 feet wide. The stalls are driven parallel as far as the undulations of the strata will permit and are connected by cross cuts at intervals of 50 or 60 feet. This is done in order to short-circuit the air and dispense with the temporary brattice.

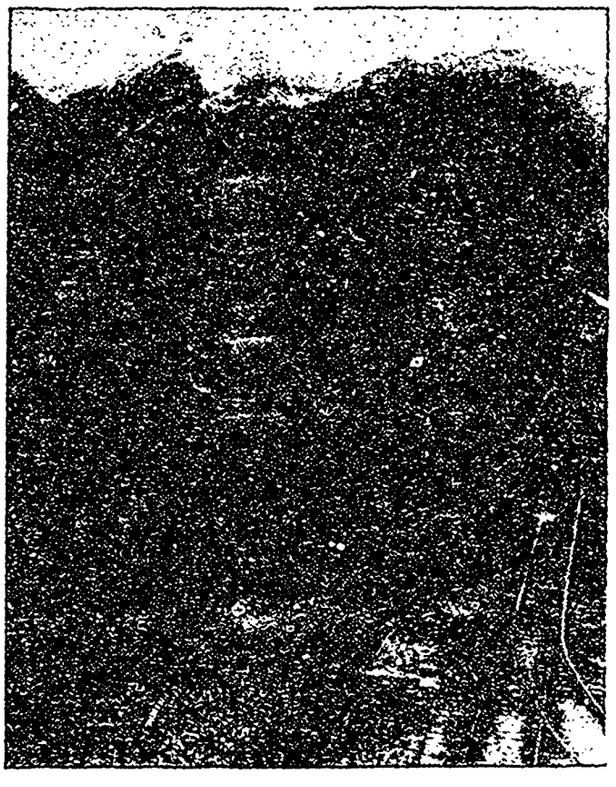


General View Surface Works looking North towards No. I Colliery.

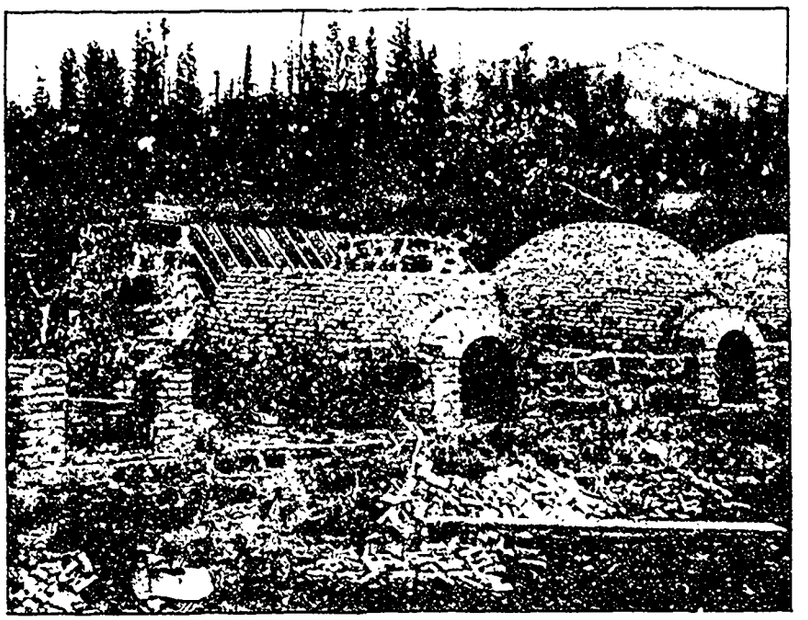


Weighing and Screening Building.

Jeffrey Electric Motor at Entrance to No. II Colliery.

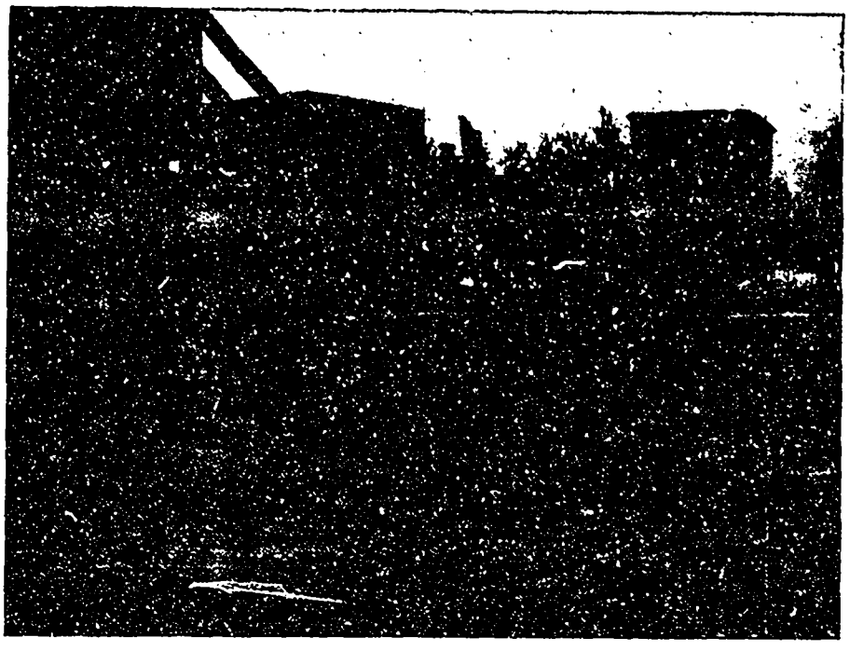


General View of Coking Plant at Fernie, B.C.

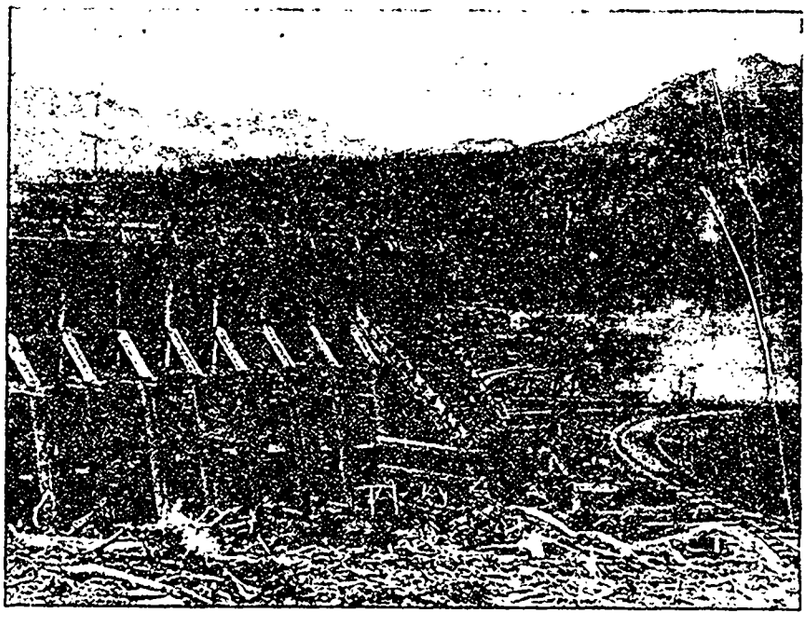


Coke Ovens at Fernie in course of construction.

Coke Ovens being constructed.



The Lorry.



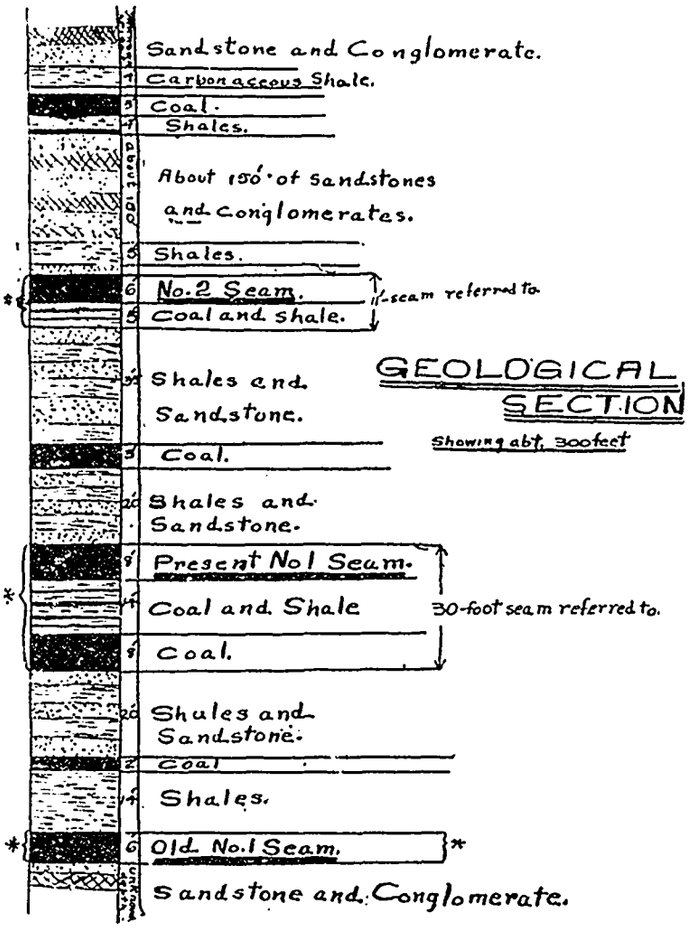
Slack Bin.

As will be seen from the plan, owing to difficulties in haulage arising from undulations of the mountain strata, the pillars are somewhat irregular both in size and position. They are, in general, about 45 feet square and are being increased in size as the workings extend north and south into the mountains which rise precipitously above the mines to the height of about 2,000 feet. This increase in size is in order to prevent a crush of the pillars or a creep in the overlying strata resulting from the enormous superincumbent pressure. It is not probable that any of the pillars will be robbed until all easily accessible, overlying seams have been extracted.

In order to stop a creep, should one occur, it may become necessary to rob a section of five or six hundred feet square and allow the roof to settle.

Though two electrically driven coal-cutting machines were purchased, they were in use only a short time owing to the excessive dip

PLATE II.



and rise in some parts of the mines. At present all cutting is done by hand. Much of the coal can be easily brought down by means of the pick alone, after the usual under-cut has been made. In gassy rooms the maul and wedge are used to bring down the coal when digging is difficult. But in rooms in which naked lights are used, after the under-cut has been made, the coal is blasted down by means of No. 2 or 3 black powder. The amount loosened by a good shot is 1 to 3 tons. The average consumption of powder is 1 lb. per 5 tons of output. A shot-lighter has charge of the placing and depth of all holes and of discharging all shots.

The rate of work is about eight to fourteen tons per pair per shift of eight hours, in wide work. In narrow work in a six-foot seam a pair averages about one yard per shift.

HAULAGE.—The undulating character of the seams renders haulage a difficult problem in engineering.

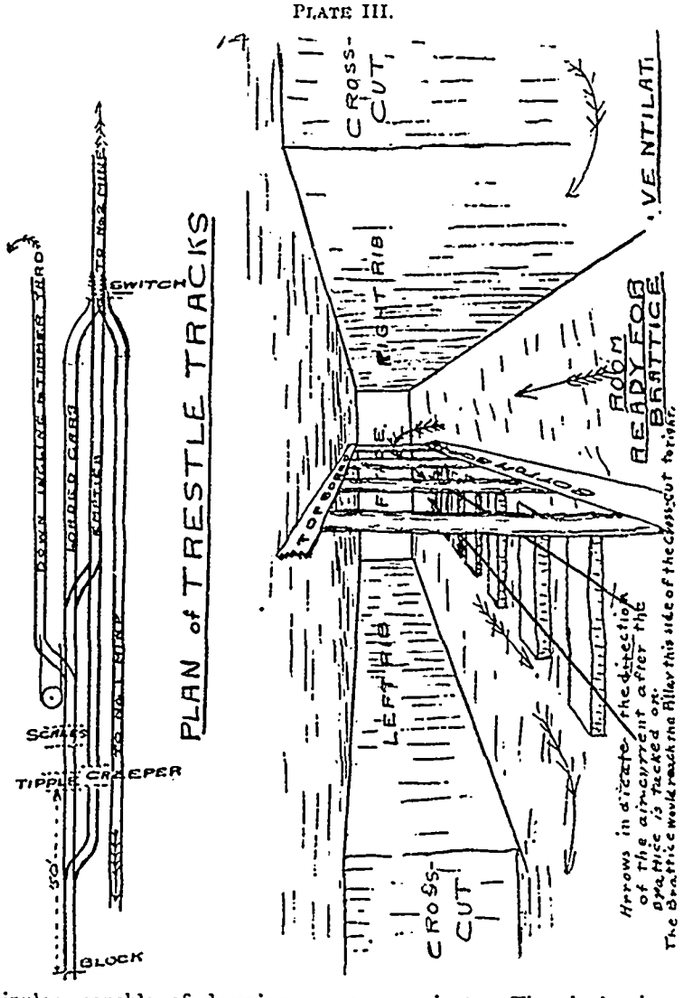
The main haulage is operated for about 2,000 feet by an electric motor in each mine. The grade of the motor tracks is 2 per cent., rising inwards as far as the first bend in the main haulage road, shown in the plan, after which it is variable. In No. 2 mine the main motor haulage was extended 600 feet by means of an electrically driven stationary hoist. The grade of the track for the hoist varies from 15 to 20 per cent. being too steep for the motor. The hoist is geared to give a cable-speed of two miles per hour. The secondary haulage in each mine is by horses and is under the superintendence of a driver boss in each. The driver boss remains at the landing and oversees the coupling and starting of the motor trips. Each driver hauls, on the average, about 40 boxes per shift, from four working places to the landing—a distance not exceeding 300 feet. It is found to be bad economy to let the round trip for a horse exceed 600 feet.

The arrangement of tracks, switches, scales, tipple and creeper are shown in the plan trestle tracks (See Plate III).

Two men are required on each motor, a motor man and a conductor. These haul the trip from the landing in the mine, out upon the trestle, and switch it on to the weighing and dumping track, returning with empties. The loaded cars are now uncoupled and pushed forward on the scales by a bankman. A tally-boy removes the tally and reads the miners' number to the weighman, returning the tally to its proper place on the tally-board. The miners have availed themselves of their legal right to appoint a check-weighman who overseers the weighing and checking of each box.

After being weighed, the cars are dumped by means of a Mitchell

PLATE III.



tippler, capable of dumping 10 cars a minute. The tippler is so arranged that the following cars release the wheel-grips of the empty car in front, which then runs down a 5 per cent. grade for a distance of 50 feet, and then switches automatically back on another track,

falling 5 per cent. for the same distance, to the side of the tipple. From this point, reached by gravity, the car is pushed by a creeper up a 15 per cent. incline, to a sufficient height to permit it to run forward, under the action of gravity, on the empty track ready for attaching to the next return trip.

