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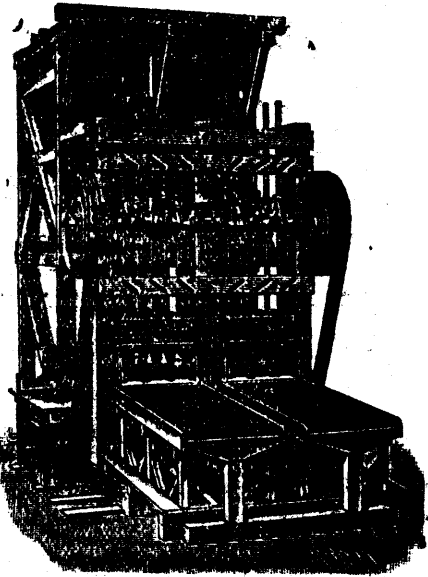
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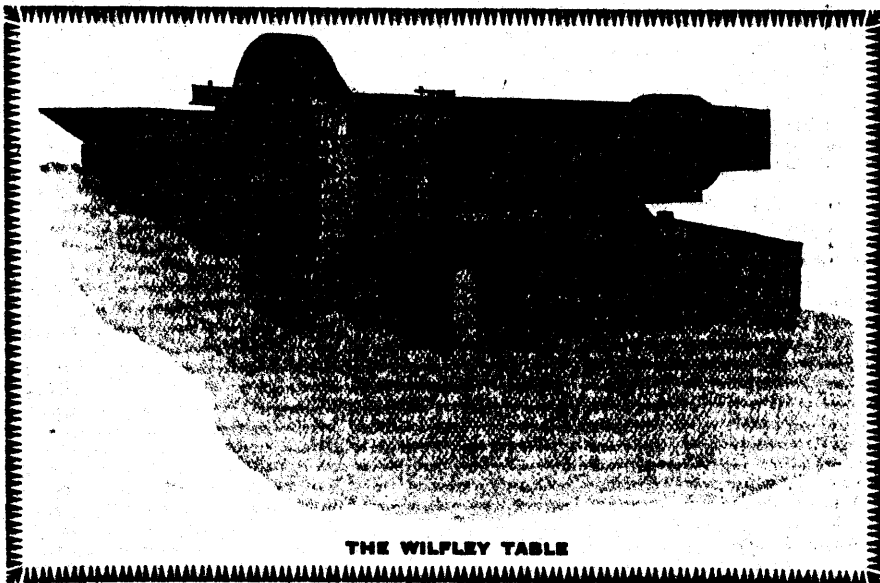
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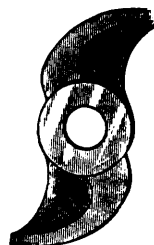
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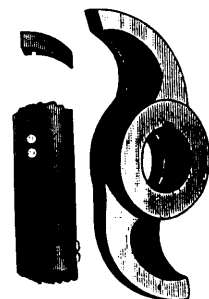
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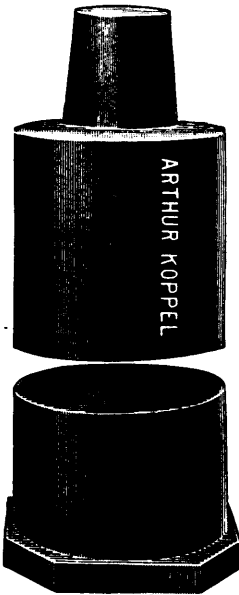
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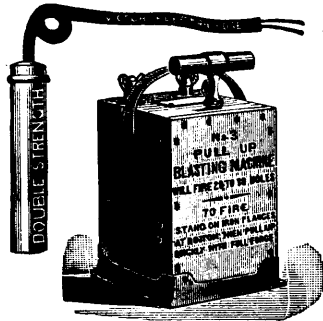
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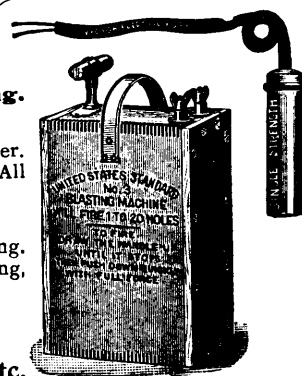
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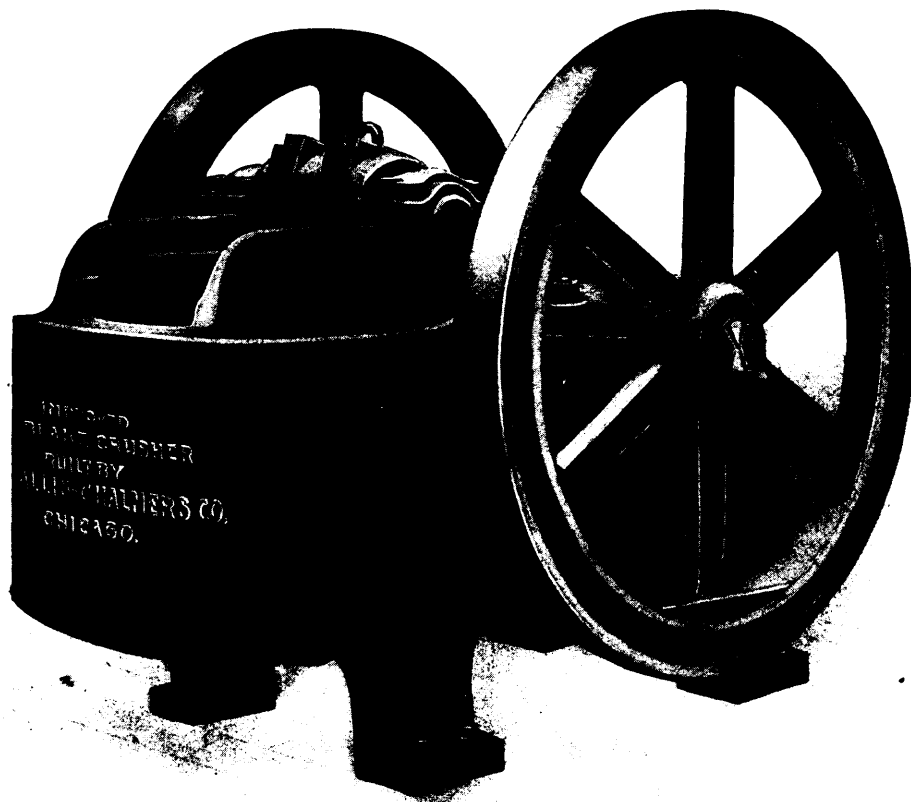
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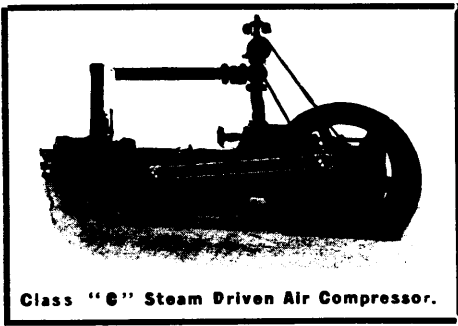
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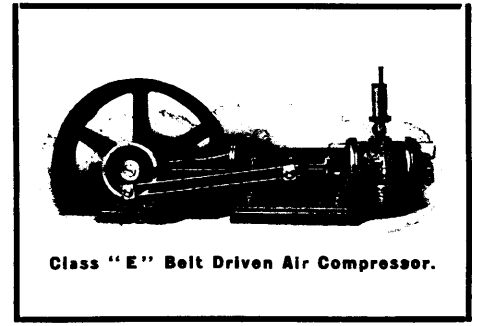
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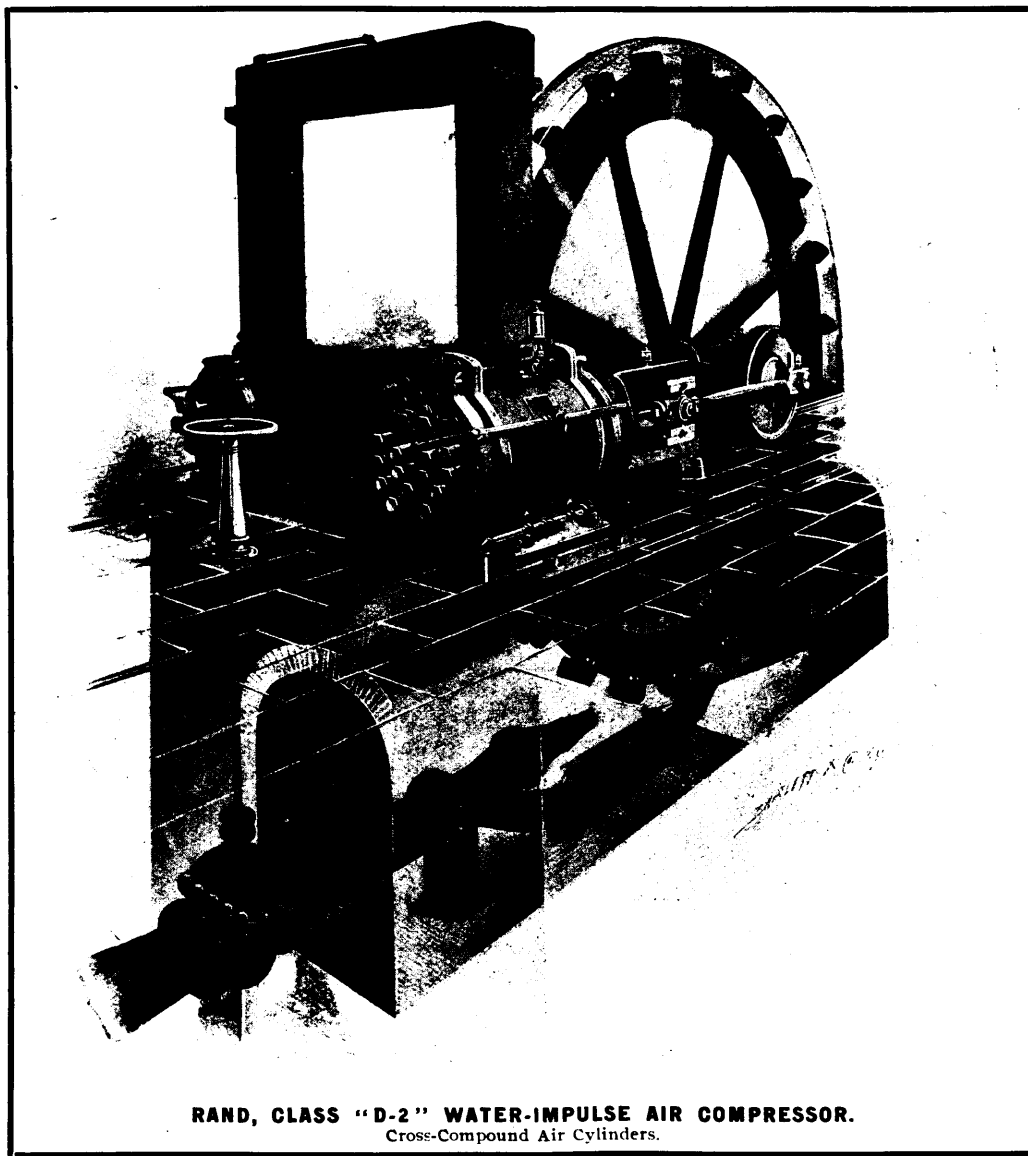
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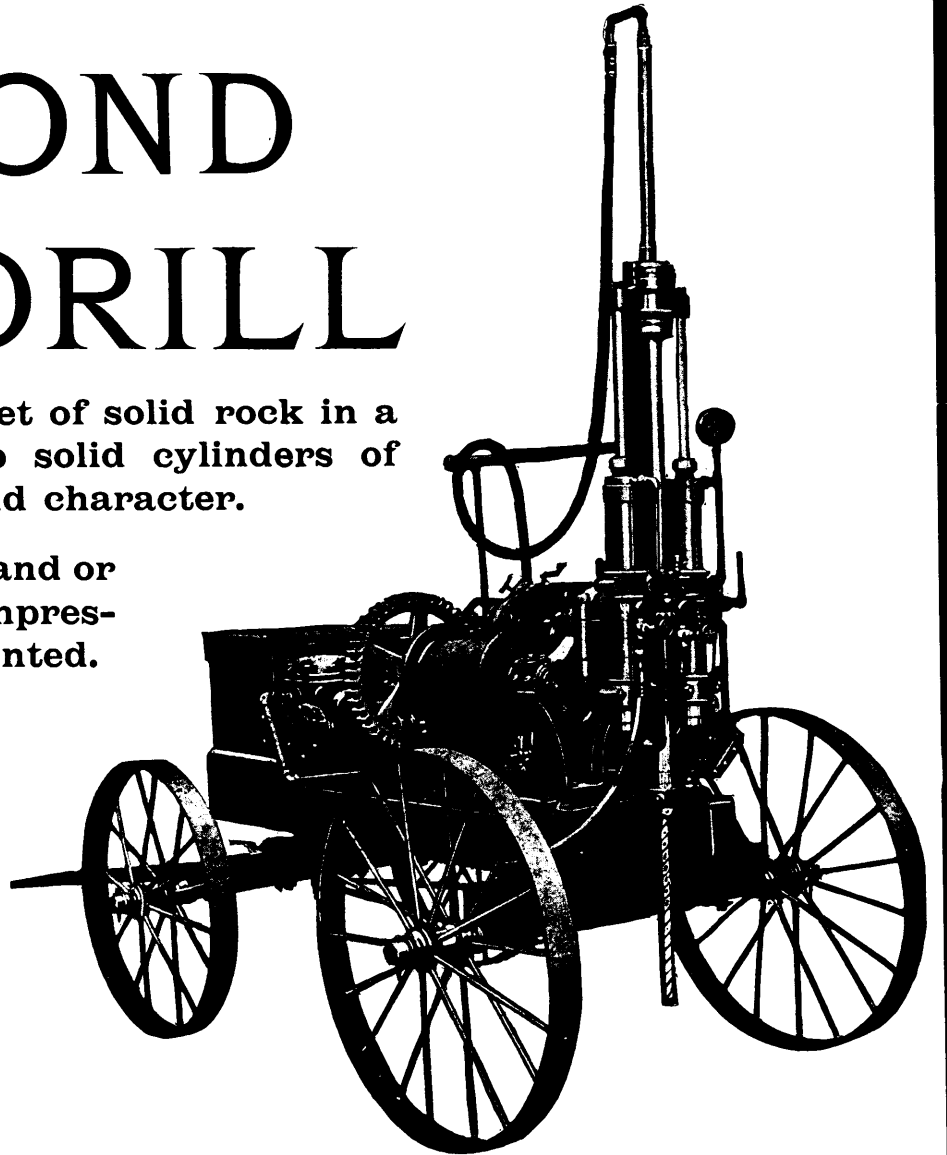
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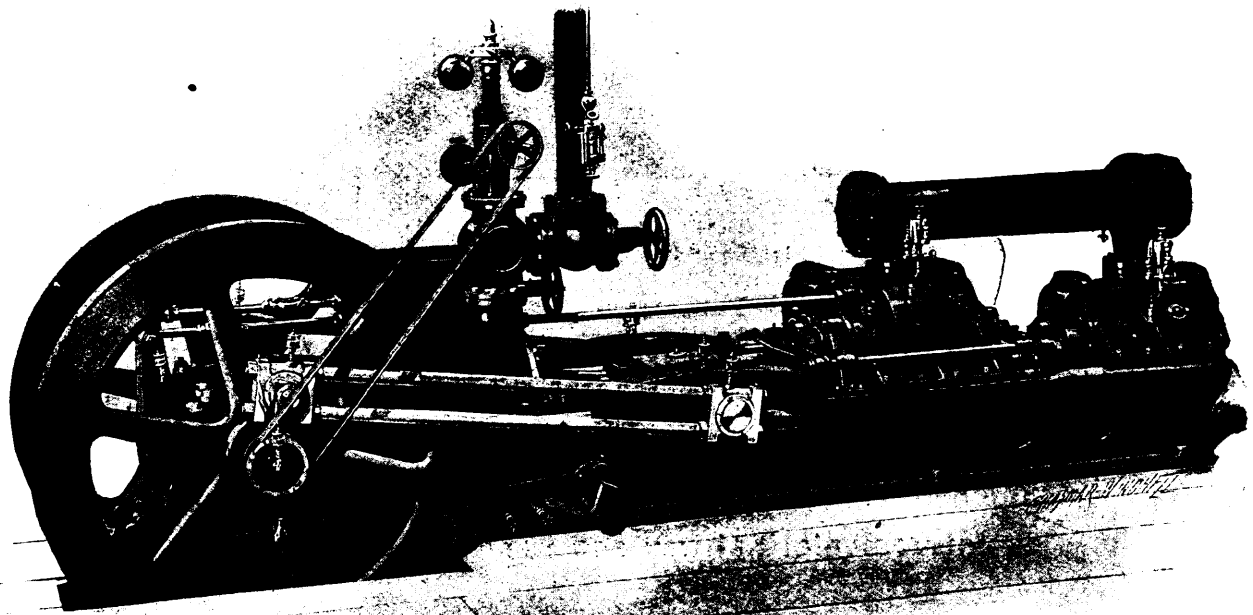
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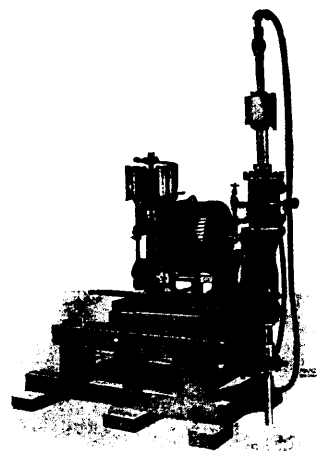
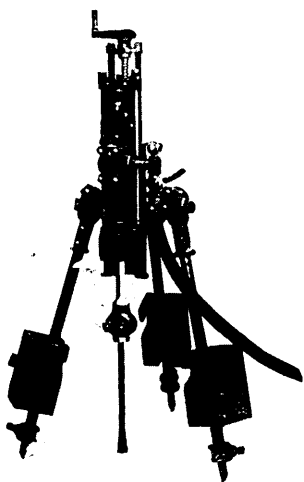