DIFFICULTIES.—Owing to the thickness of the seams being worked, there has been no necessity for "brushing" the roof for haulage-roads in either mine.

In No. 2 Mine there have been a few cases of heaving of the floor but these have so far caused but little trouble, being of no great extent.

On the other hand, the undulating character of the strata causes, even on the general line of strike, some very steep grades, which it is practically impossible to overcome by horse-haulage. The haulage on these parts, between the rooms and the landings, presents a series of difficulties which it will tax the utmost skill of the engineer economically to overcome. As already mentioned, one of these long 15 to 20 per cent. up-grades is operated by an electrically driven stationary hoist. A second 20 to 25 per cent. down-grade in No. 2 Mine, is operated by gravity for about 400 feet, being provided with double track, ¾ inch cable, and a drum at the head of the incline, worked by means of a friction clutch.

TIMBERING.—As the roof in both mines has been very sound, timbering has been a comparatively easy matter. The chief difficulties so far met with, have arisen from slight faults and one slight fall in No. 2. But even these have been secured by the use of a few extra props with ties as cap-pieces. The props and booms are of tamarack and spruce, procured from the neighboring forests. They range from 7 inches to 10 inches in diameter. The timbers are set in the usual way, it being rather more than usually important to set the head of the props a little above a perpendicular from the foot of the prop to the roof, owing to the tendency to creep. This causes the prop to tighten in case of a creep, thus offering resistance instead of falling out.

The method of timbering the gravel tunnels will be described later on.

VENTILATION.—Considerable quantities of fire-damp, $C H_4$, are given off in both mines, due probably to the fact of the coal-beds being still almost intact and to their great thickness. Both mines show the natural tendency to become more fiery as the workings extend inwards from the exposed outcrops, and as, in consequence, the depth of covering increases. The problem of ventilation is, therefore, of increasing importance.

Moreover, the altitude, 3,800 feet, gives very low barometric readings of 24 to 25 inches, corresponding to a pressure of 12 to 12½ pounds per square inch. This low pressure greatly increases the amount of fire-damp's given off from the coal. It also increases the volume of air required to dilute the fire-damp and supply the men, in the ratio of 5.4. Besides, the reduced pressure augments the difficulty of exhaustion by fans. Thus, ventilation, as well as haulage and the tendency to creep, will require the closest attention of the engineer.

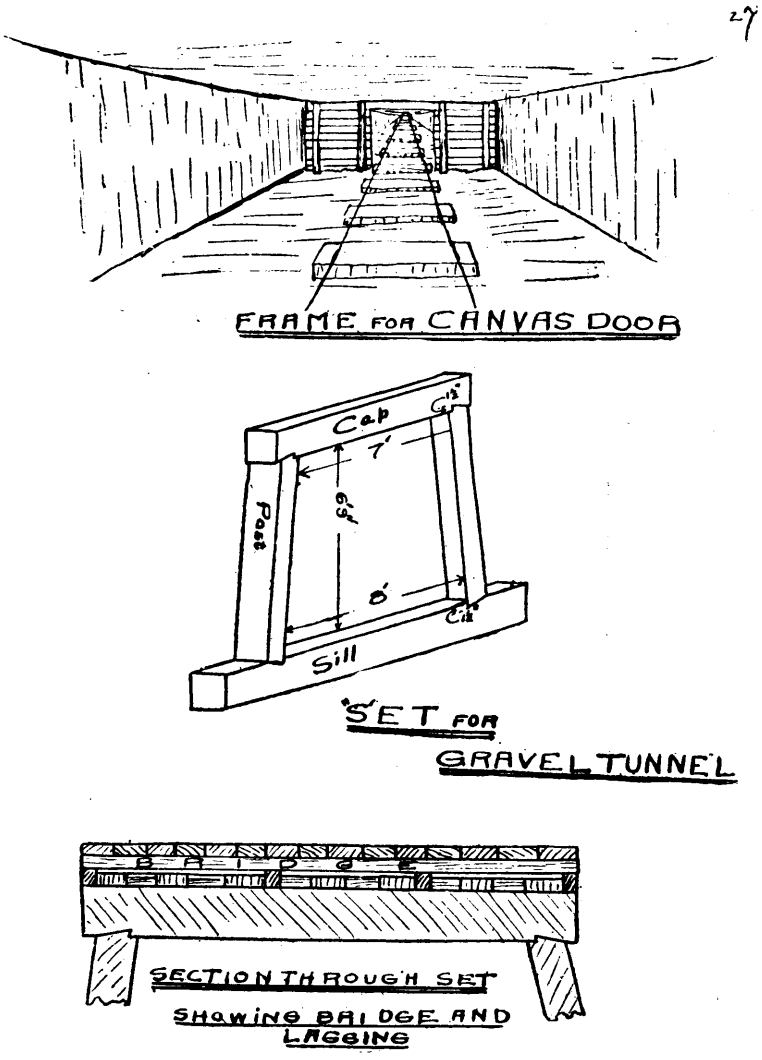
The splitting system of ventilation is the one adopted, there being at present 2 splits in each mine. The air-courses, splits, stoppings, etc., for No. 2 Mine are shown in the plan, the direction of the air-currents being shown by arrows. The ventilation of No. 1 is similar to that of No. 2.

It may perhaps be interesting to follow one of the splits around.

Referring to the plan of No. 2, we see that the air-current, 50,000 feet per minute, enters the mine by the main haulage road, 6 feet high and 8 feet wide, having a velocity therefore of a little over 1,000 feet per minute. At A, the current is split, one part turning to the right and the other to the left, as shown by the arrows. The air-current in both splits is directed round to the working places and kept from being dissipated through the old workings of the mine by means of the doors and stoppings indicated by the lines drawn from pillar to pillar. At B, is the first door, as the stopping here is across a haulage road. As a certain amount of leakage is necessary, in order to keep the haulage road from B down the main deep, supplied with air, this door is made of canvas. The use of a canvas curtain also saves the expense of a door-boy. Similar canvas doors replaces the tight-board stoppings wherever the latter would interfere with haulage.

Following the left split around, we come to a typical working place at E (See E on tracing of plan). Here the air would short-circuit and not sweep the gas from the working-face were it not for the canvas stretched from roof to pavement shown by the line a b. The brattice is extended as the working-face is pushed forward, always

PLATE IV.



being kept within about 9 feet of the face. When the room is extended about 60 feet, to C, a cross-cut, c d, is made into the next working-place, a tight-board stopping is placed at E F, the brattice is removed, and the air is thus short-circuited through the cross-cut, c d. This is the method of directing the air-current to the face of all rooms and entries. Entries are driven in pairs with cross-cuts at intervals of about 60 feet, one entry acting as the intake, the other as the out-take.

Still following the left split we come to F, where the right split having traversed a similar course, unites with the left in the return drift. At G, is an over-shot, where the outgoing current is made to pass over the left in-coming split.

Passing onwards we come to the air-pit. Here a tight door is placed across the return-drift and the air passes up the air conduit, the fan above acting as an exhaust.

This fan is of 8 feet diameter by 4 feet width, with 14 vanes. It

is belted to an Atlas horizontal engine, the ratio of the engine and fan speed being 5.8. The fan speed at present is 208 revolutions, supplying 50,000 feet of air to the mine per minute. It is capable of supplying 70,000 to 80,000 feet per minute as occasion arises.

The amount of air required by law is 100 cubic feet per man per minute. The amount in circulation in each of these mines as shown by calculation from the velocity indicated by the anemometer, is more than 300 feet per minute for every man, boy and horse.

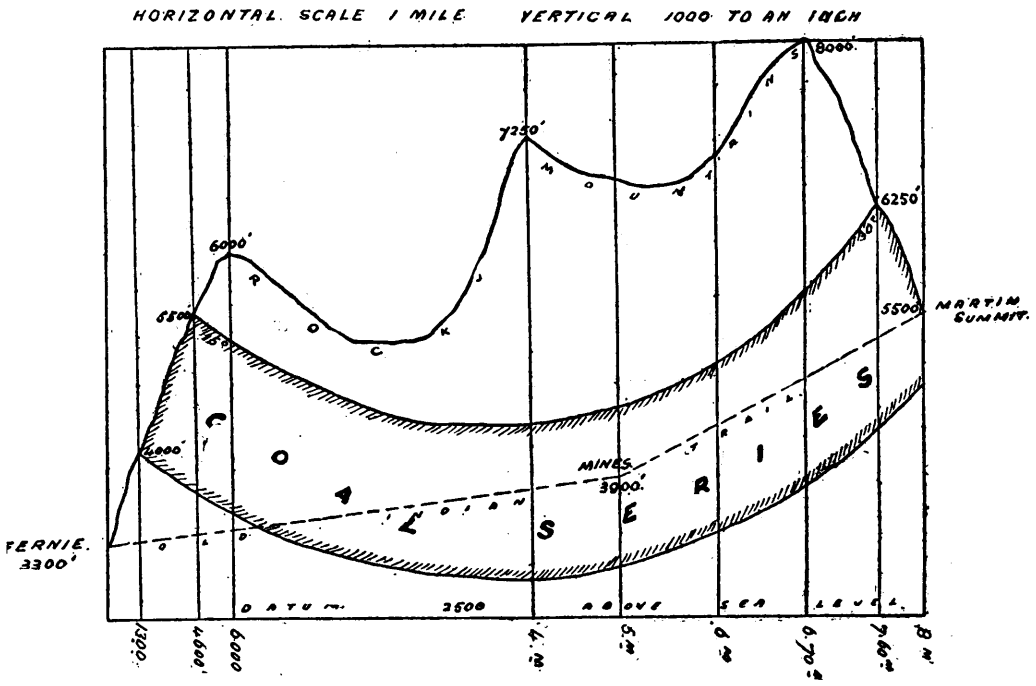
LIGHT.—The trestle is lighted by 16 pairs of incandescent lamps of 16 candle power. The main haulage roads are lighted by 40 similar lamps of 20 c. p., one lamp being placed at each turn in the road and 3 at each landing. Arc lamps were tried at first, but these proved unsatisfactory as they burned out quick by owing to coal dust.

Naked lights are used in all parts of the mines except those reported unsafe by the fire-bosses. In July, 1900, 40 Clanny safeties were in use but the company keeps on hand a sufficient supply for use by all underground laborers in case of emergency.

DRAINAGE.—Considering the extent of area developed below the drainage level there is but little water. The irregular ground prevents concentration into one or more main sumps. To remove the water

diggers. The picking-table is 60 feet long, 5 feet wide, and travels 40 feet per minute. The discharge of coal is regulated by means of friction gear attached to the driving shaft. The large coal and slack are discharged direct into cars standing on the sidings below. These cars are run down by gravity for filling, and again for coupling into trainloads, the grade for that purpose being 2 per cent. All the slack goes to Fernie for manufacture into coke. The grade of the spur from Fernie to the mines is 2 per cent.—length of 5 miles.

POWER.—Two Polson's fire-tube boilers, locomotive style, of 100 H. P. each supply steam at 100 lbs. pressure to the following engines: Dynamo engine, No. 2 fan engine, machine-shop engine and engine for screens and creeper. Steam for No. 1 fan engine is supplied by a small separate boiler. Two new boilers are being introduced to meet the increasing demands for steam as the mines rapidly develop. One is a water-tube boiler of the Polson make, Heine type, 200 H. P.; the other is a return tube boiler, horizontal furnace, 80 H. P. made by the Jeffrey Manufacturing Co., at Columbus, O. The dynamo is driven by a Polsons horizontal engine. It is a direct-current, constant-potential dynamo of 134 H. P., over-compounded 10 per cent. It supplies a current of 400 amperes on the line at 220-250 volts. The



met with in the lower rooms of No. 2 Mine, 2 Tripley electric pumps, 1 Sould hand pump and 1 water car are in use. The capacity of the electric pumps is about 20 gallons per minute, each of the 3 plungers working at 60 strokes per minute. Their position is shown in the plan. The small quantity of water met with in No. 1 is handled by 1 electric pump and 1 hand pump. Each of the electric pumps is driven by a 3 H. P. Motor.

SURFACE TREATMENT.—After being dumped by the Mitchell Tippler as above described the "run of mine" coal passes on to the screens. There are 2 mechanically driven shaker screens, 20 feet by 5 feet, with a working speed of 100 strokes per minute, the stroke being 6 inches. Their inclination is 17 degrees. The slack eliminated by the upper screen passes on to the under screen, which, as required, separates it into coking, and smithing or domestic coal. The screens are fitted with interchangeable, steel-wire bottoms of ¾ inch, and 1½ inch, mesh. The large coal is discharged by the upper screen upon a travelling picking-table from which the sorters remove any pieces of bone, slate or stone that may have escaped the notice of the

current is conducted into the mines by a figure-8 copper wire (equal to 00 B. and S. gauge) suspended on standard mine hangers. The dynamo supplies electricity for: 3 electric pumps, 2 locomotives, the hoist in No. 2 Mine and the incandescent lights at the surface and in the mines. Details of the boilers, engines, etc. will be given under "Statistics."

The disposition of the surface plant will best be made clear by referring to Photo No. 1.

DEVELOPMENT.—Besides the usual driving of narrow-work, at which 40 miners are employed, a new tunnel is being driven to each of the mines. That to No. 1, is a rock and gravel tunnel of 1¼ per cent. grade and is to serve as a main haulage road. Owing to striking a bed of quick sand after the rock had been pierced, excavation from within has been abandoned and has been begun from without. The dotted line in the plan indicates the unexcavated part. The short trestle shown to the right of the old trestle (in Photo No. 1) is for this tunnel. The new trestle is provided with gravity return for the coal-boxes and with an Ottumwa box-car loader.

The new tunnel to No. 2 Mine, (really a slope since it follows the dip) is shown in the plan. The first 60 feet is in gravel, the grade being 12½ per cent. At this point the tunnel enters the coal, when the grade becomes variable, as the seam is undulating. At 90 feet the drainage tunnel (shown in the plan) was driven. Rooms are to be branched from this slope, along the strike. The timbers used in the gravel tunnel were hewn 10 to 12 inches square and framed in sets as shown in the sketch (See page 27). These sets were placed at right angles to the dip, 4 feet apart from centre to centre. To prevent filling in, the sides and top were tightly lagged, the top lagging being 3 inches thick. The lagging was strengthened, when the tunnel was completed, by placing lining sets midway between the sets above referred to. Owing to the steep grade, this slope will be operated by a separate engine and cable.