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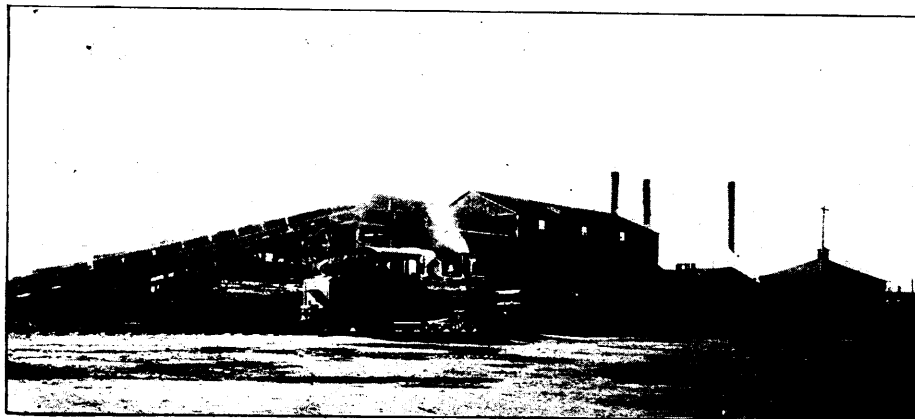
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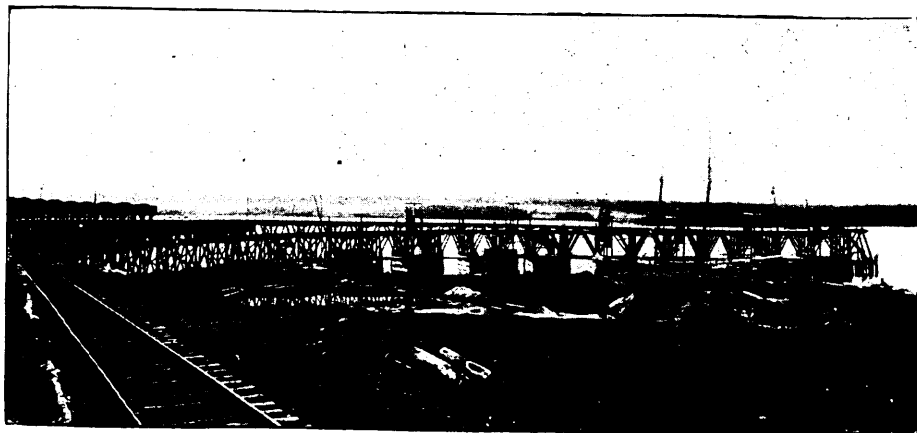
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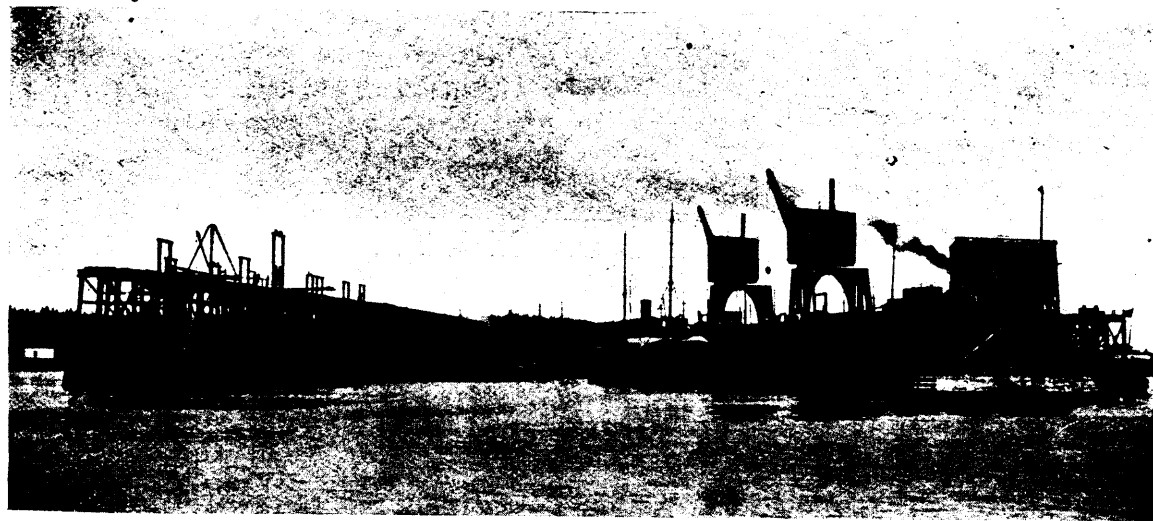
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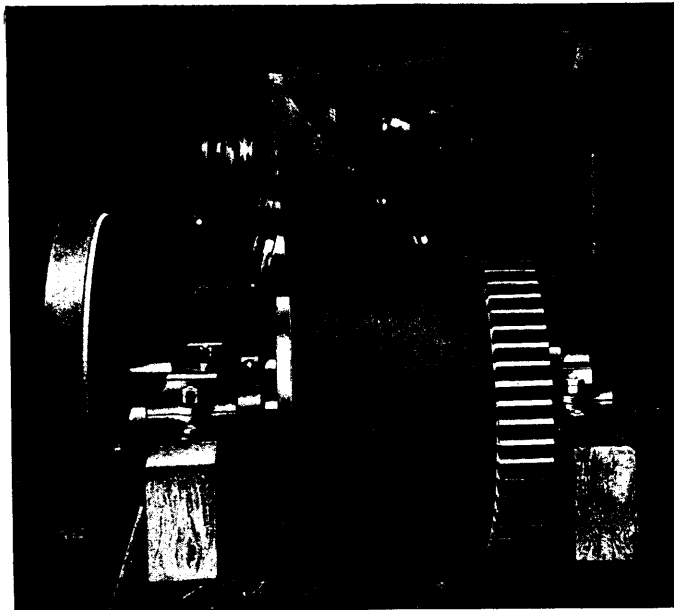
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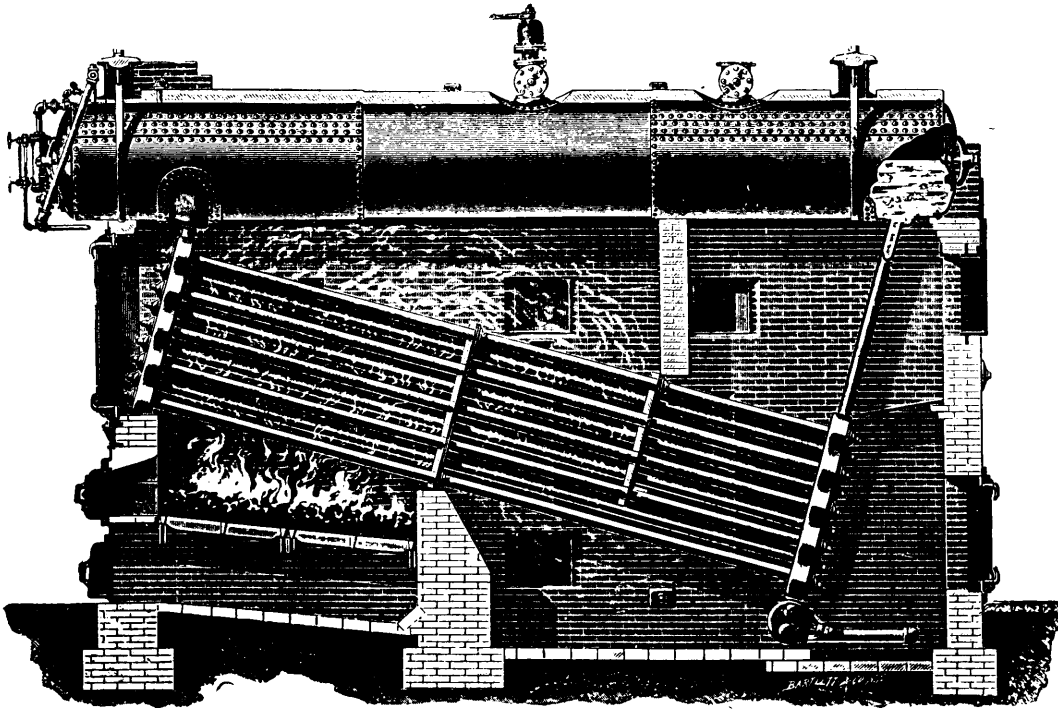
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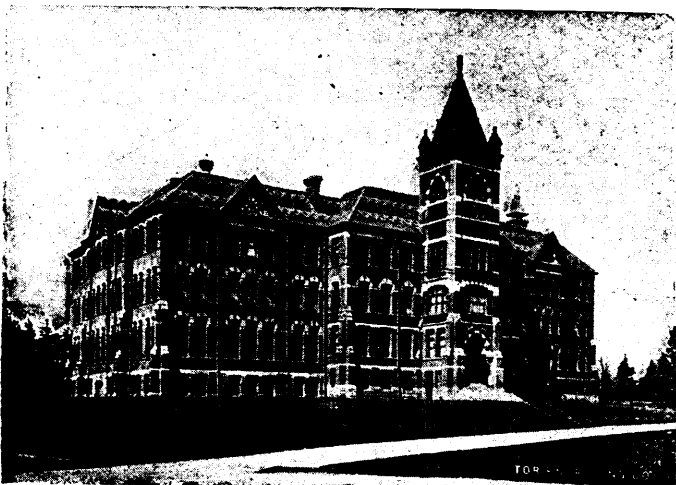
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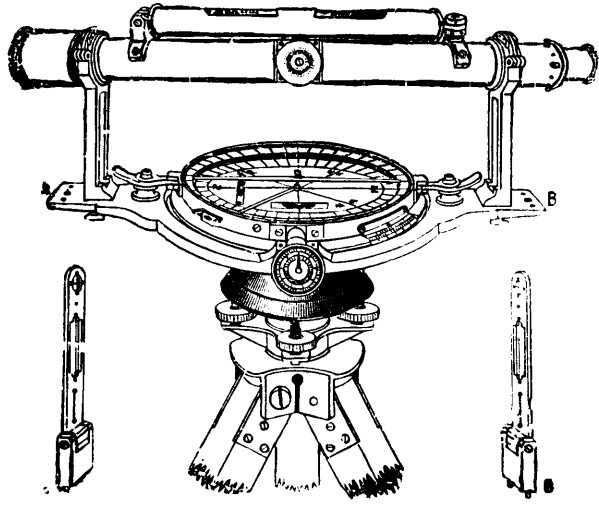
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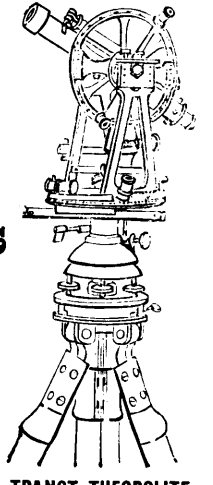
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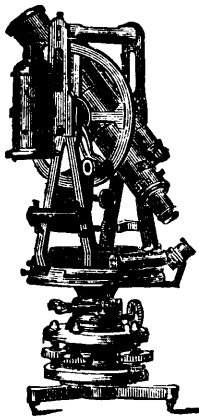
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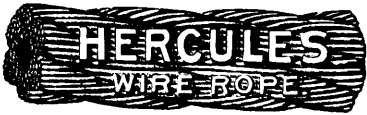
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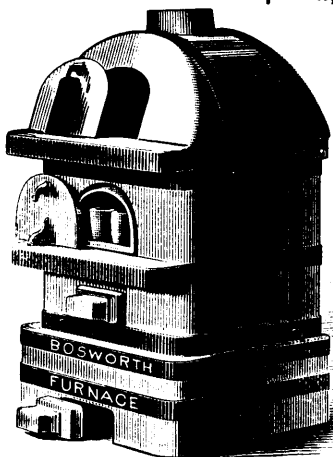