OFFICE WORK.—Following is a brief account of the staff at the mines with the duties of each: One superintendent, who has complete charge, under the General Manager, of the mines and coke ovens; one assistant superintendent, who has charge of the mines only; 3 overmen, one on each shift, who have control of the ordinary miners and shift-men, but not of those employed in development work, these being under the immediate charge of the superintendent; 1 time-keeper and 1 assistant, who have charge of the store-houses and magazines, issue the time checks, powder, oil, tools and other mine supplies, and keep all the books necessary to account for these; one clerk, whose duties are to keep the "coal-tonnage" book and the "yardage and considerations" book, and to make out the daily report, which, signed by the General Manager is at once forwarded to the Managing Director at Toronto.

At the General Office at Fernie, the General Manager, who, under the Managing Director, has control of the Michel, the Erickson and the Coal Creek Collieries, is assisted by: 1 book-keeper, 1 type-writer, 1 clerk, 1 coal-shipper and weigher, 1 coal agent and 1 surveyor and helper.

A complete survey of the working-places is made once every 3 months and added to the large progressive plan kept at the general office, a tracing of which is immediately forwarded to the Managing Director. Minor surveys are made at shorter intervals as needed.

PRODUCTION.—About 50 per cent. of the total "whole coal" is at present left as pillars forming an enormous reserve for extraction when the upper seams shall have been exhausted. Of the coal extracted 40 to 45 per cent. is slack, which is entirely utilized for coke, the coke being of the best quality and in great demand.

The average daily output, July, 1900, was 700 tons, the total average cost of extraction and preparation per ton being $1.30. No doubt by this time, with the completion of the two new tunnels this output is more than doubled.

All the coal is of the class known as coking coal, lying between bituminous and anthracite in hardness and containing 80 to 90 per cent. of carbon.

COKE OVENS.—All the slack from the C. N. P. Co's. collieries is shipped to Fernie for manufacture into coke.

The coke-ovens are of bee-hive shape, 12 feet in diameter and 7 feet 3 inches high with open tops. When completed, there will be 500 of them, placed in two double rows, with 3 railway tracks one on each side and one between. The shape, construction, tracks, etc. are shown in Photos Nos. 4, 5 and 6.

The coking-coal is stored in the mammoth, double-decked, self-discharging bin shown in Photo No. 8. The bin has a capacity of 4,500 tons, cost $20,000, and required ¾ of a million feet of lumber in its construction.

The ovens are charged by the steam lorry (an electric lorry was used at first) shown in Photo No. 7, having a capacity of 7 tons of slack. The lorry-track, passing over the oven and under the bin, is of standard gauge, 4 feet 8½ inches.

The average charge of slack per oven is 6½ tons (2,000 lbs.); production of coke per charge, 4.42 tons; percentage of coke, 68; time of burning charge, 60 to 72 hours; average out-put per day, 1.4 tons.

No provision is made at present to recover any of the by-products.

The coke is cooled by watering inside the ovens. Coke thus cooled is said to be superior to that cooled outside the ovens, containing less moisture though the process deteriorates the inside lining of the oven and causes considerable loss of heat.

MARKET.—Both coal and coke have found a ready market and the demand for both is rapidly increasing. The distribution embraces the Territories east to Winnipeg, the Western States and British Columbia. Large quantities have been used by the C. P. Ry. and large consignments have been shipped to the Royal Navy at the Pacific Station. The coke finds a ready market at Trail, Butte, Anaconda and other smelter towns of the West.

TRANSPORTATION.—As before stated, the colliery is situated 5 miles from the Crow's Nest Branch of the C. P. Ry., with which it is connected by a spur of 2 per cent. grade. By means of this railway there is direct communication east and west but there is the serious drawback of high freight rates, resulting from lack of competition. Large consignments of coke, for smelting purposes, are shipped to the Western States via the Lethbridge and Great Falls Narrow Gauge Railway, 200 miles in length, which necessitates transhipment from broad to narrow, and again from narrow to broad gauge before reaching its destination. Application has been made for a charter for a branch railway connecting Fernie with a spur to be built from Jennings on the Great Northern.

It is highly probable that Fernie will become a great smelting town as it has, in addition to coke, an unlimited supply of limestone in the mountains near at hand.

Thus are being opened up, the vast resources of one comparatively small part of the unlimited mineral wealth of our Dominion.

STATISTICS.—I. *The Motor:* (See Photo No. 3). Length, 10 feet 6 inches; height, 3 feet 4 inches; width, 4 feet 7 inches; wheel centres, 3 feet 4 inches; gauge, 3 feet; driving wheels, 2 feet diam.; weight, 10 tons; H. P., 70; possible load, 17 boxes of 3,000 lbs. each; average loads, 13 boxes; speed, 8 m./h.; made at Columbus, O., by the Jeffrey M'f'g. Co.

II. *The Coal Boxes:* Made by blacksmiths and carpenters when not employed on repairs. Following are details: Capacity. 1 ton or with top setting (or "pitchings"), 3,000 lbs.; tare, 1,100 lbs.; material of box, 1½ inches spruce; length, 5 feet; depth, 2 feet; width, 4 feet; length over trams, 6 feet 6 inches; frame, 2 lengthwise pieces, 4 inches x 6 inches, acting as bumpers, and 3 cross-pieces, 4 inches x 6 inches. *Mountings:*—Front strap, 2 inches x ⅝ inch; middle strap, 2½ inches x ¾ inch; inside angle-iron, 3 inches x 1¼ inches; hinges for end dumping doors, 2½ inches x ½ inch x 23½ inches; strap round 2 sides and one end of box at top, 2¼ inches x 1¼ inches; wheels, Hadfield's patent, cast-steel, 12 inches diameter, 7 spokes; axles, 1⅞ inches diameter; wheel centres, 1 foot 10 inches; gauges 3 feet; wheels rotate separately on axles; total height of car above rails, 3 feet 3 inches; couplings, 3 links of 1 inch round iron and 2 clevises of 1¼ inches iron. Spragging is used by the drivers instead of brakes.

III. *Tracks:* Gauge, 3 feet; ties of main haulage roads, 5 feet x 4 inches x 6 inches—2½ feet from centre to centre, firmly spiked and fish plated. Motor rails, 40 pounds to the yard; stall rails 25

pounds to the yard; switches and frogs, made at colliery shops from F. B. rails. No. of track layers, 2 on each shift in each mine, 12 in all. Tools used: 1 combined pick and claw, 1 spike hammer, 1 shovel, 1 bar, 1 track-gauge, 1 "Jim Crow",—(for bending rails)—for for each mine. Also one track-cleaner is employed.

IV. *Engines:* *(a) Dynamo Engine:* Horizontal engine of Polson make; cylinder, 16 inches diam.; stroke, 16 inches; speed 225 strokes per minute; I. H. P. 150; cut-off, automatic, cutting-off light at 1/6th stroke; loaded from 1/6 up.

(b) No. 1 Fan Engine: Nagle horizontal engine; cylinder, 14 inches diam.; stroke, 16 inches; speed, 62 strokes per minute; cut-off at 3/4 stroke; B. H. P., 40; steam supplied by a 45 H. P. loco-tubular boiler with working pressure of 50 pounds per square inch; engine slowed down once in 2 weeks to fill oil-cups of crank and cross head.

(c) No. 2 Fan Engine: Atlas horizontal engine; cylinder, 12 inches diam.; stroke 14 inches; cut off at 3/4 stroke; speed, 130 revo per minute; steam supplied by 2 inch piping, from power-house boilers 500 feet distant—being first dried in an upright receiver; pressure, 100 pounds per square inch; engine stopped about 3 minutes every 24 hours to fill oil-cups of crank and cross head.

(d) Engine for Surface Plant: Upright; cylinder, 10 inches diam.; stroke, 12 inches; cut-off at 3/4 stroke; I. H. P., 22; steam supplied by power-house boilers 100 feet distant—not dried before using.

(e) Machine shop Engine: Upright; cylinder, 6½ inches diam.; stroke, 9½ inches; cut-off at 3/4 stroke; speed, 130 revs. per minute; I. H. P., 10; steam supplied from power-house boilers.

V. *Boilers:* In use in summer of 1900—2 Polson's fire tube boilers, locomotive style, of 100 H. P. capacity each, supplying steam at 100 pounds pressure to the engines mentioned above; diam.; 4 feet 6 inches; length, 23 feet; diam. of tubes, 3 inches; consumption of coal, 4 to 5 tons each per 24 hours; draft for each, 24 inch stack, 70 feet high. Two additional boilers were being added, one of the Polson make, Heine type of 200 H. P. capacity; the other of 80 H. P. capacity and made by the Jeffrey M'f'g. Co.

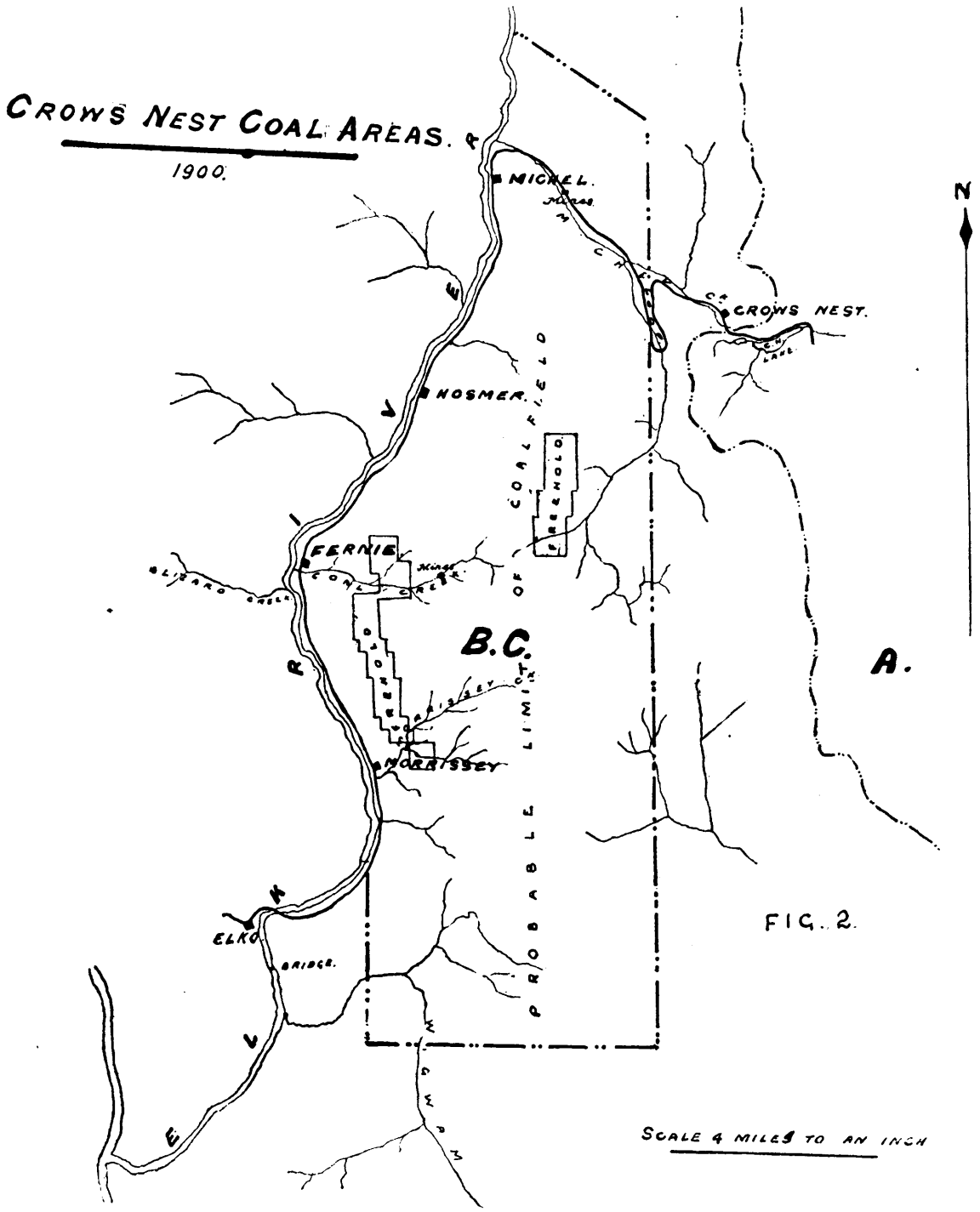
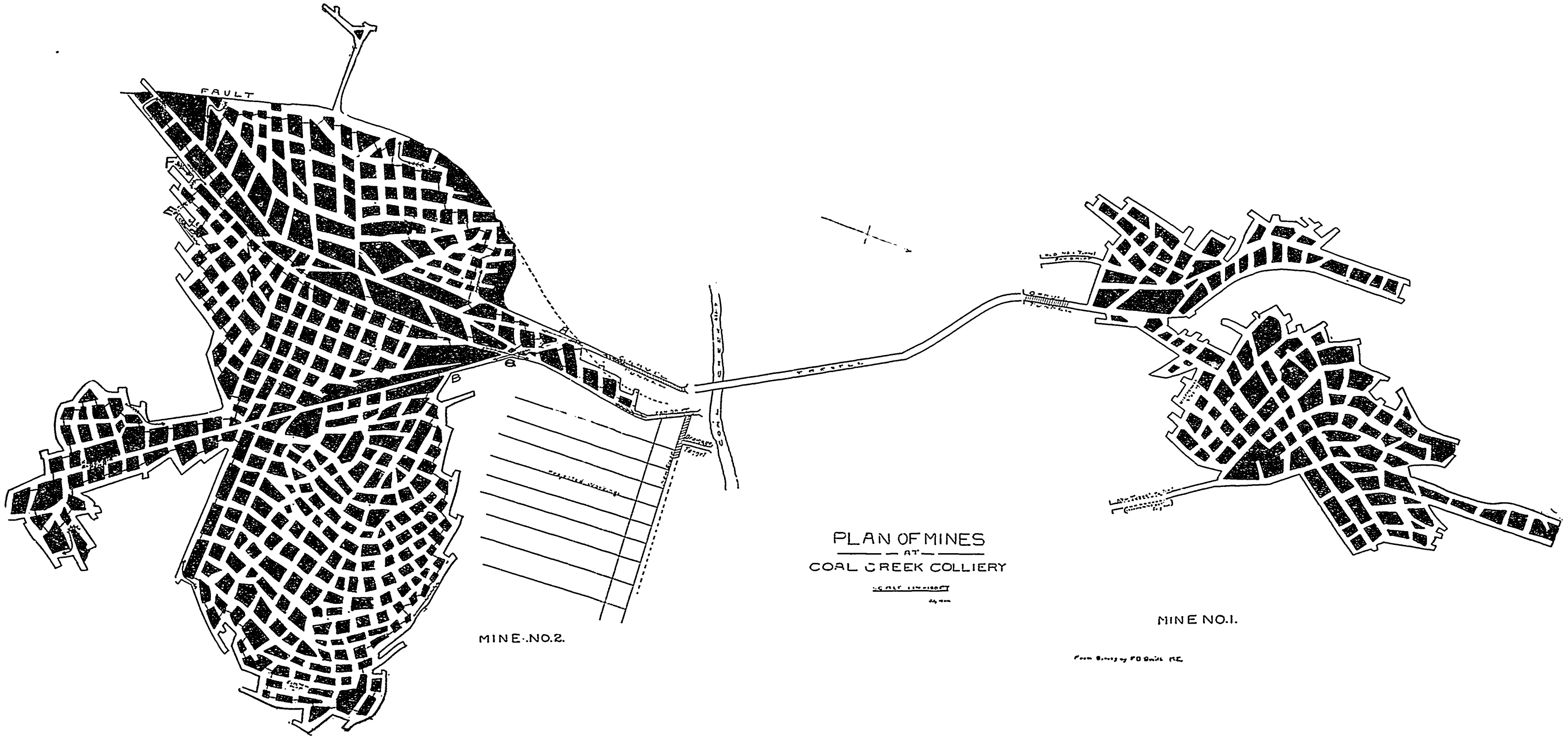
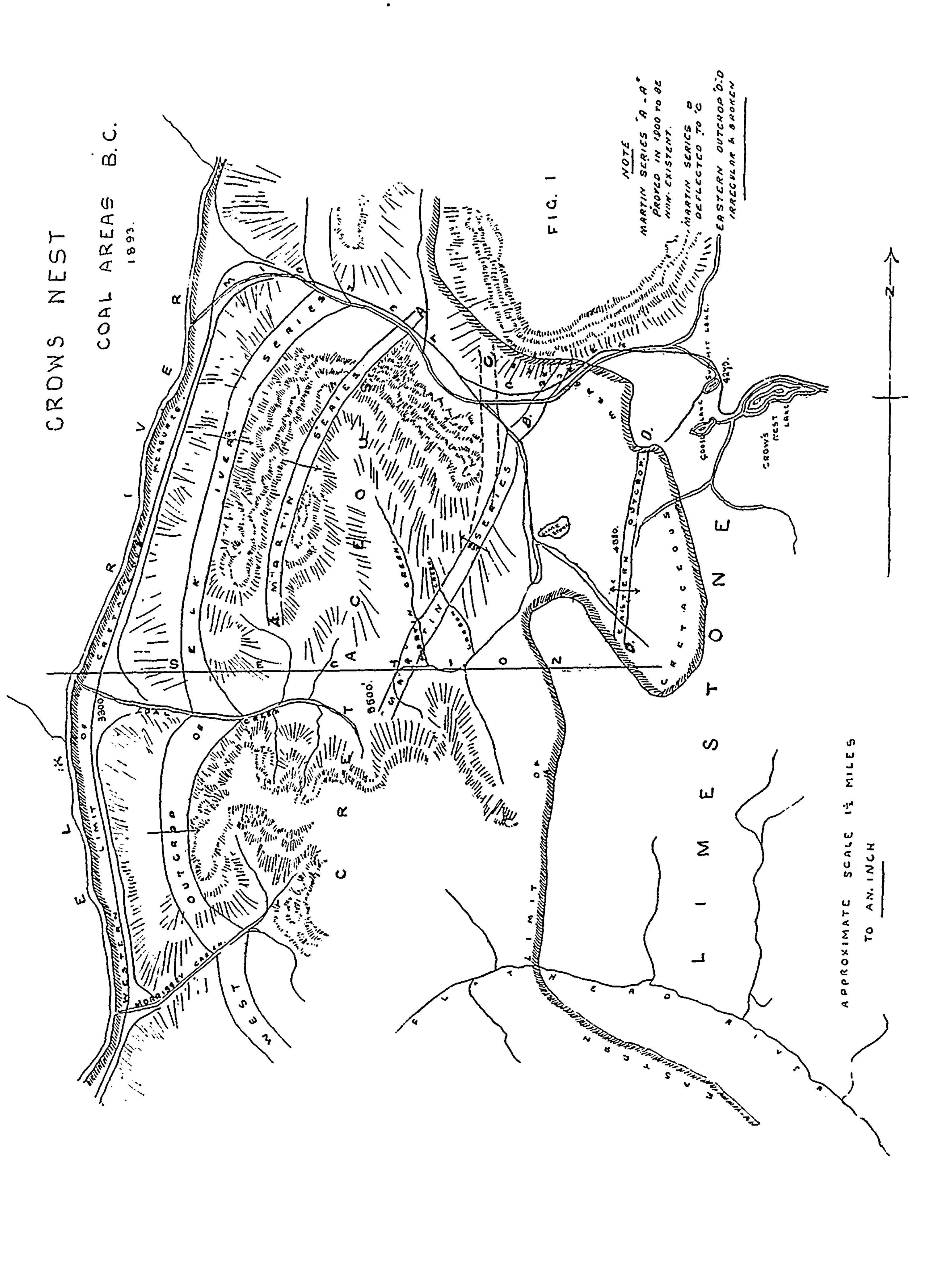