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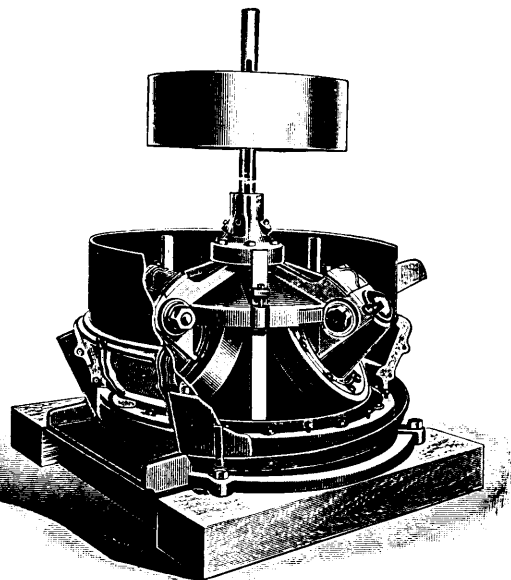
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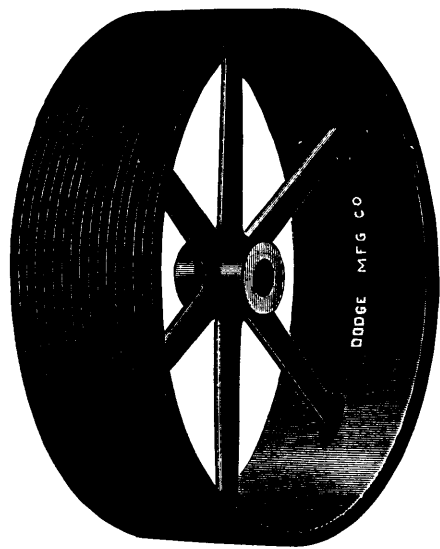
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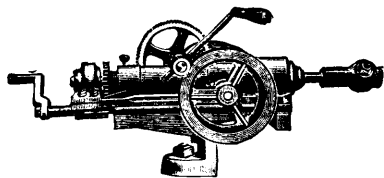
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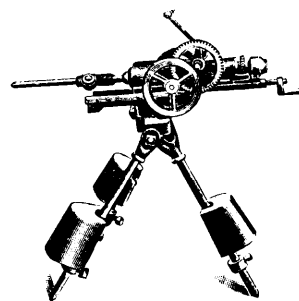
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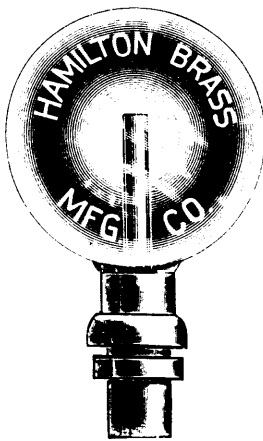
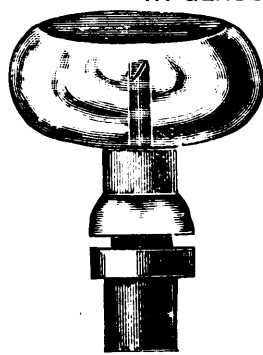
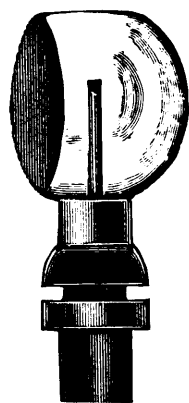
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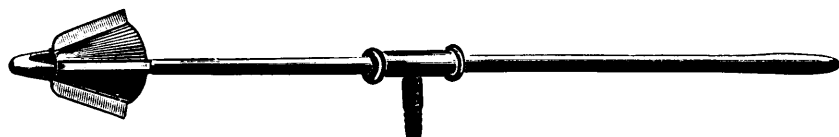
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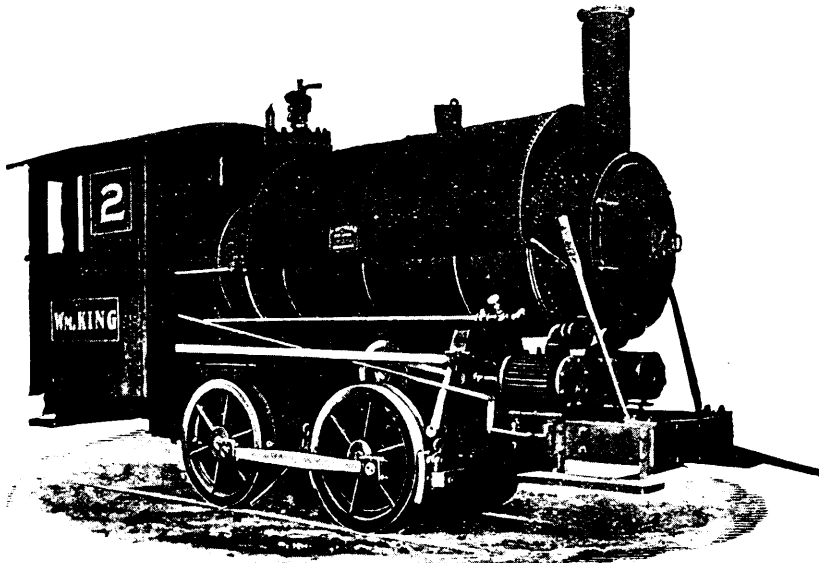
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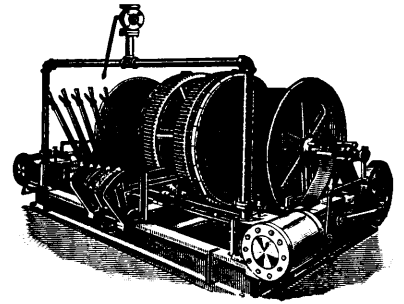
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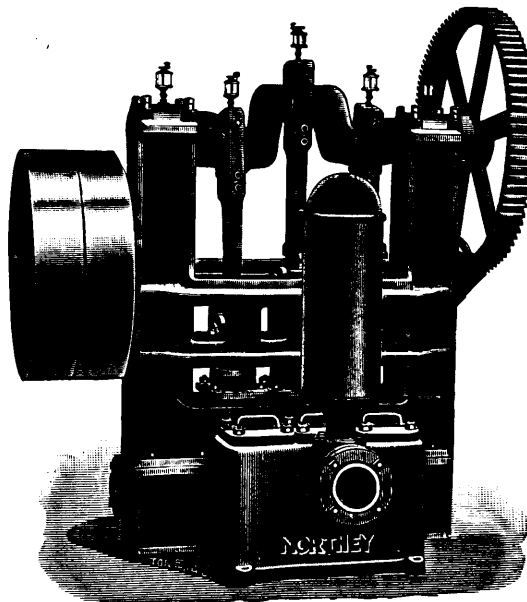
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The CANADIAN MINING REVIEW