FIG. 2.



PLAN OF MINES
AT
COAL CREEK COLLIERY


CROWS NEST
COAL AREAS B.C.
1893.
FIG. I
NOTE
MARTIN SERIES 'A-A' PROVED IN 1900 TO BE NON-EXISTENT.
MARTIN SERIES D DEFLECTED TO C
EASTERN OUTCROP D-D IRREGULAR & BROKEN
ELK RIVER
WESTERN LIMIT OF CRETACEOUS
CRETACEOUS
LIMESTONE
EASTERN OUTCROP
MARTIN SERIES
ELK RIVER SERIES
OUTCROP OF COAL
WEST
MORRISSEY CREEK
FLATHEAD RIVER
CROW'S NEST LAKE
APPROXIMATE SCALE 1½ MILES TO AN INCH
N

VI *Costs etc:* Miners are charged for oil, powder, squibs and lost or broken tools, but not for tools and repairs.

Costs, last summer (1900) were as follows: Oil, 80c. to 90c, per gallon, powder, 15c. per pound, squibs, $1.00 per 100. Not more than 4 pounds of powder are allowed to a pair at one time.

The prices paid for work were as follows: Per ton, in rooms with nights, 60c. with closed lights, 80c. In narrow work the usual tonage is paid, also yardage, and $1 per set for timbers. In both wide and narrow work, "considerations" are allowed by the Superintendent for special difficulties—as for water, stone, slight faults or branching stalls. The allowance for branching a stall is $1.25; other "considerations" are settled as they arise.

VII. *Machine shop Fittings:* One Williams lathe; one drilling machine; two emeries; four jackscrews; three sets bolt dies; one set pipe dies; pipe vise; and the usual hand tools for keeping the engines and other mine machinery in repair. Three mechanics are employed besides three electricians, two engineers and one on repairs.

VIII. *Smithy:* Five blacksmiths are employed as follows: 1 steele-sharpener who sharpens all picks, augers, wedges and other tools used by the miners; 1 blacksmith and helper for new work; 1 blacksmith and helper for shoeing and repairing. All steel and iron used, together with the scrap, are meighed and charged to the job for which used; The number of hours spent on each job is also charged against that job.

IX. *Labor:* The average wages earned by the miners is $3 to $4 per day; general mine labor costs $2 to $2.75 per shift; general surface labor, $1.75 to $2; boys receive $1 to 1.75.

About 350 men were employed at the mines (July 1900), distributed as follows: (*a*) *Above Ground*, 2 weighmen, 2 tally boys, 6 bankmen, 6 slate pickers, 12 car loaders, 2 trimmers, (for trimming slack cars and box cars), 5 yardmen, 3 blacksmiths and 2 helpers, 2 carpenters and 1 framer, 3 mechanics, 3 on electric works, 2 firemen, 2 fan tenders, 2 engineers for screens, 3 prospectors, 8 on construction work 1 time keeper, 1 helper, 1 clerk. (*b*) *Underground*, (about 290 in all); 3 overmen, 5 fire.bosses, (2 shot-lighters and 3 bosses), 6 track-layers and 6 helpers, 2 driver bosses, 18 drivers, 4 motormen, 4 conductors, 2 on electric hoist in No. 2 mine, 6 landing tenders, (3 men and 3 boys), 10 pushers and incline men, 12 pumpmen, and bailers, 3 shiftmen, (sparemen on each shift for emergencies, e. g. of water), 4 timbermen, 12 on new rock tunnel work, 40 miners on yardage (narrow work), 120 ordinary miners in rooms. Length of shift under ground is 8 hours "from pits mouth to pits mouth."

The Composition of Some Canadian Limestones.

(A) For Calcium Carbide. (B) For Chemical Wood Pulp. (C) For Portland Cement.

By J. T. Donald, M.A., Montreal.

The rapid development of industries in which lime or limestone is a raw material has given a new interest to this common mineral.

The term limestone, however, as generally used includes any rock in which carbonate of lime is the predominant ingredient.

This of course gives a wide range of composition.

The ideal limestone is pure calcium carbonate containing 56 p.c. of lime and 44 p.c. of carbon dioxide.

The conditions under which beds of limestone have been deposited were such that it is scarcely possible to find them fully up to our ideal in degree of purity.

Being a sedimentary rock, we usually find limestone containing more or less siliceous matter, either as silica or as silicates.

The amount of siliceous matter may vary from a few tenths of one per cent. up to even forty or fifty per cent.; in which latter case it is a question whether we should consider we have a sandy limestone or a calcareous sandstone.

But again, in nature we usually find that carbonate of lime is associated with carbonate of magnesia; indeed, it is scarcely possible to find a limestone that does not contain an appreciable percentage of magnesia; whilst on the other hand the magnesia may occur in such percentage that the stone becomes a magnesian limestone or dolomite, which normally contains: Lime 30.40 p.c., Magnesia 21.70 p.c., Carbon dioxide 47.90 p.c.

In addition to silica or silicates and magnesia, all limestones contain more or less of what someone has aptly called the "intruder into everything on earth" viz., iron, in the form of iron oxide or iron sulphide.

The principal industries that call for limestone as one of their raw materials, are:

Calcium Carbide.
Chemical Wood Pulp.
Portland Cement.

The object of this brief paper is to state in a general way the characters of the limestone required in each of these industries, illustrating by reference to Canadian limestones that have been analysed by the writer.

(A) *Calcium Carbide.*

A limestone to be suitable for the manufacture of this article should be as nearly as possible pure calcium carbonate. The presence of magnesia is particularly detrimental. A small percentage of siliceous matter and a little iron oxide may be tolerated. These points are illustrated by the following analyses.

I.—Is being used in a Canadian carbide works.

II. and III.—Are unsuitable for carbide; II. because of the magnesia it contains; and III. on account of the high percentage of siliceous matter.

	I.	II.	III.
Insoluble	——	2.14	10.92
Carbonate of Lime	96.89	52.00	87.71
Carbonate of Magnesia	1.64	42.71	.30
Iron Oxide	——	2.20	.70

(B) *Chemical Wood Pulp.*

For soda pulp, *i.e.* pulp made by "cooking" the spruce or other wood in a solution of caustic soda, any ordinary good limestone will yield a lime suitable for causticising the soda.

But in the case of sulphite pulp it is otherwise; selected material is required. In this case the presence of magnesia is desirable, indeed the higher the percentage of magnesia, the more desirable is the stone. But iron is decidedly objectionable; its presence causes discoloration of the pulp. The following analyses are of Canadian limestones.

I. is an excellent stone for sulphite pulp. II. whilst good in other respects contains too much iron. III. does not contain sufficient megnesia.

	I.	II.	III.
Insoluble	2.10	2.14	.14
Carbonate of Lime	56.21	52.00	98.78
Carbonate of Magnesia	41.20	42.71	Traces.
Iron Oxide	.09	2.20	.19

(C) *Portland Cement.*

This article is made by calcining a mixture containing proper proportions of silica, lime and alumina; this is usually a mixture of limestone and clay. A somewhat wide range of material is admissible in this industry. Magnesia is debarred to the extent that the finished cement must contain less than 3 per cent. of magnesia.

A limestone comparatively high in silica is admissible here, provided a clay or shale rich in alumina is obtainable.

A certain kind of impure limestone is the sole raw material for certain kinds of Portland cement. This is commonly known as natural cement rock. It is really an argillaceous or shaley or clayey limestone; that is, it is the materials for Portland cement ready mixed by nature.

The following analyses illustrate the statements just made.

I. is an ordinary limestone suitable for cement. II. contains too much magnesia. III. is a natural cement rock.

	I.	II.	III.
Insoluble	1.51	20.23	24.74
Carbonate of Lime	97.21	50.37	41.80
Carbonate of Magnesia	1.15	24.63	8.60
Iron Oxide	.17	2.81	6.30

The Analysis of Corundum and of Corundum Rock.

By Dr. W. L. Goodwin, Kingston, Ont.

Since the discovery of corundum in Eastern Ontario the writer has been obliged to pay considerable attention to the analysis of the rock in which the corundum occurs, and particularly to the determination of the percentage of corundum, of iron, and of silica. Each of these determinations presents difficulties of its own.

Determination of Corundum.—The percentage of corundum can be arrived at in three different ways, two of which are fairly accurate, viz. (1) The hydrofluoric acid method, and (2) the specific gravity method; while the third is only approximate, viz: (3) separation by heavy solution. These methods have all been used in the laboratories of the School of Mining, and (1) and (2) have been shown to give concordant results. Details of the separation by hydrofluoric acid may be of service.

The Hydrofluoric Acid Method.—Hydrofluoric acid attacks corundum very slowly at temperatures up to 100° C, but more rapidly at higher temperatures. On the other hand it quickly disintegrates the minerals which accompany corundum. The effect of temperature is shown by the following results, which were obtained by treating the ground sample in a platinum crucible heated by a small Bunsen flame. The sample was moistened with sulphuric acid, covered with sufficient hydrofluoric acid, and evaporated until fumes of sulphuric acid appeared. The soluble matter was washed out and the insoluble corundum ignited and weighed. The samples were all alike. The percentages of undissolved corundum were 83.58, 89.02, 81.63, 80.06, 69.75, 77.48, and 74.77. The variation is very marked. This sample contains 93 68 per cent. of corundum, as shown when the evaporation is carried on on a steam bath, followed by heating with a Bunsen burner until fumes of sulphuric acid just appear. For this determination it is not necessary to grind the sample very fine. Crushing in a 'diamond' mortar is sufficient. Two samples of another lot gave 95.64 per cent. and 95.38 per cent. To test the insoluble residue from another specimen, it was fused with Na H S O_4, and from the dissolved melt, the alumina, etc. were precipitated by ammonia, with the following results:—

Insoluble in H F and H_2 S O_4 ..... 92.16 per cent.
Alumina, etc. in this insoluble part. .. 92.16 "

To test the applicability of the method to corundum rock a mixture was made of 20 per cent. of pure corundum and 80 per cent. of tailings containing at most a trace of corundum. This yielded on analysis 20.32 per cent. insoluble in H F and H_2 S O_4. Three samples from 500 lbs. of corundum rock gave

	Insoluble in H F and H_2 S O_4.
I.	21.01 per cent.
II.	20.51 "
III	19.28 "

Sample I. was treated without previous ignition. Sample II. was ignited, and sample III. was ignited for a longer time than II. Ignited corundum was shown by other experiments to be attacked to a greater extent than when not ignited. This is perhaps due to the disintegration of the granules by the escape of the combined water, which amounts in a 93 per cent. sample to about 1.5 per cent.

Determination of Corundum by Specific Gravity.—This method is applicable to the concentrates freed from magnetite. The approximation to the results of the chemical method is very close, as shown by numerous experiments. For example, the specimen which by chemical analysis showed 93 68 per cent. of corundum, gave 93.71 per cent. by specific gravity. The calculation is made on the basis of a specific gravity of 4 for the corundum and of 2.7 for the impurities (mostly feldspar).

Determination by Separation with Heavy Solution.—By this method the results are only approximate, as the corundum carries down adherent feldspar and mica, thus giving too high a percentage of corundum.

For the sample already mentioned the following are the comparative results by the three methods:

I. By chemical analysis 93 68
II. By specific gravity 93.71
III. By heavy solution 95.23

Determination of Iron and Silica.—The principal difficulty here is to grind the sample finely enough without picking up iron from the mortar. Experience has showed that a considerable percentage of iron is added by crushing in a 'diamond' mortar. Attempts were made to estimate this and to apply a correction, by estimating the iron soluble in acetic acid, and calculating this as metallic iron derived from the mortar. The following results were obtained:—

	Fe dissolved by Acetic Acid.
Sample I.	0.57 per cent.
" II.	0.32 "
" III.	0.20 "

This method was abandoned in favour of crushing and grinding a weighed quantity of the grains a little at a time in a large agate mortar closely covered with paper, and finding the gain in weight. In this sample both iron and silica can be estimated, as the gain in weight can be taken as silica. To illustrate the magnitude of this correction the following will suffice:—

	Weight of Sample.	*Gain from Mortar.*	*Percentage Gain.*
1.	0.4702	0.0039	0.83
2.	1.0000	0.0122	1.22
3.	1.0000	0.0073	0.73
4.	1.0000	0.0029	0.29
5.	1.0000	0.0034	0.34
6.	1.0000	0.0084	0.84
7.	1.0000	0.0211	2.11
8.	1.0000	0.0106	1.06
9.	1.0000	0.0209	2 09

Nos. 1, 2, 3, 6 and 8 are high grade corundum grains.

Nos. 4 and 5 are corundum rock containing about 20 per cent. of corundum.

Nos. 7 and 9 are pure corundum.

The difference in the abrading effect on the mortar is marked.

The sample is fused with Na H S O_4, as recommended by Lawrence Smith, and dissolved. The iron is estimated by titration in the soluble portion. The insoluble portion is ignited and weighed as Si O_2. As a check, the silica may be volatilised by H F and the residue, if any subtracted.

Corundum is now being produced at Combermere by the Canada Corundum Co. of a very high grade, viz. 95 p.c. corundum. When it is remembered that manufacturers have heretofore been satisfied with an 80 per cent. product, the outlook for the Canadian industry seems very bright.

CANADIAN MINING INSTITUTE.

Annual Meetings Largely Attended.—Valuable Papers—Interesting Discussions.

The annual General Meetings of the members of the Canadian Mining Institute were held as usual in the Club Room, Windsor Hotel, Montreal, on Wednesday, Thursday, and Friday, 6th, 7th, and 8th March. There was a large attendance of members, including quite a number of mining students from McGill University, Montreal, and Queen's University, Kingston.

WEDNESDAY SESSION.

The sessions opened on Wednesday afternoon at three o'clock. Mr. John Hardman, S.B., M E., Montreal, being called to the chair, in the unavoidable absence of Mr. S. S. Fowler, the President.

The minutes having been held as read:—

NEW MEMBERS.

The Secretary submitted the following names, having received the approval of Council, for election :—

Mr. W. F. ROBERTSON, Mining Engineer,
Provincial Mineralogist for B.C., Victoria, B.C.

Mr. FRANK B. SMITH, Mining Engineer,
Fernie, B.C.

Mr. JOHN NORTHEY, Mechanical Engineer,
Toronto, Ont.

Mr. C. D. MAZE, Civil Engineer,
Montreal, Que.

Capt. BRUCE CARRUTHERS,
Kingston, Ont.

Mr. CHARLES H MACNUTT, Mining Engineer,
Pulacayo, Bolivia, South America.

Mr. F. N. SPELLER, B. A. Sc.
Bureau of Mines, Toronto, Ont.

Mr. HARRY WILSON, Mining Engineer,
Montreal, Que.

Mr. HARRY W. WELLER, Mechanical Engineer,
Montreal, Que.

Mr. D. E. K. STEWART,
Madoc, Ont.

Mr. FRED M. WELLS,
Republic, Washington.

Mr. H. C. FARNUM, Gen. Mgr. Copper King Mining Co.,
Eldorado, Ont.

Mr. ROBERT R. CARR-HARRIS, Civil Engineer,
Kingston, Ont.

Mr. SMITH CURTIS,
Rossland, B.C.

Mr. JOHN DEAN,
Rat Portage, Ont.

Mr. C. A. CHESTERTON,
Rat Portage, Ont.

Mr. H. C. MICHELL,
London, England.

Mr. J. E. ALDRED,
Montreal, Que.

These, together with about twenty others approved by Council, were duly declared elected members, subject to the provisions of the Constitution and By-laws.

SECRETARY'S REPORT.

Mr. B. T. A. BELL, Secretary, then reviewed the operations of the Institute during the year. The membership had grown from 192 in 1898, when the Institute was formed, to 323 in 1900, including 14 student members. In Canada, the membership by Provinces was : Nova Scotia, 19; New Brunswick, 2 ; Quebec, 77 ; Ontario, 91 ; British Columbia, 71 ; Northwest Territories, 5 ; Newfoundland, 2. Six members had been removed by death viz :—Mr. James King, Quebec ; Dr. George M. Dawson, Ottawa ; Dr Carl Hoepfner, Hamilton ; Mr. Ernest Bielenberg, Greenwood ; Mr. Barclay Stephens and Mr. James Foley, Montreal. Four members were absent in South Africa, serving with the colors. A reference was made to the work done by the Institute towards securing better mining legislation and in extending the library and reading-room of the Institute, and to the elaborate series of excursions carried out during September, when the Institute had as its guests the members of the American Institute of Mining Engineers. The Report, on motion of Mr. W. Blakemore, was unanimously adopted.

TREASURER'S REPORT.

Mr. J. STEVENSON BROWN submitted his audited financial statement, showing the receipts for the year to have been $1,055.37, and disbursements $3,424 76, leaving a cash balance forward of $630.61. The disbursements included :—Publications, $775.76 ; Library, $561.75 ; Meetings, $335 07 ; Legislation, $271 25 ; Secretary's Office, $674.60 ; Treasurer's Office, $316.09; General Disbursements, $487.24.

The Report was unanimously adopted.

DEATH OF DR. DAWSON.

Mr. B. T. A. BELL said that every member of the Institute and every mining man in Canada deplored the untimely death of Dr. Dawson, the honoured head of the Geological Survey, and their late Vice-President. As Dr. Ami would present a memoir of the late Director at a later stage of the proceedings he only desired to intimate that the Council had decided to appropriate the sum of one hundred dollars and open a subscription among the members for the purpose of presenting to the Museum of the Survey a memorial portrait of the late Dr. Dawson, and also one of his predecessor, Dr. Selwyn.

Mr. WM. BLAKEMORE, seconded by Mr. P. KIRKGAARD, moved the following resolution :—"That the Canadian Mining Institute, in annual session assembled, desires to place on record its sense of the deep loss sustained by the Dominion of Canada, and especially by the mining profession of this country, in the lamentable death of Dr. George M. Dawson, late Director of the Geological Survey of Canada. It recognises the immense value of the services which he rendered in the important position which he occupied with such distinguished ability, and not least, the high qualities of mind and personal character which he displayed. The Institute wishes further to express its sympathy with his surviving relatives in their irreparable loss, and herewith forwards a copy of this resolution to them."

The motion was unanimously adopted.

SURVEY STAFF INADEQUATELY PAID.

Mr. B. T. A. BELL.—The matter of an appointment to fill the responsible position vacated by the death of Dr. Dawson seemed appropriate to direct attention again to the absolutely inadequate character of the remuneration given to the officers of the Geological Survey. It was little wonder that every year saw the ranks of this important branch of the public service depleted of some of its most valued officials. Only lately Mr. A. P. Low had been secured at a large salary by a Philadelphia Syndicate. Mr. W. A. Carlyle was managing the Rio Tinto Mines, in Spain, at a salary of $25.000 per annum. Mr Coste, Mr. J. B. Tyrrell, Dr. Lawson, and Dr. Adams, were other examples of members of the Geological Survey who had greatly bettered themselves by leaving the Survey. While, of course, it was not to be expected that the Government could compete with private corporations in the matter of salaries, everyone would admit that the remuneration provided by the Government for the gentlemen occupying positions on the Survey was altogether too small for technical officers. Some representation might well be made to the Government on behalf of the Survey, not only on account of the inferior salaries paid its officers, but also regarding the wholly inadequate and dangercus character of the building provided for its valuable museum and offices. It was time more suitable premises were provided for the Survey's invaluable collections. He was in favor of sending a deputation from the Institute to press these matters on the Government. (Applause)

Dr. W. L. GOODWIN (Kingston) endorsed the remarks of the Secretary. Every member of the Institute agreed that the mining men would have to educate the legislators to the importance of the work done by the Survey for the development of the mineral resources of the country. He believed a committee should be appointed to draw up strong resolutions to be presented to the Government on the subject.

Mr. E. D. INGALL, of the Geological Survey, remarked that there was one point that had not been touched upon. The museum which the Institute and all mining men advocated would be a national museum, and the Geological museum would be a portion thereof. At the present time they had many valuable specimens which might be very instructive to those interested in mining, but they had to keep these specimens in boxes, as there was no room to display them. He thought it highly important to secure a safe display for the exhibits. The men in charge could be replaced if the building tumbled about their heads, but the exhibits could not be duplicated.

Dr. FRANK D. ADAMS, of McGill, considered the subject one of national importance. While the Government could not be expected to pay the salaries that are offered by some of the mining companies, the salaries should be such as would be an inducement to good men to remain with the Survey, which had done and was still doing such excellent work for the development of the country.

Professor CARR-HARRIS advocated the appointment of a delegation to draw up resolutions and present them to the Government.

The Chairman appointed the following delegation :—Prof. Carr-Harris (chairman), Kingston ; Dr. Adams, Montreal ; Charles Fergie, Westville, N.S ; W. Blakemore, Montreal ; B. T. A. Bell, Ottawa ; A. J. Moxham, Sydney ; H. M. Whitney, Boston ; F. H. Clergue, Sault Ste Marie ; Bernard MacDonald, Rossland ; S. S. Fowler, Nelson, B.C. ; and J. M. Clark, K. C., Toronto.

SCRUTINEERS APPOINTED.

On motion, Messrs. P. Kirkegaard, Charles Brent, and Wm. Blakemore were appointed scrutineers to examine the ballots for the election of officers.

NEXT PLACE OF MEETING.

It was decided to report to the Council the desirability of holding the summer meeting of the Institute in Eastern Ontario, making Belleville headquarters.

CIVIL ENGINEERS' BILL.

PROFESSOR CARR-HARRIS (Kingston) then brought up a matter which he believed was of great interest to every man present and to all mining men. The Canadian Society of Civil Engineers had made an effort to establish themselves as a close corporation. These efforts had been unsuccessful several times in Ontario and in the Dominion Parliament. They had also failed on e or twice in Quebec but finally had succeeded in getting their act of incorporation through the Legislature of this Province. He himself had joined the Society years ago on the understanding that it was not to be a close corporation but when they tried to obtain legislation to that effect he had left them. He represented that some of the claims laid before the legislators were unfounded and produced letters to show that the Institu e of Civil Engineers of England and the Association of Civil Engineers of the United States were not protected by law as close corporations. He invited engineers to join the Dominion Institute of Federated Engineers, which included such men as Sir Sanford Fleming and welcomed members whether they had gone through the course prescribed by the rival association or not Professor Carr-Harris concluded by cautioning members of the Institute against entertaining any half way measures or compromises regarding the Bill.

The Session adjourned at 5:30 p m.

EVENING SESSION.

The Members reassembled in the Club Room at eight o'clock, Mr. Hardman presiding.

The following papers were presented:—

"Across the Pitch vs. Up the Pitch." By O. E. S. Whiteside, M. E., Anthracite, N. W. T.

"Notes on Gold Milling Practice at the Athabasca Mine, Nelson, B. C." By E. Nelson Fell, A. R. S. M., Nelson B. C.

"Leaching Copper Ores by Sulphurous Acid " By E. P. Jennings, M. E , Salt Lake City, Utah.

"Shipping Coal by the Aerial Wire Rope System at Port Morien." By J. G. S. Hudson, M. E., Port Morien, C. B.

"A Simple and Convenient Instrument for Mine Surveys." By Frank Robbins, M. E., Kimberley, B. C.

"Rope Driven vs. Direct Driven Colliery Fans." By Francis T. Peacock, Montreal.

"Pioneer Work on The Crow's Nest Coal Areas." By Wm. Blakemore, M. E , Montreal.

"On the Iron Ore Deposits of Bilbao, North Spain " By Dr. Frank D. Adams, Montreal.

INSTITUTE RECOMMENDS DR. ADAMS AS SUCCESSOR TO DR. GEORGE M. DAWSON.