Established 1882

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

B. T. A. BELL, Editor and Proprietor.
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FEBRUARY, 1902.

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The Lead Problem in British Columbia

No. I.

For a period of about nine months now, an Order-in-Council has been in existence which offers a bonus for five years on refined lead which is "the product from ores mined, smelted and refined in Canada;" this bonus is a decreasing one, but averages \$3.00 per ton of refined lead produced, for the whole five years. In the closing days of last December the Canadian Smelting Works, through its general manager, announced that a small refinery of ten tons daily capacity would be erected at Trail, B.C., to be completed about May 1st; so that it is probable that within twelve months of the date of this Order-in-Council British Columbia will have a small refinery and will then attempt to work out the problem of a market.

Numerous articles have appeared in print, both east and west, bearing upon this problem, and although the non-technical man may have had his mind confused by the diversity of the views presented, yet all of these articles have tended to throw light upon what is vital to the life of the silver-lead industry of Canada. The relation of the cost of production to the price received for the product is stated by one writer as *the difficulty*; but it seems to the REVIEW that the real difficulty is to get a market for the products of the lead mining industry. There is no home metal market of sufficient size or importance to be of any great aid; our country produces almost every mineral product largely in excess of its needs, and pig iron, coal, copper, lead, precious metals, asbestos, graphite, mica and other minerals are obliged to seek a foreign market. In the case of the lead industry and under the restrictions imposed by the Lead Trust of the United States, there is no market in that country, and lead bullion must go across the ocean, either to a European or an Oriental market. To reach either of these markets involves such heavy charges for transportation and insurance as to quite obscure from popular view, for the time, the local charges for smelting and freights. From recent information, directly received, the cost of land and ocean freight and of treatment in European markets, may be said to average *not less* than \$30 per ton. Considering the Oriental market, there is no demand there for other than a special refined quality of lead suitable for the native to beat into the tea lead used in the tea industry of India, China and Japan. It is a matter of record, and of fact, that the large Australian corporation, the Broken Hills Proprietary Company, tried for three years before it succeeded in making a soft lead which suited the requirements of the oriental lead-beater. It is equally of record that the Selby Smelting and Refining Company of San Francisco also took much time to make a pro-

duct which was satisfactory, and that the market is now largely supplied (if not completely filled) by the production coming from these two large concerns and from England. The Canadian refiner seeking an oriental market has therefore no simple or easy task ahead of him, for, in addition to lengthy experience required to make the quality which the Eastern market requires, he would be handicapped by coming into direct competition with the well established product of the concerns already mentioned, and, unless a pooling arrangement could be effected, a war of prices would unquestionably ensue.

The Southern market, the United States, has been definitely closed by the action of the American Smelting and Refining Company, whose object unquestionably is to secure control of production so as to dictate the price of lead for the United States, and for the whole continent. This company will naturally restrict its production so as to enable it to keep control of the price of the metal, and a paragraph in the *New York Evening Post* of February 19th, 1902, announced that the Guggenheims had now secured control of the production of the principal producing mines in the United States.

Upon surveying the ground it is difficult to see how the erection of the refining plant at Trail will substantially alter the conditions which now prevail in British Columbia. As the entering point of a wedge, it may grow, in the course of time, to a factor able to afford a distinct relief to the industry, but it cannot for many months, and perhaps for years to come, afford any distinct relief to an industry which, although it is not yet paralyzed, has nevertheless suffered a very serious curtailment of its production and is in anything but a prosperous and progressive condition. It is not so very many years since the United States tariff was so arranged as to promote and favor the importation of lead ores which were required to smelt the excess of dry ores which the country was then producing, and, as a direct consequence, the importation of Mexican lead ores, and subsequently of Canadian lead ores, was enormously stimulated. Some five or six years ago the United States production of lead ore had grown so as to be in excess of the amount required to flux the dry ores, and the tariff was again increased, being doubled. The direct result was beneficial to the United States, as it kept the lead smelting and refining industries alive, and supplied them with the proper ores. Now that the raw material is offered in excess of what is required for home consumption that excess has had to be exported, and quite recently the monopolizing of the industry by the trust called "The American Smelting and Refining Company" has enabled the price of lead in the domestic markets to be kept steady, although prices in foreign markets have dropped tremendously. The apparent control by the Guggenheim corporation

(the trust) of the chief silver-lead producing districts in the United States, holds forth no hope of a future Southern market for British Columbia for some time to come.