On the conclusion of Dr. Adams interesting and valuable paper which was beautifully illustrated by lantern projections, the Secretary stated that his attention had been called to an item in the evening paper announcing that the appointment of a successor to the late Dr. Dawson, Director of the Geological Survey had not been made. In this connection he desired to say that at a meeting of the Council held on the previous evening the Council had unanimously agreed to recommend to the Government the appointment of Dr Frank D Adams. Dr. Adams was eminently qualified to fill this important and responsible position. (Applause.) He would therefore on behalf of the Council submit their recommendation for the endorsement of the meeting

Mr James F. Lewis (Sherbrooke) said he had very great pleasure in moving that the recommendation of the Council nominating Dr. Adams be approved.

The motion having been agreed to unanimously the Secretary was instructed to forward the following telegram to the Hon. Clifford Sifton, Minister of the interior:—

> "Canadian Mining Institute at a large and representative meeting to-night unanimously recommends the appointment of Dr. Frank D. Adams an old member of the Survey staff and Logan professor of geology at McGill, as successor to the late Dr. G. M. Dawson."

INVITATION TO VISIT THE MINING LABORATORY AT McGILL.

Dr. Porter at McGill extended to the visiting members the usual invitation to visit the mining laboratories of McGill University which they would find most interesting.

MEDAL FOR STUDENTS.

The Secretary intimated that the Council had decided to appropriate Friday morning for a Student's Session and that their President elect, Mr. Charles Fergie, had agreed to donate a gold medal for the best Student's paper contributed to the proceedings of that session.

The meeting adjourned at 10: 0 p. m.

THURSDAY AFTERNOON.

The members met at three o'clock, Mr. Hardman in the chair. The following papers were presented:—

"Notes on the Magnetic Iron Sands of the North Shore of the St. Lawrence " By Mr. J. Obalski, Inspector of Mines, Quebec.

"On the Occurrence of Nickel in Oregon." By Dr. A. R. Ledoux, New York.

"On the Treatment of Auriferous Mispickel Ores" (Two papers). (*a*) By Mr. P. Kirkgaard, Deloro, Ont. (*b*) By Mr. Sydney B. Wright, Deloro, Ont.

After discussion on these papers Dr. Henry M. Ami presented a comprehensive sketch of the life and work of Dr. George M. Dawson.

The meeting adjourned at 5 45 p.m.

THURSDAY EVENING.

Mr. Hardman took the chair at 8.15 p.m.

AUDITORS APPOINTED.

On motion, Messrs. H. W. DeCourtenay and George Macdougall were reappointed auditors for the ensuing year.

Dr GOODWIN then presented his paper "On the Analysis of Corundum and Corundum Rock."

NOTICE OF MOTION.

Mr. J. STEVENSON BROWN, Treasurer, gave notice that at the next Annual Meeting of the Institute he would move that all rebates on Provincial Societies' subscriptions be abolished.

MINING PROGRESS IN 1900.

Mr. B. T. A. BELL, Secretary, then presented the balance of his annual report in which he reviewed in considerable detail some of the more salient features of mining enterprise throughout the Dominion in 1900. A conservative estimate he said, would place the value of the mineral production at not less than $67,000,000 as compared with $47,275,512 in 1899. Roughly speaking the production might be distributed as follows:—

Yukon, N. W. Territories and Manitoba.....	$28,000,000
British Columbia.....	16,000,000
Ontario.....	9,283,424
Quebec.....	3,000,000
Maritime Provinces.....	11,000,000

Returns from British Columbia while not complete gave a very fair idea of the progress made in that Province. So far they indicated: Tonnage ore mined 90 per cent. increase, Gold production 20 per cent. increase, Silver 35 per cent. increase; Copper 20 per cent. increase; Lead 200 per cent. increase, and increase in the value of lode mines of from 50 p. c. to 60 per cent. The Vancouver Island Collieries are expected to have at least held their own, while the output from the Crow s Nest Pass had risen from about 69,000 tons in 1899 to over 230,000 in 1900 and this increase of 161,000 tons will about represent the increase in the total production. From the Yukon the gold output had increased from about $17,300,000 in 1899 to over $25,000,000 in 1900. Returns from the Assay office, Seattle, showed dust and bullion from the Yukon received during the year $16,946,437.68, and purchased by the U. S. Mint and Selby Smelting Co., San Francisco, during eleven months, 1st Jan. to Nov. 30th, $5,395,000, to which would be added dust taken out but not reported, dust used in the country as a medium of exchange, at least another $3,000,000. Several thousand tons of coal were mined in the territory, and 531 tons exported to United States Territory. Dredging for gold on the Saskatchewan was still in an experimental stage, but this industry had a promising future. The coal output in the North-west Territories was Bituminous coal. 304,000 tons; anthracite coal, 17,500 tons. In Assiniboia the production of lignite at Roche Percee and Coal Fields will show an increase over previous years. In Manitoba prospecting for gold was being carried on in the district lying adjacent to the Western boundary of the Province of Ontario. The gypsum deposits lying north of St Martin were also being opened up. The total value of the mineral output of Ontario for 1900 was $9,288,424, as compared with $8,789,901 in 1899. 11,109 persons were employed, and the wages paid amounted to $3,364,400. The prominent features were the great expansion in the production of copper, nickel, and iron. In Quebec the notable feature was the flourishing condition of the asbestos industry, the shipments for the year being the greatest and most valuable in the history of the industry, being:—From Thetford mines 31,254,700 lbs., from Black Lake 6,896,565 lbs., and from East Broughton 1,789,000 lbs. Including all districts the shipments of asbestos amounted to 23,251 tons and nearly 7,000 tons of asbestic, the whole of a value at the mine of not less than $1,000,000. The iron, pyrites, mica, graphite, gold, and other industries were touched upon.

Entering, as they unquestionably are, upon an era of immense activity, the coal iron, and steel industries of Nova Scotia occupied a foremost position in the mineral expansion of the year. The output of coal was the largest in the history of this industry. New collieries were being opened up at Port Morien, at Port Hood, Broad Cove and other parts of the Province. Mr. Bell then dealt with the iron, gold, gypsum, and other mineral industries, concluding a comprehensive review with statistics showing the pig iron, steel and lead bounties paid, and the quantities and values of mining and smelting machinery imported free and dutiable during the year.

Mr. E. D. INGALL, Chief of Division of Mineral Statistics confirmed the estimates of production given by Mr. Bell, and pointed out that one interesting feature he had omitted was the fact that phosphate is being shipped from Tennessee right to Buckingham, which used to be the centre of our phosphate industry.

MR. W. BLAKEMORE—I should like to say a few words on the extremely interesting and valuable report presented by our Secretary The only difficulty is to grasp so much material as he has laid before us. Whatever else may have happened, it is evident we are face to face with a very large and satisfactory increase in the mineral production of Canada. An increase of 35 per cent is certainly very large. An interesting feature is that some of these developments are even more significant than the value indicates. For instance, the very large increase in the output of coal is significant, for all our industries or nearly all are dependent upon coal, and the large increase indicates the busy state which prevails in our other industries. We are all aware of the gigantic steel plant that is being developed and which was wanted to promote the consumption of our ore in Canada. There is no doubt that within a few years this will call for an increase in the production of coal that we perhaps do not now even estimate and a consequent large increase in population and prosperity. Recently I have been more interested in the west than in the east You know the effect there upon the smelting industry of a suitable and cheap coke. There is a larger market over the border than in Canadian territory—a legitimate and natural market for Can-

adian coke and it must go there, because there is no suitable coke produced over the border. As to the difficulty of transportation, that can be overcome by standardizing the narrow guage railway that runs from Lethbridge, and it would enable British Columbia coke to be laid down at Butte, Condor, and Helena at from $2 to $3 per ton cheaper than American coal. I have no doubt that that enterprise in the West will be the source from which all supplies of coke will be drawn for the West for use in both Canadian and United States territory, for smelting purposes. There is another question—that of sending coal from the East further into Canada. All the coal consumed in the centre of Canada comes from the States; but there are indications that it may be possible to send Nova Scotia coal as far west as Winnipeg. With a good waterway from Montreal to the Lakes, which I believe you will have before very long, and with the splendid iron ore from the shores of Lake Superior which is necessary to mix with the Nova Scotia ore to produce perfectly satisfactory results in Cape Breton steel-making, there will be a return cargo for boats which can take coal up to the lakes, and this will make it possible to lay coal down in Winnipeg for less than $7 a ton. I will leave other gentlemen to speak of the lead and silver; but as to the coal, iron, and steel industries, I can see that some of the anticipations in which I ventured to indulge when I came to this country, eight years ago, are being realized As mining men we wish every success to the great enterprises which are being established in our midst, and which have a very reasonable probability of success.

Mr. CHARLES FERGIE moved a vote of thanks to Mr. Bell for his excellent paper.

Dr. GOODWIN—I listened with much pleasure to the secretary's most exhaustive report. There is one part of it I should like to remark on, as being more particularly interested in the mineral development of Ontario, and that is the production of mica I didn't gather that Mr. Bell gave any figures of the output of this mineral.

Mr. BELL—Yes; I quoted Mr. Gibson's figures of the production in Ontario. The bulk of the mica produced in Canada comes from Ottawa County, in Quebec, but it is difficult to approximate the value of the output. The figures published by the Government are not to be relied upon, being very much under estimated.

Dr. GOODWIN—I understood Mr. Bell to say that the mica producers had formed an organization of some sort?

Mr. BELL -Yes, they have formed the Canadian Mica Miners' Association, an organization of which I happen to be the Secretary. We are collecting and have a mass of useful data concerning the consumption of mica which for commercial reasons we desire to keep to ourselves. There is some talk of the producers forming a trust or combine with a view to regulating prices, and extending the market for Canadian mica, but I am doubtful whether this will ever be accomplished.

Mr. A. B CLABON (Rossland) gave some interesting particulars of the progress of mining in British Columbia, the outlook for which, he said, was never more promising.

The vote of thanks to Mr. Bell having been carried unanimously the meeting adjourned at eleven o'clock.

FRIDAY MORNING.

Friday morning was devoted to a student's session, when valuable papers were contributed by Dr. J. Bonsall Porter and a number of the mining students at McGill.

FRIDAY AFTERNOON.

Mr. P. KIRKGAARD, on behalf of the scrutineers, reported that the following had been unanimously elected, the officers and Council for the ensuing year being :—

PRESIDENT.

Mr. Charles Fergie, Mining Engineer, Westville, N.S.

VICE-PRESIDENTS.

Mr. R. R. Hedley, Metallurgist, Nelson, B.C.
Mr. Graham Fraser, Ironmaster, New Glasgow, N.S.
Dr. Frank D. Adams, Geologist, Montreal.
Mr. Jas. McArthur, Metallurgist, Sudbury, Ont.

SECRETARY.

Mr. B. T. A. Bell, Editor *Canadian Mining Review*, Ottawa.

TREASURER.

Mr. J. Stevenson Brown, Montreal.

COUNCIL.

For British Columbia—

Mr. J. B. Hobson, M.E., Quesnelle, B.C.
Mr. W. F Little, Colliery Manager, Anthracite, N.W.T.
Mr. E. B. Kirby, M E., Rossland.
Mr. Bernard MacDonald, M.E., Rossland.

For Ontario—

Prof. Courtenay DeKalb, M.E., Kingston.
Mr. P. Kirkegaard, Mine Manager, Deloro, Ont.
Mr. Major R. G. Leckie, Sudbury, Ont.
Mr. R. G. McConnell, Ottawa.

For Quebec—

Mr. George R Smith, M.L.A., Mine Manager, Thetford Mines, Que.
Mr. James T. McCall, Iron Merchant, Montreal, Que.
Mr. Jas. F. Lewis, Sherbrooke, Que.
Mr. J. Burley Smith, M.E., Montreal.

For Nova Scotia—

Mr. R. E. Chambers, M.E., Bell Island, Newfoundland.
Mr D W. Robb, Mechanical Engineer, Amherst, N S.
Mr. Henry S. Poole, M.A., A R.S.M., M.E., Halifax.
Mr. G. F. McNaughton, Mine Manager, Forest Hill, N.S.

Mr. HARDMAN, vacating the chair, called upon Mr. Fergie, the President elect, to preside over the meeting, and in introducing him to the meeting referred to his distinguished career in Canada as a mining engineer.

Mr FERGIE, who was received with much applause, then took the chair He thanked them for the great honour they had done him in electing him as their President, and he promised that during his term of office the work of the Institute and its interests would receive his earnest attention. He called for the co-operation of all the members, particularly in the matter of contributions to their Transactions. He invited members to present their experiences in mining practice. What was wanted was an interchange of ideas and experiences in practical mining work presented in a form most likely to bring about discussion.

Mr. J. M. CLARK, Q.C., LL.B., then presented a valuable paper on "Company Law."

Mr. J. LOWLES (of London, Eng.) on being called upon said—It is quite a surprise to me to be called upon, for I cannot claim to be a mining engineer, although very nearly one. I was interested in hearing Mr. Clark make his remarks about the English Company Law, as I was in the House of Commons during the whole time the Bill was before it, and I heard the debates thereon. In one respect I think Eng ish company law has been far ahead of company law on this side, because no such thing as issuing treasury stock below par has been allowed. An agreement setting out the whole terms of the contract has to be fyled, and it is open for anyone to examine, so that the whole history of the thing can be seen. There has been this trouble on our side, that company shares have been used too much as gambling counters on the stock exchange. One has to take risks, but there is too much dependence on the front page of the prospectus. People don't examine the enterprise so much as they look at the front page of the prospectus. I think that Canadians would do well to assimilate their company laws on the English model. The whole intention of the Act was to make company promotion a more honest occupation. I hope that the effect of an endments on our side will result in more attention being given to the purity of company law on this side, and of the assimilating of your company laws more closely with ours I do hope it will be possible to open up some reciprocal connections on our side with men who will be willing to introduce Canadian stock, without necessarily putting it under English administration, which is more costly than Colonial in these matters. May I venture to make a suggestion that various mining organizations, I mean organizations of mining men, will be doing a service to English investors by having a sort of bureau of engineers whom they can recommend, not only for the higher positions, but also the junior positions in the mine. It would be a real boon if this Institute were to make that provision. I would like to pay my tribute to Mr. Clark for having brought this subject forward, and probably the effect of it will be that you will study English law a little bit more, and perhaps make some amendments in the direction I have indicated. I sincerely hope that the effect of a wider knowledge and greater interest on our side, and theenormous strides on this side, will be that you will do all in your power to justify the confidence many feel in your resources, and the conviction that we can trust our money to capable men, who will see that our interests are taken care of, although so far removed from home—(applause).

MR. LESLIE HILL (Vancouver)—I was much interested in hearing the paper and getting some information about the English Company Act. I feel very strongly about the disadvantage of the issuing of shares so very much below par, and I think it is a very unfortunate way, and has led to a great deal of trouble. It would be much better if we could assimilate our law more to the English law, so that it would be more uniform. I think it would give confidence in England.