Some writers have taken the point that when ores were scarce in the United States the difference in the tariff, between the importation of the *ore* and the *bullion*, constituted a bonus which that country paid to British Columbia for smelting and refining this ore, and the claim has been made that since that bonus has been removed the restriction against the production of bullion on the Canadian side has also been removed. The statement may be true, but it does not point out any market for British Columbia bullion without having to pay excessive charges, which really amount to a tariff against such exportation. Another claim has been made that it is possible to establish a lucrative business by manufacturing lead pipe, and the different oxides of lead (red and white) which go to the manufacture of lead paints, the grinding of these oxides, and the establishment of a Canadian brand of lead manufactures which would be profitable. We regret to say that the figures of the consumption of lead and lead manufactures in Canada as given in the Trade and Navigation Returns do not support those who hold this view. With an annual production of 60,000,000 pounds of lead, and a total home consumption of less than 25,000,000 pounds of lead, and all its manufactures, there remains a very large amount of unmanufactured lead which *must be sent to a foreign market* for sale.

The claim that the discrimination against British Columbia by the American Smelting and Refining Company provides an inducement for the establishment of the refining and manufacturing in Canada is a sophism, until the market for such refined and manufactured products is obtained. To say that the question of competing against the Trust is merely the three matters of "(1) owning the raw material, (2) being able to reach the market, and (3) being able to procure the capital necessary for the manufacture," is only to re-state the problem without giving any attempt at solution. The matter of owning the raw material is a *fact*, an axiom; the *crux* of the question is to get a *market*. A market once obtained, capital in abundance will readily be found without much seeking.

The complaint of lead mine owners that charges for freight and treatment rates are exorbitant, involves a statement and discussion beyond the limits of this article, but which the REVIEW promises to take up in a later issue.

Reduced Costs at the Le Roi.

Detailed figures of the results obtained at the Le Roi Mine during the month of November last were received too late for our January issue, but are republished herewith. Only the operations for the month of November are included, but the figures must be most gratifying to the shareholders as showing a substantial reduction in costs, and as an intimation of a probable further reduction in the near future. As Mr. J. H. McKenzie, the new General Manager of the Le Roi Mining Company, Ltd, did not arrive in Rossland until November 26th, the report, in reality, shows the results of a month's active personal management of Mr. R. J. Frecheville, the Managing Director.

For the 30 days included in the report there were shipped to the Northport Smelter 14,088 tons, giving an average assay value of \$11.28 per ton. This value is divided as follows:—Gold \$7.09, silver \$0.34, copper \$3.85; as the price of copper is given at 15½ cents in the returns the average copper contents would be \$1.24 per cent. 1,639 tons of low-grade ore were sent from the dump to the Trail smelter and realized a net sum of \$11,634.07, or \$7.00 per ton; the total income from all ore shipped was therefore \$170,593.66. The total mine

costs were \$50,671.53; to mine equipment was charged the sum of \$1,557.50, to surface improvements \$787.40, to machinery \$14.57, to handling ore from the dumps \$409.79, or a total of \$2,769.26, leaving \$47,902.67 as the cost of mining 14,088 tons, an average cost of \$3.40 per ton.

The total costs per ton therefore are.—

Mining.....	\$3.40
Transportation.....	.75
Smelting.....	4.50
Marketing, etc.....	.75
Total.....	\$9.40

This total cost of \$9.40 per ton contrasts most favorably with the \$10.72 per ton under the former management, and should convince the shareholders that Mr. Frecheville's estimate of \$9.00 per ton will be quickly realized. Since these lines were written a despatch has been printed in the daily press announcing that Mr. Whittaker Wright has again obtained control of the Le Roi Company. We discredit the report, and for the sake of the good name of British Columbia we hope we are right: the economies already introduced and the good showing made by Mr. Frecheville during the month of November have confirmed our belief that the *men* and not the *mines* have hitherto been the bugbear in Rossland.

Mining Progress in British Columbia.

With commendable promptitude Mr. W. F. Robertson, the Provincial Mineralogist for British Columbia sent to the Minister of Mines on the 15th of January his approximate estimate of the mineral productions for the year 1901. Mr. Robertson is to be congratulated on his recognition of the importance of publishing promptly, at the beginning of the year, figures which approximate, if they are not final, the production of the whole Province for the year just ended.

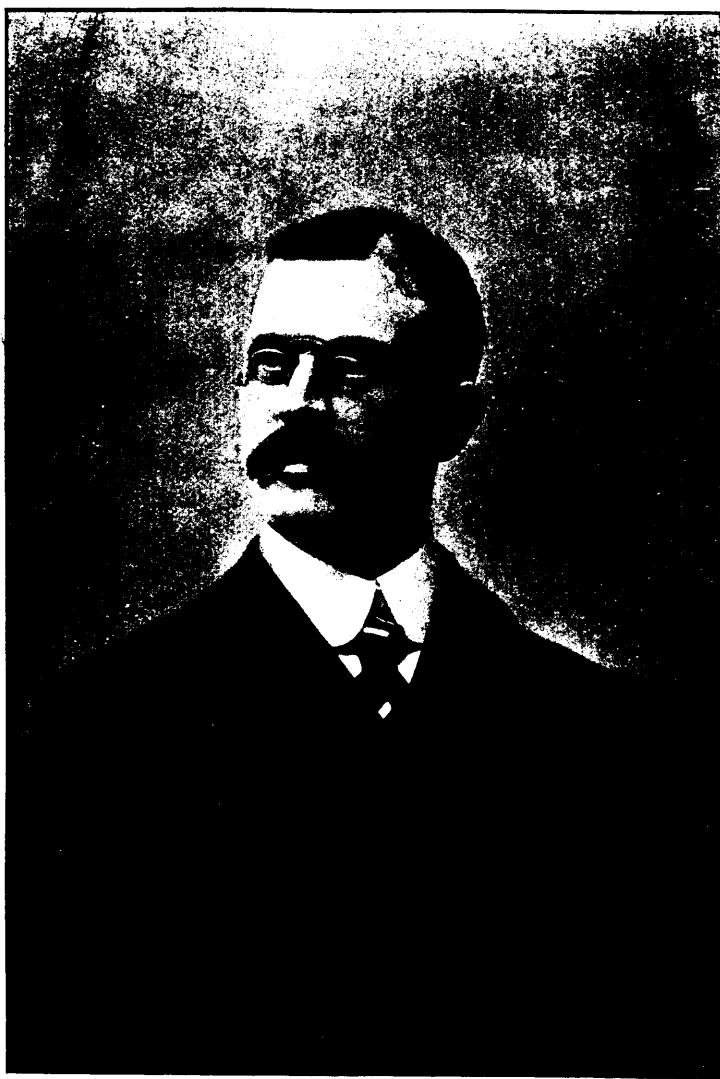
The astonishing and very welcome feature of the report is the increase in *values* produced, which amounted to over 25 per cent. (the estimated value of the total mineral production being \$20,713,501, as against \$16,344,741 for 1900), and also the increase in *quantities*, amounting to 63 per cent., or 354,727 tons.

The two districts to which this increase must be credited are Yale and West Kootenay, and of these Yale district (the "Boundary Creek country") must be given the palm, as it shows an increase of \$3,328,993, or 76 per cent. of the whole *net* increase, amounting to a production two and one-third times greater than in 1900.

The increase in West Kootenay is found in the two divisions of Trail Creek and Nelson, in which the actual increase was \$1,341,406, or 22 per cent. over 1900, and forming 30 per cent. of the total *net* increase. The Coast districts practically were stationary, as they showed but 2 per cent. advance; Cariboo, Cassiar and Lillooet districts each showed a decrease.

In metals, placer gold decreased about 30 per cent., while lode gold increased in amount 36 per cent. The production of silver was increased as to *quantity* by 18 per cent., but as to *value* by only 13½ per cent. The production of copper increased 207 per cent. in quantity and 206 per cent. in value, while the only remaining important metal, lead, decreased 20 per cent. in amount and 23 per cent. in value.

The production of coal and coke was increased by only 9 per cent. in quantity and 11 per cent. in values, which we must confess is a surprise as smelting operations in the Boundary Creek country were expected to cause a very considerable increase in the quantity of Crow's Nest coke consumed; of coke (specifically) 1901 shows less than 50,000 tons more than 1900.



MR. J. B. TYRRELL, M.A., MINING ENGINEER,
Dawson, Y.T.

The general result is an agreeable surprise to most people who have not followed closely the development of the Province during the past 12 months, but it confirms the opinion expressed in these columns a short time ago that more legitimate work is doing to-day in British Columbia than ever, and probably is twice what was done during the period of inflation and boom times of 1890 to 1898. The REVIEW's congratulations to British Columbia!

Canadian Mining Institute.

The fourth Annual General Meeting of the members of this representative body of Canadian Mining Engineers and Mine Managers will be held, in the Club Room, Windsor Hotel, Montreal, on Tuesday, Wednesday, Thursday and Friday, 4th, 5th, 6th and 7th March next. Business sessions will be held on Tuesday and Thursday mornings at 10.30, and for the presentation and discussion of papers on the afternoon and evening of Tuesday and Wednesday, on Thursday afternoon and also, if necessary to close up business, on Friday evening. The annual dinner will be held in the Windsor on Thursday evening. In a programme of nearly forty papers we note the following:—

1. Copper Production in the Boundary District, B.C.
By Dr. A. R. LeDoux, New York.
2. A Method of Mining Low Grade Ore in the Boundary District, B.C.
By Frederic Keffer, M.E., Anaconda, B.C.
3. The Old and New Iron Industry Compared.
By Mr. John Birkinbine, M.E., Philadelphia, Pa.
4. On the Occurrence and Treatment of Diamonds at the DeBeer's Mine.
By L. J. Abrahams, F.G.S., Bruce Mines, Ont.
5. On the National Importance of Mining.
By Mr. John E. Hardman, S.B., Montreal.
6. On Air Compressing.
By Mr. W. L. Saunders, New York.
7. On Wire Ropes.
By Mr. W. L. Hardie, M.E., Lethbridge, N.W.T.
8. On the Characteristics of the Atlin Gold Fields, B.C.
By Mr. J. C. Gwillim, B.Sc., Nelson, B.C.
9. On the Hoisting and Hauling Plant at the LeRoi Mine.
By Mr. Bernard MacDonald, M.E., Rossland, B.C.
10. The Leaching of Copper Ores by Sulphurous Acid at the Coconina Mill, Arizona.
By Mr. E. P. Jennings, Salt Lake City, Utah.
11. Notes to Accompany Plan and Drawings of the Athabasca Mine, Toad Mountain, B.C.
By E. Nelson Fell, A.R.S.M., Nelson, B.C.
12. Coarse Concentration in the Slocan District, B.C.
By Mr. S. S. Fowler, S.B., M.E., Nelson, B.C.
13. On the Harris Air Lift for Raising Water at the Deloro Mine.
By Mr. P. Kirkgaard, M.E., Deloro, Ont.
14. On Certain Fault Conditions in the Copper Mines at Butte.
By Mr. Wm. Braden, M.E., New York.
15. Coal Mining in the North-West Territories and its Probable Future.
By Mr. Frank B. Smith, M.E., Calgary, N.W.T.
16. On the Electro-Metallurgy of Copper and Nickel as Applied to Canadian Ores and Mattes.
By Mr. Wm. Koehler, Cleveland, Ohio.
17. Eastern Ontario: A Region of Varied Mining Industries.
By Prof. W. G. Miller, Kingston, Ont.
18. Notes on the Dry Ores of the Slocan District, B.C.
By Mr. R. C. Campbell-Johnston, M.E., Nelson, B.C.
19. On the Origin and Distribution of Yukon Gold.
By Mr. R. G. McConnell, Ottawa.
20. Notes on Gold Dredging. (Illustrated by lantern slides.)
By Dr. J. Bonsall Porter, M.E., Montreal.
21. Notes on Gold Milling at Republic, Wash.
By Mr. Fritz Cirkel, M.E., Montreal, Que.
22. On the Analysis of Insolubles.
By Mr. Douglas Lay, A.R.S.M., Nelson, B.C.
23. On the Hematite Ores at Kitchener, B.C. (Illustrated by lantern slides.)
By Mr. Wm. Blakemore, M.E., Montreal.
24. On the Iron Ore Deposits of Western Ontario.
By Mr. F. Hille, M.E., Port Arthur, Ont.
25. Oil Furnaces for Milling and Assaying.
By Mr. Charles Brent, M.E., Rat Portage, Ont.
26. Notes on the Limestone of the Philipsburg Railway and Quarry Co.
By Mr. J. T. Donald, M.A., Montreal.
27. A Review of the Canadian Iron Industry in 1901.
By Mr. George E. Drummond, Montreal.
28. Canadian Chromite.
By Mr. Milton L. Hersey, Montreal.
29. Gold Dredging on the North Thompson River, B.C.
By Mr. F. Satchell Clarke, Vancouver, B.C.
30. The Ores and Minerals of Hastings County and District.
By Mr. W. A. Hungerford, Deloro, Ont.
31. On the Economic Minerals of Vancouver Island, B.C.
By Mr. W. F. Best, Victoria, B.C.
32. Notes on Silver Lead Mining at Huanchaca de Bolivia.
By Mr. C. H. Macnutt, M.E., Pulacayo, Bolivia.
33. On Corundum Mining and Concentration in Ontario.
By Mr. F. M. Fairlie, Kingston, Ont.
34. On the Copper Bearing Rocks of the Eastern Townships, Que.
By John A. Dresser, M.A., Richmond, Que.
35. Power Drills.
By Mr. C. C. Hansen, Montreal.
36. Mine Ventilation.
By Mr. Charles Fergie, M.E., Westville.
37. Mine Pumping.
By Mr. John P. Northey, Toronto, Ont.
38. Mine Haulage.
By Mr. Wm. Blakemore, M.E., Montreal.

By special arrangement made with the Canadian Pacific, Grand Trunk, Intercolonial, Canada Atlantic, and Quebec Central Railways, mining men attending these meetings will be carried to Montreal and returned for a single fare on obtaining the usual form of Convention Certificate from the ticket agent when purchasing their ticket and on same being signed by the Secretary of the Institute. These meetings promise to be of an unusually interesting character, and the attendance of Canadian mining men will be large.

Crow's Nest Pass Coal Company.

The REVIEW acknowledges receipt of the following letter from the Solicitor of the Crow's Nest Pass Coal Company, Limited, complaining of certain paragraphs contained in a communication printed in the last issue of the REVIEW under title of "An Appeal to Cæsar."

Having no desire to be unfair, or to prejudice the interests of this corporation, we have pleasure in reproducing this document:—

The Publisher, &c.

Sir:—On behalf of the Crow's Nest Pass Coal Company, Limited, I give you notice in writing that they complain of the following statements contained in the issue of the CANADIAN MINING REVIEW published at Ottawa on the 31st day of January, 1902.

A. "And it can hardly be a pleasant reflection for loyal Canadians that a property which by common consent is one of the most prodigal gifts of nature, one which is absolutely unique in value and kind, should already have passed beyond the control of Canadians to whom it was originally entrusted, should have been officered and managed almost exclusively by Americans, who in several important respects, which need not here be dwelt upon, have begun to show their total disregard both for the sentiments and interests of Canadians."

B. "The second ground upon which our contemporaries base their appeal to Mr. Sifton is that actual discrimination against Canadian interests has already taken place."

C. "Further, there has been a constant discrimination against Canadians in respect of the price of coke if not of coal. Coke supplied to the Great Falls smelter has been furnished as low as \$3.50 a ton on cars at Fernie."

G. G. S. LINDSEY,

General Counsel, Crow's Nest Pass Coal Company, Ltd.

Dated Toronto, Feb. 14th A.D. 1902.

While giving space to this letter, we would take the opportunity of suggesting that Mr. Lindsey enlighten our readers upon the following questions arising out of the paragraphs noted in his complaint:—

While Mr. Hill may not at the moment hold a controlling interest in the stock of the Crow's Nest Pass Company, his investment in it is admitted to be a very large one, amounting, we understand, to something like \$600,000—is it not a fact that his American connections and interests are of such vital importance to the success of the corporation that he cannot be regarded other than the predominating factor in the direction and control of its affairs? Is it not true, also, that since Mr. Hill's connection with the company an American consulting engineer, an American superintendent, Mr. Stockitt, and several American mine managers have replaced their predecessors, and that practically the whole office staff at Fernie, with the exception of an accountant, or head clerk, is American?

Incidentally we may remark here that there are two Stockitts. The elder, Mr. Louis Stockitt, has been for several years a mining engineer in the employ of Mr. Hill. He was manager of the Sand Coulee, and other mines, until a few years ago, when Mr. Burrill resigned the position of chief mining advisor to Mr. Hill and Mr. Louis Stockitt was then promoted to take his position. This is the gentleman who, it is said, supervises the mining operations of the Crow's Nest Pass Coal Co. He resides in the States but is represented on the spot



MR. THOMAS STOCKITT,
Manager, Crow's Nest Pass Coal Co., Fernie, B.C.

by his brother, Mr. Thomas Stockitt. To prove the absolute identity of interest between Mr. Hill and the coal company, it may be pointed out that these men superintended the railway construction in the Crow's Nest Pass on behalf of the Great Northern last year, while directing the management of the mines; and in one instance in particular, when the C. P. R. had applied for and secured an injunction to prevent the Great Northern from continuing to build a branch railway from the Crow's Nest line up Morrissey Creek, the only person who was authorized to accept service of this injunction was Mr. Thomas Stockitt, to whom the officers of the law were referred and who ultimately accepted it.

Mr. Lindsey might also be good enough to inform our readers if it is not a fact that while large shipments of coal and coke were being made last summer to the United States for the use, presumably, of competitive American smelters, Canadian smelters were short in their supplies, could not obtain coke from the company, and the situation became so acute that the Canadian Pacific Railway positively refused to supply cars for export until Canadian demands were supplied!

Finally, concerning paragraph C, we have been informed on no less an authority than a former manager of the company that, in the early part of 1899, Crow's Nest coke was sold at \$3 50 at ovens to the Great Falls smelter. Does the Company deny this?

We shall be pleased to give prominent publication to Mr. Lindsey's refutation, on behalf of the Crow's Nest Pass Coal Co., of these points of interrogation.

A Method of Mining Low Grade Ores in the Boundary Creek District.

By FREDERIC KEFFER, M.E., Anaconda, B.C.

It is usually the case in new districts presenting a variety of new conditions, that a good deal of preliminary work must be done to determine the best methods of mining and treating ores. This has been true in the Boundary District, the ores of which, as a rule, are of very low grade, occurring in deposits of great extent without well defined walls.

It is the purpose of this paper to describe the methods of mining at the Mother Lode mine in Deadwood Camp, near Greenwood, and the reasons which have led up to their adoption.

The ore deposit here outcrops at intervals for a distance of about 2,000 feet, the width in explored portion averaging perhaps 140 feet, although the absence of any defined walls prevents exact measures being given. The dip is about 70 degrees easterly, and pitch toward the south at an angle yet undetermined. Only the ground to the north of the shaft, which is located centrally, has been explored as yet. At the beginning of stoping operations, the ore body had been developed by a northerly drift from shaft on the 200 level, the drift extending to apparent end of ore. The deposit was crosscut at intervals of about 100 feet. Similar work was also done on 300 level. A winze to surface, about 500 feet north of shaft, afforded good ventilation.