Mr. CLARK—Perhaps I should have pointed out that when I was talking of issuing stock at a discount I was speaking of provincial Acts. The Dominion Act is practically the same as the English law was before the passing of the recent Act to which I have alluded. Under the Dominion Act, a company having a Dominion charter cannot issue shares at a discount, and they must be paid in cash, unless an agreement is filed with the Secretary of State. The only difference between the Dominion act and the old English law was that the agreement had to be fyled with the Secretary of State in Canada, and in England with the Registrar of Joint-Stock Companies. Very few of our companies have been incorporated under Dominion law.

Mr. LOWLES—What percentage, do you know?

Dr. CLARK—About one in a hundred.

Mr. RUFUS H. POPE, M.P., at the request of the secretary, made a few remarks. He expressed pleasure that the English act had been improved, as when he was over there on a visit he thought criticism might be offered on their methods of doing business. We required capital very badly in Canada in our mining business, and many of us had felt, when we went to England, that there was too much money wanted to remain in London before it found the mine. A large portion of the money of Canada was locked up in the banks of Canada. Bank directors had to be exceedingly cautious, and the older they got, the more cautious they grew, until they became of no use either to this country or anywhere else. It had come to this stage today, that if you went to a bank with the best possible paper, no matter whose good names might be on it, the bank would ask if the money was to find its way into mining in any shape or form. If the answer was in the affirmative, the money was refused. Therefore it would readily be seen why we were particularly short of capital. He considered this a reflection upon the whole mining industry of this country. Bank directors were quite right in shutting down on matters which had no basis; but when a property had become a sure fact, and required a little more money to complete it, he did not see why banks should not consider good names in the same way as they would for a pulp mill or any other factory. Mining was just as essential as any factory for the advancement of the country. It was about time that the Dominion Parliament told these gentlemen that they must be patriotic as well as business-like in the use of the public money which Parliament gave them a charter to lock up—(Applause).

Prof. W. G. MILLAR presented his paper on "The Iron Ore Fields of Ontario," which, after discussion, was followed by one from Dr. H. M. AMI on "The Sedimentary Formations of the Province of Ontario, and Boring Operations carried on in them."

After discussion, the members adjourned at six o'clock.

ANNUAL DINNER.

In the evening about seventy members and their friends sat down to dinner in the Windsor Hotel. After an excellent collation, a thoroughly enjoyable evening was spent in song and sentiment, speeches being limited to three minutes. A splendid programme of vocal and instrumental music was carried out under the auspices of the Zingari Glee and Banjo Club, who most generously volunteered their services for the occasion.

Sultana Mine of Canada.

The accounts covering the operation of this company for the year ended 30th September, 1900, show :—

BALANCE SHEET, 30TH SEPTEMBER, 1900.

Dr.

	£ s. d.	£ s. d.
To Capital authorized	275,000 0 0	
Issued—		
,, 225,000 Shares of £1 each, fully paid, allotted to vendor	225,000 0 0	
,, 13,507 Shares of £1 each, fully paid	13,507 0 0	
,, 1,200 shares of £1 each, 5s. paid	300 0 0	
		238,807 0 0
,, Sundry Creditors—		
London	911 8 8	
Canada	2,995 4 3	
		3,906 12 11
		£242,713 12 11

Cr.

	£ s. d.	£ s. d.
By Cash—		
At Bank, London	402 0 10	
,, Canada	129 12 11	
In hand	2 9 11	
		534 3 8
,, Property, buildings, and equipment taken over as per contract, 26th July, 1899, subject to Vendor's encumbrances, not exceeding £10,000, against which encumbrance Vendor has deposited 50,000 fully paid shares		225,000 0 0
,, Further expenditure—		
Mine development	9,455 15 0	
,, Assay house	11 9 10	
,, Boat	19 2 6	
,, Building	1,118 0 0	
,, Boarding house	36 11 6	
,, Electric light	63 19 8	
,, Mill	336 15 2	
,, Mine	2,110 4 8	
,, Power plant	84 6 5	
,, Office	29 10 9	
,, Stable	9 6 10	
,, Machine shop	147 7 3	
,, Sleeping camp	28 16 2	
		13,451 6 6
,, Vendor—		
Paid on his account		404 3 0
,, Stores and materials		585 6 4
,, Preliminary expenses		1,307 5 4
,, Loss—		
Per Profit and Loss account	986 18 7	
Add September wages not yet paid or apportioned	444 9 6	
		1,431 8 1
		£212,713 12 11

PROFIT & LOSS ACCOUNT, 14TH AUGUST, 1899, TO 30TH SEPTEMBER, 1900.

Dr.

	£ s. d.	£ s. d.
To Canadian expenses—		
Assay account	162 4 6	
Boat account	128 9 4	
Electric Light account	12 9 3	
Insurance, Fire	145 4 7	
Insurance, Accident	150 8 3	
Management	389 0 1	
Mill expenses	723 18 10	
Mine ,,	4,052 9 3	
Office ,,	143 15 3	
Stable ,,	137 14 6	
Sleeping Camp	7 6 10	
General expenses	121 6 2	
Interest and discount	7 11 3	
		6,181 18 1
London expenses—		
Printing, stationery, cables, and postage	177 10 6	
Secretarial expenses and rent	291 13 4	
Directors' fees	500 0 0	
		969 3 10
		£7,151 1 11

Cr.

	£ s. d.
By Bullion	5,937 9 2
,, Boarding house	63 3 2
,, Exchange	9 16 9
,, Transfer fees	3 6 0
,, Rents	150 8 3
,, Loss	986 18 7
	£7,151 1 11

War Eagle Consolidated Mining & Dev. Co.

The accounts of this company submitted at the annual meeting on 26th ulto., show :—

FINANCIAL STATEMENT

FOR THE YEAR ENDING 31st DECEMBER, 1900.

ASSETS.

Mines and Mineral Claims	$1,701,176 39
Cash on hand and in bank	2,107 19
Stores on hand	19,365 84
Machinery, buildings and equipment	227,624 62
Furniture of Offices	1,840 55
Monita Gold Mining Co.'s Stock	89,549 94
Mugwump Gold Mining Co.'s Stock	28,336 88
Rossland Red Mountain Gold Mining Co.'s Stock	56,190 20
War Eagle Hotel Co.'s Stock	12,000 00
Accounts receivable	27,353 81
Profit and Loss	197,514 93
	$2,363,060 35

LIABILITIES.

Capital Stock	$1,750,000 00
Bank of Toronto, Rossland	255,608 27
George Gooderham	351,462 00
Accounts payable	5,990 08
	$2,363,060 35

PROFIT AND LOSS ACCOUNT.

DR.

To Cost of Mining and developing War Eagle Mine, including salaries, wages, Directors' remuneration, office and general expenses	$272,266 67	
" Diamond Drill Prospecting	20,598 18	
" Consulting Engineers' fees	4,850 00	
" Hoist and Compressor Litigation	6,200 68	
" Other Legal Expenses	1,430 67	
" Mine Accidents	72 05	
" Interest and Exchange	15,495 32	
" Travelling Expenses	358 94	
" Auditor's Fees	200 00	
" Crown Point Expense	15 50	
" Richmond Group Expense	319 78	
		$321,807 79
" Dividend No. 21		26,250 00
		$318 057 79

CR.

By Balance	$74,989 09
" Net Proceeds from Ore Sales	74,431 08
" Transfer Fees	325 55
" Amount received from Insurance Co. re Pender Damage Suit	797 14
" Balance	197,514 93
	$348 057 79

Athabasca.—The annual report covering the work on this Nelson Mine to January 1st, 1901, gives the product for the year as $170 608, obtained from 5,054 tons of ore, the profit being $29,551. The cost of mining is still high. In development 1,927 ft. was done at a cost of $29,0 4, or $15 10 per foot. The milling cost was $14 97. Ore and waste mined, 28,176 tons Cost per ton, $2 69. Total cost of development was $29,014; and of extraction, $75,712, making a total of $104,726. The net profit in 1899 was $31,500.

Centre Star.—The company has announced the 5th dividend of 1c., or $35,000, payable April 1st, making $175 000 paid by the new company to the date mentioned. About 2 500 tons of ore are shipped weekly to the Trail Smelter, and this amount is likely to be increased.

COMPANY NOTES.

The Crow's Nest Pass Coal Company, Limited.—The annual report of this Company dated 1st. March is as follows:—

The Net Profits for the year after paying all operating expenses and all charges of every kind at Head Office and Mines, amounted to $141,064.10. This amount has been derived from the various departments of the Company's business, viz: the sale of coal and coke, and from waterworks, house rentals, general store, etc., etc. As no dividend was paid for the year on the Company's Capital, the above sum has been carried forward to credit of Profit and Loss, making a total sum at credit of that account (including the amount already there from the earnings of 1899) of $188,874.52.

The coal produced during 1900 amounted to 220,458 tons. Of this tonnage 114 063 tons were sent to the Company's coke ovens at Fernie, and produced 73,496 tons of coke, while the balance of 106,395 tons was disposed of as merchantable coal.

During the year the Company paid out in cash the sum of $874,080.83 of which the pay rolls amounted to $419,037 09 the balance of $454,943.74 having been disbursed for new coke ovens, additions to plant and for development work at Fernie and Michel. One hundred and ten (110) new coke ovens were built in 1900 which makes with the 202 in operation at the end of 1899, a total of 312 ovens with a capacity of over 450 tons of coke per day.

The number of men at present in the Company's employ is about 800 and this number will of course steadily increase as our mines are developed.

The Financial statement at 31st December, 1900, shows :

ASSETS.

Mines, Real Estate, Plant, Development, etc., etc.....		$2,266,016.65
Cash in Bank.....	$37,501 62	
Accounts Receivable.....	67,005.42	
		104,507.04
		$2 370,523.69

LIABILITIES.

Capital Stock Paid-up.....		$2,000,000.00
Profit and loss Account:—		
Balance at Credit 31st. December 1899....	$ 47,810.42	
Added in 1900.....	141,064.10	
		188,874.52
Bills Payable..	$121,795.72	
Accounts Payable.....	59,853.45	
		181,649.17
		$2,370,523.69

Granby Consolidated Mining and Smelting Co.—The success of the smelting plant established by this company at Grand Forks is giving great satisfaction to the shareholders of this enterprising company. The plant consisted of two rectangular water jacketted furnaces, 44″ x 160″, with all the necessary appurtenances incident to a modern copper smelting plant. It was installed at Grand Forks, B. C., to handle the low grade copper ores in the Boundary District, and was designed to handle 500 tons per day. Under the direction of the Superintendent, Mr. A. B. W. Hodges, the plant has averaged 600 tons per day, and has reached as high as 763 tons. The Company has, within the last month, completed smelting its first one hundred thousand tons, and has reached a low cost of mining and smelting that has made a new record.

To complete this plant the Granby people have just placed their second order with the Gates Iron Works, Chicago, consisting in part of two more water jacketted furnaces, 44″ x 160″; a complete ore crushing and sampling works, with No. 5 Style "D" crusher, one 9″ x 15″ Blake crusher, one "F" Gates crusher, one sample grinder, three sets of rolls, elevators, etc; a complete Silica crushing mill, including a Dodge crusher, dry pans, rolls, elevators, etc., and the following converting machinery: one tilting reverberatory furnace complete, one converter stand complete, cars, a complete hydraulic system, blowing engine; one ten ton electric crane, one forty ton electric crane, with everything complete to make a perfect plant.

British American Corporation.—The local officials of this company have been notified that their services will not be needed after April 1st, but they will all be re-engaged as officials of the Rossland Great Western. The change is due to the voluntary winding up of the British America Corporation in London. It floated the Le Roi, Le Roi No. 2, Rossland Great Western, and Kootenay Mines, which will now stand on their own merits. The officials in Rossland concerned are General Manager Bernard Mcdonald and his assistants.

Intercolonial Coal Company.—The annual meeting took place March 7th at the office of the company in Montreal The sales of coal and coke for the year ended December 31st, 1900, amounted to 225,869 tons. The following gentlemen were elected directors for the ensuing year: Messrs. James P. Cleghorn, W. M Ramsay, Thomas Wilson, E. G ff Penny, A. W. Hooper, R. MacD. Paterson, Charles Fergie and F. C Henshaw. At a subsequent meeting of the board, Mr James P. Cleghorn was re-elected president; Mr. Charles Fergie was re-elected vice president and general manager; and Mr. D. Forbes Angus was re-appointed secretary-treasurer.

Dominion Copper Co.—James Breen, manager of the Dominion Copper Company, has been in the Phœnix Camp recently in consultation with J. H. Parker, the superintendent. For the last three months development on the Brooklyn, Stem-winder, and Rawhide has been actively prosecuted by Mr. Parker, and although nothing official is given out, it is known that in the two first mentioned properties the results have been more than satisfactory. The Brooklyn is the only one equipped with an air compressor, but a large force was put at work on the Stemwinder at hand drilling. In this mine the work was largely drifting, and valuable ore bodies were opened up. It was the intention to put a five drill compressor on the Stemwinder temporarily for use till the large 20 drill plant was available, and excavations for the foundations of the smaller plant were made This plan has been changed and part of the Stemwinder force laid off. This week the company began development work on another of its claims - the Idaho, which adjoins the Brooklyn on the south. A double compartment shaft is being sunk about 250 feet west of the old 50-foot shaft. It is understood that no time will be lost in proving up the immense ore bodies, which have a phenomenal surface showing. The Idaho has long been known by old timers as one of the best properties in the Boundary.

Le Roi Mining Co.—The manager at Rossland cables :—"The following amount of ore has been shipped from the mine to the smelter, 12,394 tons, yielding 5,309 ozs. gold, 9,207 ozs. silver, 129 tons copper, value £31,830. The smelter shipped $334,000 worth matte for the entire month." (Office note—"The decrease in returns is caused by a break-down in the old shaft, which occurred about the middle of the month, having rendered inaccessible for the time being the ore body east of the shaft, from which the principal supply of ore was being stoped.")