It was the original intention to sort all the ore from the mine, filling the stopes with the waste, and with other rock blasted from walls or elsewhere obtained. To this end a system of belt conveyors was arranged whereby the ore from shaft was dumped into a No. 5 Gates crusher, thence passing over a 3 foot wide picking belt to the ore bins. The waste was dropped into side pockets falling upon another belt system, whereby it was conveyed to a bin at top of winze, whence it was to be dropped into the stopes.

It may be said here that the term "waste" is, generally speaking, merely comparative, for the whole of the ore body (with exception noted below) contains copper, gold and silver in varying degree, and waste is merely rock with lesser quantities of these metals. The sorting and conveying belts worked to a nicety, but the smelter had been in operation but a short time when it became apparent that its capacity for these self-fluxing ores was much greater than had been thought possible, and consequently smelting costs were lower than had been figured. A direct result of this was that the definition of "waste" was altered, and its quantity greatly diminished. And further, that the cost of sorting out this diminished waste was approximately equal to the cost of smelting it; for even the poorest of the rock contains some values to offset in part the smelting charges. These conditions necessitated the abandonment of the filling plan for stopes. Also the sorting of ores was suspended, save for certain ores from 300 level, where the waste happens to be totally barren and easily sorted out.

The filling system having been dropped, it was then planned to timber the stopes in the ordinary fashion, but this plan was abandoned on account of high cost of timber compared with ore contents.

A third alternative was next adopted in one stope—that of timbering the whole of the floor of stope heavily, only the excess of ore from above being dropped through shutes conveniently placed. This plan

SECTION ON "A B" (PLAN)

Showing General Scheme

of STOPS.

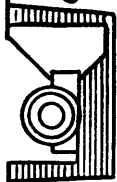
Mother Lode Mine.

Quarry.

TUNNEL TO HILLSIDE.

ORE-BODY.

Ry.



Crusher.

TUNNEL.

UPRAISE 110'.

UPRAISE FOR AIR.

STOP.

SHUTE.

PASSAGE

ROOF.

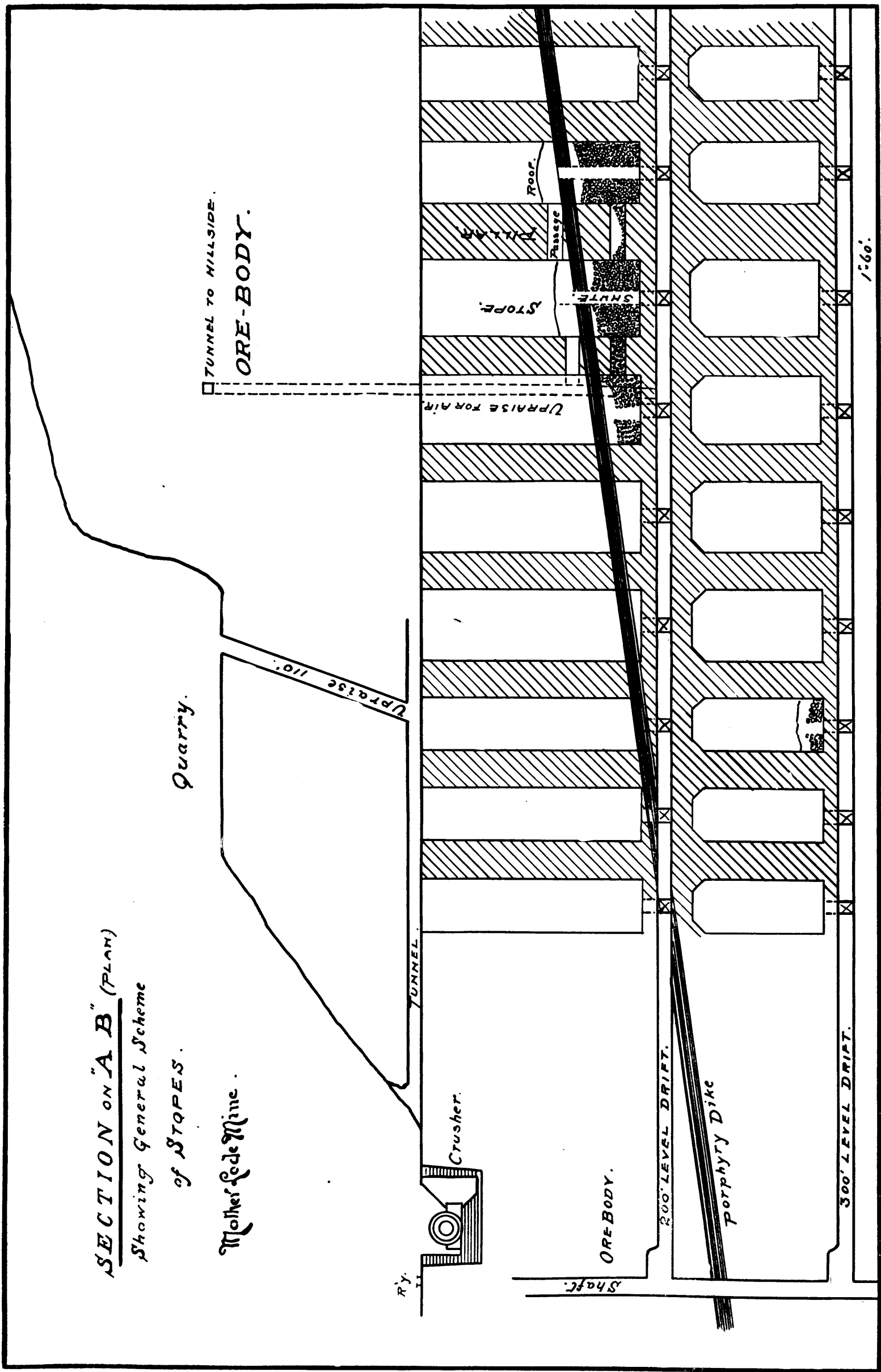
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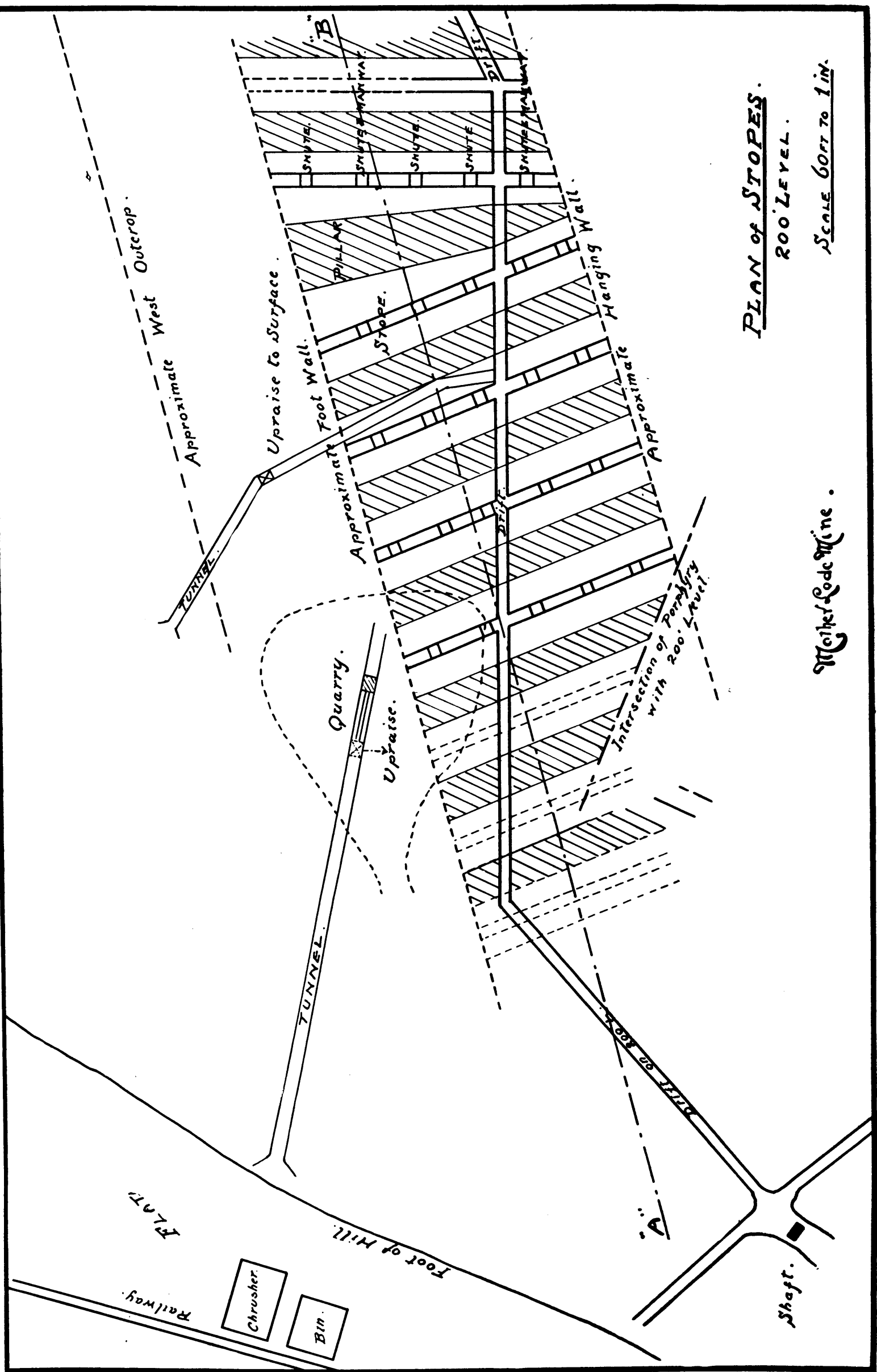
200' LEVEL DRIFT.

porphyry Dike

300' LEVEL DRIFT.

1'-60"





PLAN of STOPES.

200 LEVEL.

SCALE 60 FT TO 1 IN.

Mother Lode Mine.

was going nicely until the roof of stope was some 20 feet over timbers, when a mass of ore became detached from roof, which mass weighed some hundreds of tons. Everything in its path was crushed and the stope wrecked. Luckily no one was hurt.