Cordova Exploration.—Under Mr. Kerr this company is making splendid progress with the opening up and re-equipment of their Belmont mine. The new 30-stamp mill is 175 feet long, 90 feet wide, and 85 feet from lowest to highest point. It is substantially built, neatly finished and painted, and well lighted. The 30 stamps are driven by a Corliss engine of 150 h.p. The engine and shaft have been put in strong enough to extend the mill and drive 120 stamps if necessary. Pulleys on main shaft to drive stamps are equipped with friction clutches, so that ten stamps can be hung up completely without slowing the engine. From the side of the engine is a 6-ft. driving pulley up to stone breaker counter shaft. Crushers are two, one 10 by 20 and a smaller one 7 by 10. The mill in this part has ore bin capacity of 600 tons. The crushed ore, on leaving the mortar boxes, flows over plates 36 feet long, having a series of 10 drops. From there it passes over 6 Wilfley tables, driven by a separate engine, which has a capacity for double that number. Below this floor is the new cyanide plant. It consists of three large circular steel leaching vats, 15 feet in diameter and 4 ft. deep. Below these are two circular steel tanks, 7 by 2 ft., and further below are zinc boxes where the gold is precipitated. Below these are two sump tanks 9 by 4 ft , and also three wooden acid tanks, on this floor. Above the leaching vats are two other steel tanks 10 x 5 used for storage. This is the first cyanide plant ever used in this district. The cyanide plant is in charge of W. H. Whytock, who spent five years in the Rose Deep Mine in South Africa. The stamps and tanks were manufactured by the Wm. Hamilton Company, of Peterborough. The engine and boiler-house attached to the mill is 80 x 40 ft., with a hall-way 6 ft. wide through the centre to enter the mill. The engine-room on north-west side is substantially built with 18 feet ceiling, and contains the Corliss engine already mentioned. The old mill engine is used for driving the dynamos for electric lighting. The boiler house contains 2 horizontal tubular boilers, set in brick, with space for a third. There are the usual feed pumps, with National Heater to heat water by exhaust steam. Electric current for lighting is generated by two dynamos, driven from counter shaft by clutches. One generates current for the day, when light is used in the mine, and the other for night. It is a three-wire system, this being preferred for its convenience, safety in mine, and for better insurance rates. There are abundant lights throughout the mine, shafts, mills, shops, office, manager's residence, store, boarding-house for the staff, etc.

Behind the mill is a large tank house 112 by 20 by 20, connected with the mill by a passage. It contains 7 large water tanks 15 feet in diameter, 12 feet deep with capacity to hold 75,000 gallons. The water supply comes from No. 1 shaft. The assay office consists of a brick building in two parts 20 by 28 and 20 by 20 feet. The larger part contains a sample grinding room, where will be installed a motor sample grinder stone breaker, underneath the floor of which is a 20 by 20 cellar for coke, and a furnace room 20 by 18, equipped with combine gasoline furnace and muffle. The other part consists of a laboratory, 20 by 20, an office 10 by 10, and a balance room. The building is heated by furnace.

Several additional machines have been added to the machine shop. It is fitted up with a large turning lathe, 6-ft. planing machine, 2 drill machines, pipe cutting and screwing machine and bolt screwing machine, driven by a small air engine. This, together with the three blacksmith shops, on the mine, enables them to make and repair any part of the machinery. The air compressor is a frame building 140 by 60 feet and contains a cross-compound air compressor with intercooler and aftercooler condenser, 185 H. P., with air receivers and air line from air receiver to the various shafts: 2 return tubular boilers in separate rooms with electric damper regulators, large water tank, 7,000 gallons capacity, for coolers. At the mine there are 10 shafts, the deepest being down 400 feet. No. 2 is down 185 feet and No. 3 is 250 feet. None of the others is yet over 100 feet. A large amount of drifting and cross-cutting has been done

The property consists of 425 acres at the mine, 300 of which is in the township of Belmont and 125 acres in Marmora. At Deer Lake the company has 160 acres also.

The company owns a most admirable water-power at Deer Lake, a distance of 2½ miles from the mine. Two dams have been built at the foot of the lake. The large dam is 80 feet long, 12 feet high, 13 feet thick at base and 5 feet at top. It is built of concrete and cement masonry. The other dam has a timber slide 20 feet wide for use of lumbermen, and also a sluice gate to admit water to flume pipe 7 feet square. It is contemplated to instal a large air compressor and bring air to the mine through a 10-in. wrought iron pipe, which will then supply power for the whole mine. Manager D G Kerr's plant is to have ample stamp capacity in his mill and power cheap enough that the lowest grade ores can be thoroughly treated at a low cost.

A tramway has been built, commencing at the level of the top of the mill. Ore is hauled along this tramway (level with top of mill) in cars containing 10 tons, by one horse. This tramway forms a perfect circuit for collecting the ore from all the shafts.

LAKE OF THE WOODS.

At the *Stella* the shaft is down about 165 feet.

At the *Mammoth*, north of Black Sturgeon Lake, the shaft is down 55 feet, and at that depth a cross-cut of the vein has been started. The gangue contains a large percentage of pyrite.

The *Boulder* Mine on Camp Bay is starting up again; teams with supplies, &c., left Rat Portage for the mine today.

A gang of men will in a few days be sent out to the *Homestake* Mine to recommence mining operations.

The only news about the *Wenago* is not of a very cheerful character, it being to the effect that the unpaid miners had been offered twenty-five cents on the dollar as a settlement. The miners have refused to accept this.

It is reported that a new company is to take hold of the *Keewa* mine, putting up $100,000.00 for a three fifths share in the property, the vendors retaining two-fifths.

The *Champion* Mining Co. is gazetted, with a capital of one million shares. This is the old *Bad Mine*, and is about eight miles from Rat Portage.

Eagle Lake.—On Prendible Island the drift is in about 90 feet the shaft is down 60 feet, and sinking will now be resumed. The vein is promising.

Close by the above Messrs. Prendible and Bruce have begun development of a fine-looking vein on one of their islands. This is a strong vein of quartz right in the contact, having the Huronian schists on one wall, and the eruptive granite on the other.

Mr. Partington is showing in his store a chunk of very rich gold quartz taken from the Partington-Farmer's claim near Prendible Island. Some of this phenomenally rich quartz has been sent to the Buffalo Exhibition.

A prospector has just come into town from Eagle Lake, bringing some rich gold samples from a recent find.

The Anglo-Canadian Gold Estates Co. are going to test some gold properties with a diamond drill this spring.

There will probably be quite a rush of prospectors to the Sturgeon Lake country north of Ignace, when the snow goes.

Rat Portage, March 21, 1901. J. M.

Winding From Great Depths.

In deep winding, as usually carried on, a great load has to be set in motion, made to attain a high velocity, and again be brought to rest within a very short period of time; the engines and the winding apparatus have to be well up to the work and under perfect control, whilst the rope must be of the highest quality and must be carefully treated. It should, therefore, not be allowed to overlap on the winding drum, nor should it be allowed to "angle," that is, get out of the direct line of winding and suffer undue friction against the rim of the pulley. The prevention of these undesirable features incident to winding a great length of rope on large stationary cylindrical drums of small diameter has led to the introduction of many modifications. These and other disadvantages of ordinary winding are well shown in the second of a series of articles which appears in the "Engineer" of February 22nd; and clear illustrations are given of the Koepe system which is designed to overcome such drawbacks. The Koepe system, says our contemporary, introduced into Germany some thirty years ago, had in the place of the drum a single grooved pulley and two headgear pulleys; a single winding rope was employed, and it passed from one cage over its headgear pulley, round the winding pulley, over the second headgear pulley to the second cage, whilst beneath the cages a balance rope was used connecting them together and passing round a pulley at the bottom of the shaft, by which means the descending rope, cage and empty wagons balanced those ascending, thus leaving the weight of coal or other mineral as the only and constant load against the engine throughout the wind. The Koepe system has its advantages. With the pulley in place of the bulky heavy drum, smaller engines placed closer together with a shorter crank shaft may be used. The engine house, too, may be smaller; only one rope may be used for winding, which always coils round the same diameter, and is subject to uniform flexure, avoiding the baneful influence of irregular bending. There should, moreover, be no "angling," and the load is uniform throughout the wind. An objection to it in its original form was the liability of the rope to slip, and further, when the cages rested on the stops, the weight being taken off the rope, it no longer had sufficient adhesion on the motive pulley to enable the load to be restarted. There was also the difficulty in re-capping the ropes, and more serious still was the probability that in case of injury to the winding rope, both cages would be precipitated down the pit. These objections have since been overcome to some extent, consequently the system has some vogue in Germany, but has not gained ground here.

Briefly, by the Koepe system the winding can be done more economically, with comparatively small engines and plant, and with less liability to overwind than with drums, but there is the danger attendant on the rope breaking, the extra trouble in capping the ropes, the extra stress on the cappings, the slipping, and the unsuitability of the system for lowering or raising heavy loads such as are occasionally required to be dealt with at mines; and somehow these disadvantages have stood in the way of its more extensive employment.

THE DOMINION IRON AND STEEL COMPANY, of Sydney, Cape Breton, is about to start its second furnace. The dates fixed for the third and fourth furnaces are May 1st and June 1st respectively. These 4 furnaces will give a total daily capacity of 1,000 to 1,500 tons. The steel mill will be in operation in October for the manufacture of billets, and January 1st, 1902, for rails and plates. Iron from the company's plant is being offered in New York.

ATLIN MINING COMPANY.—Advice has been received that the mining plant to be erected on this company's property was shipped from Vancouver on the 14th February Everything possible has been done to ensure operations commencing the moment the weather permits, and it is expected the hydraulicing will be started before the end of June.

TYEE COPPER.—The Secretary has issued the following circular to the shareholders under date the 6th inst.:—"A report for the month of January has been received from Mr. W. Pellew-Harvey, in which he states that the progress for the month consists of 115½ feet of driving, cross-cutting, and upraising at the 200 feet level. The amount of ore now developed on the 200 feet level is estimated by Mr. Harvey to be 25,000 tons, which he states will yield about $10 per ton profit when sorted and treated in the Company's own smelter. Mr Pellew-Harvey is of opinion that by the end of May the mine should be sufficiently opened up to be in a position to give a continuous supply of ore for smelting. The following cablegram has been received from Mr. Clermont Livingstone today—'We have struck ore (in) crosscut (from) east drift (at) 250 feet.' This proves another 100 feet of the ore body on the same level."

LARGE ORDER FOR NICKEL FROM NEW CALEDONIAN MINES.—It will doubtless be pleasing to the export nickel tax agitators to learn that their efforts have again alarmed the Orford Copper Co., so to protect itself it is negotiating for the purchase of 35,000 tons of New Caledonia ore, to be delivered during the next ensuing twelve months. This quantity of ore will contain about seven million pounds of nickel, and will prove a serious menace to the enlargement of operations at Sudbury, for it will supply a requirement of the Orford Copper Co. which otherwise would have been supplied by Sudbury.

SYDNEY STEEL PLANT.—The steel plant at Sydney, C. B., is an emphatic success. Cornelius Shields, vice-president and general manager of the Virginia Coal & Iron Co. and one of the best informed iron men in the United States, has been in Sydney and he says:—"I think that the Dominion Iron & Steel Co., will have a plant equal to any of its kind in the United States."

THE MINE MANAGER.—Mr. Hugh Murray gave his views of what constitutes an efficient mining manager, summing up the necessary qualifications in the following terms:—"This ideal manager is argus eyed and his vigilince is sleepless. He is a disciplinarian, a martinet, not to be gainsaid or trifled with, but his men enjoy the maximum of safety in their occupation. With him waste and extravigance are cardinal sins. He sees that not too much cotton waste is lying around in the engine room, that the oils are not used too profusely or thrown broadcast around; that ties and props are not thrown into the gob or left in worked-out rooms to rot, and that economy in the use of supplises is practied in every department. Above all he is economical of minutes. His mules and mule drivers never wait for anything, and never collide or interfere with each other in making their trips. Tools and timbers are always ready for the man that needs them, and there is no delay while they are being brought from the top. Every man in and about the mine has his work to do, and every man does it, two men always doing the work of two men, and not that of one and a quarter. The one aim and ambition of this man is to get out more coal to-day than ever he has done before, and he lays his plans at a day six months hence to reach an output hitherto never thought of. Thus planning, and with this object in view, he places his mine in a condition, as to efficiency, that leaves nothing to be desired.

Mine Pumping by Hydraulic Power.

When we remember that the difficulty of pumping a mine increases very much with the depth of working, the question of doing so efficiently is one of great importance. The Rhenish-Westphalian collieries will soon have to encounter such difficulties, for they are on the point of encountering coal measures at such a depth that henceforth shafts more than 270 fathoms deep will have to be sunk. Some indeed have already been sunk to a depth of about 437 fathoms. With such depths the use of under-

ground steam engines is hardly practicable, because there is great loss through condensation in the long line of steam pipes, and the water supplied for condensation is not sufficient even for very economical engines. Moreover, the heat set up in the shaft by the long line of steam pipes causes great difficulties, necessitating the supply of large quantities of air for ventilation. It is true that the use of highly super-heated steam permits the working to be carried a few metres deeper; but that limit is soon reached. Engines with pumpstrees are out of the question, for depths of 500 metres and upwards, first on account of their great cost and slight useful effect, and secondly owing to the great space they occupy in the shaft and round its mouth. In a *Colliery Guardian* note, from which we extract the above, the writer says that for this purpose compressed air is not to be thought of, so that for an economical pumping plant there is only the choice between electric and hydraulic power transmission; and although at first sight the former appears to offer greater advantages for underground pumps, a closer examination soon reveals several disadvantages. First and foremost an electric plant is far more delicate and difficult to keep in order than the hydraulic; the high-tension currents afford a constant source of danger to the work-people, that must not be under estimated under the hard conditions of mining; and again, in the event of sudden inbursts of water, the electric pumping plants are irremediably drowned if the motor should become flooded. On the contrary, pumps worked by water under pressure free themselves in such a case, and also start at once, after standing for some time under water, directly the motive water is admitted. Lastly, the collective useful effect is far higher with hydraulic than with electrically worked pumps, as "Gluckauf" proceeds to show in an article founded on lectures by Engineer Frohlich, of Berlin, arriving at the conclusion that the Kaselowski system is most economical, and the favour with which it is received in the Dortmund district is abundantly proved by the many plants supplied by the Berliner Machinenbau-Aktiengesellschaft. We cannot agree with our contemporary in the opinion that compressed air is inadmissible for pumping. The great advantages which air offers in respect of safety and ventilation render it, in our opinion, an ideal motive power for use in mines.

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DIRECTOR

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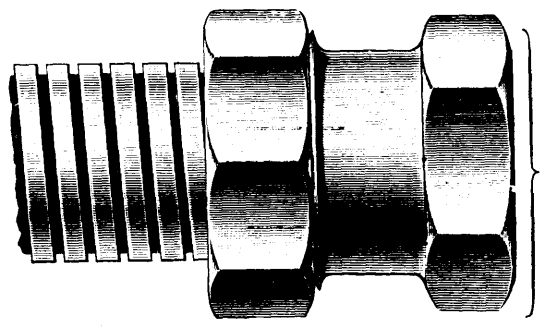

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