A further, and final plan, was then adopted. The ore body was divided into stopes 30 to 40 feet wide, the length of stopes being the distance across the ore body. The crosscuts already existing were used, and others cut where needed under the centre of each stope. From these crosscuts, upraises were made 30 feet apart. These were made 10 to 12 feet high, and were then connected by second and parallel crosscuts. From these latter crosscuts the stopes were opened out the proposed width, and then carried vertically upward, the short upraises being cribbed and furnished with gates for loading. Between the stopes, pillars 20 to 25 feet in thickness were left, these being frequently pierced to allow intercommunication and ventilation.

In the stope where the wreck occurred a very heavily timbered passage corresponding to a crosscut was built, shutes being placed at 30 ft. intervals.

The empty space was filled with porphyry blasted from a blanket dyke, which extends through all the ground yet explored. The accompanying plans and sections illustrate the general arrangement of the workings.

These stopes will be carried up to a point 160 feet above the 200 level, where they will meet with the surface workings to be described. After this occurs, the ore remaining in stopes above the porphyry will be sent through the shutes, and as much of the pillars removed at same time as safety may dictate.

The ore below porphyry may be removed at will, as this dyke is very thick and solid and will stand any pressure. In this method of working, nearly 50 per cent. of broken ore must be left in the stopes for a considerable period, but to offset this, the interest on capital so tied up is but a fraction of the cost of timbering these great stopes. Moreover, the system is as safe as mining can be made, the roof of stopes always being near the men, and there can be no wrecks occasioned by a cave. Further, there being no danger from timbers giving way, tremendous blasts can be employed and the ore broken down in great quantities at a time. One drill will frequently break down 75 to 80 tons in 24 hours.

On the 300 level, the pillars come directly below those on the 200, but in future levels the distance will be increased from 100 feet to nearly 175 to allow of less rock being left between levels, and less development having to be done.

SURFACE MINING.

To supplement the output from underground, a great amount of ore is now obtained by quarrying. In the hill which rises some 260 feet over surrounding flat, a quarry (or "Glory Hole" as it is locally styled) is in operation, this quarry being 110 feet above flat and 50 feet above collar of shaft. Ore is at present run down a gravity tram to Gates crusher, and thence over conveying belts to bins on the flat. This No. 5 crusher, experience has shown, to be far too small to admit of economical work, the ore having to be reduced to 10 inch size in order to pass into crusher. This reduction has mainly to be effected by "bulldozing" with high percent dynamite, the rock being too hard for hammer breaking. To obviate this difficulty, and to permit of cheaper handling, a tunnel has been driven into hill from level of flat. This connects by a 12 x 12 upraise with the quarry. In a pit on flat next the railway an immense Farrell crusher, with jaw opening 2 x 3 feet, is now being installed.

Ore will be dropped down the upraise, and there loaded into cars having a capacity of 4 tons. Trains of these will be drawn by mules to the crusher pit, where they will be dumped, by compressed air, over

a grizzly leading to crusher. The screenings and crushed ore will be elevated to a bin beside the railway.

As quarrying proceeds, other raises will be made, and the level of quarry floor at the same time be lowered until the flat level is reached and the tops of stopes encountered, when these latter may be emptied. The present Gates crusher will take care of all ore from shaft as at present, its capacity being from 400 to 500 tons per 24 hours when fed with ore properly broken.

A photograph accompanying this paper shows the general arrangement of works, and the appearance of quarry when it was first begun.

Silver Lead Mining in Quebec.

The following, covering the operations of their property at Lake Temiscamingue, Que., is taken from the report of the British & Canadian Lead Co.:—"The first shipment of concentrates arrived in England on the 28th August, 1900, comprising 117 tons, and there was also shipped for testing purposes a parcel of crude ore of 13 tons; the total shipment, after deduction of smelting charges, realized £1,161 18s. 10d. The assay of the concentrates was 74.82% lead and 14.87 ozs. silver, and the average assay of the crude ore was 27.49% lead and 6.90 ozs. silver. The second shipment of concentrates of 27 tons 7 cwt. arrived on November 17th, 1900, and realized £278 16s. 1d., the assay being 65.50% lead, and silver 15 ozs. Acting in accordance with the recommendation of Mr. Ashworth, the directors arranged for a shipment of 62 tons of crude ore to be made for the purpose of testing the value and obtaining information as to its concentration. This ore, taken from the No. 3, or 200 feet level, was shipped to the Mechernich Mining Co., of Mechernich, Germany, and your Chairman and Secretary were present during the treatment of the ore at the works of that company in Germany. There was a considerable quantity of rock intermixed with the crude ore, but notwithstanding this, the actual result produced was 13,576 tons of lead and 302.8 ozs. of silver, which, after payment of expenses of trans-shipment to Mechernich and the cost of concentration, realized £138 1s. 10d. On the 4th January, 1901, a shipment of 57 tons (of 2,000 lbs. each) 1,490 lbs. of concentrates was made from the mine to the Balbach Smelting and Refining Company, of Newark, N.J. The assay of this shipment was 69.87% lead and 16.50 ozs. silver. Owing to the excessive charges of the American Smelting Company, and the large deductions made by them, the amount realized was only \$1,915.54 (£392 10s. 7d.). It may be mentioned that at this time navigation had been closed, therefore shipments could not be made to Europe. The second shipment made in the present year, amounting to 107 tons 8 cwts., arrived in July last and realized the sum of £887 7s. 2d., subject to deduction of £195 freight from the mine to the smelting works, or say £1 16s. 6d. per ton including insurance (which figure practically agrees with the original estimate made by the vendors). The assay of this last shipment was 77.4% lead, 17 oz. 4 dwt. silver. There is a further shipment of 250 tons of concentrates about to be made to the mine, which, at the present market price, will realize some £1,600 after payment of freight and smelting charges"

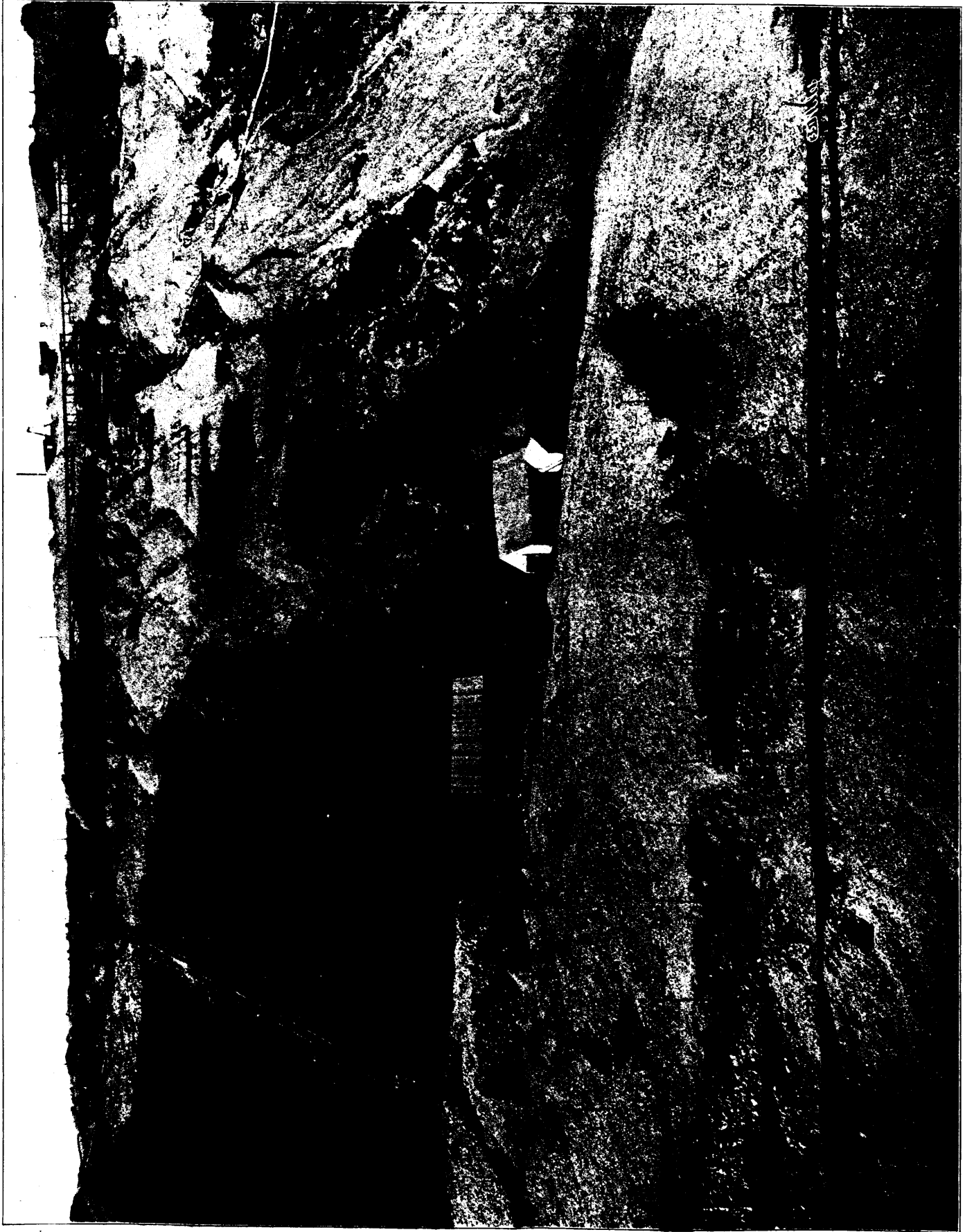
Ymir.—Cable from the company's representative at Nelson, British Columbia:—"During last month 80 stamps ran 656 hours (27 days, 8 hrs.); estimated profit on operating is \$9,472 (£1,953). The falling off is due to total amount crushed, 5,210 tons low grade ore. The grade of the ore shows considerable improvement during the present month drawn from the same stopes." (Office note—This explanation means that during January it was found impracticable to supply the mill with ore of the usual general average value owing to some temporary difficulty in getting the higher grade ore in the same stope.)

CANADA'S GREATEST GOLD FIELD—THE YUKON.



Gold Mining in the Yukon.—Looking down Bonanza Creek, Y.T.

CANADA'S GREATEST GOLD FIELD—THE YUKON.



Gold Mining in the Yukon.—The famous Chechaco Hill.

CANADA'S GREATEST GOLD FIELD—THE YUKON.

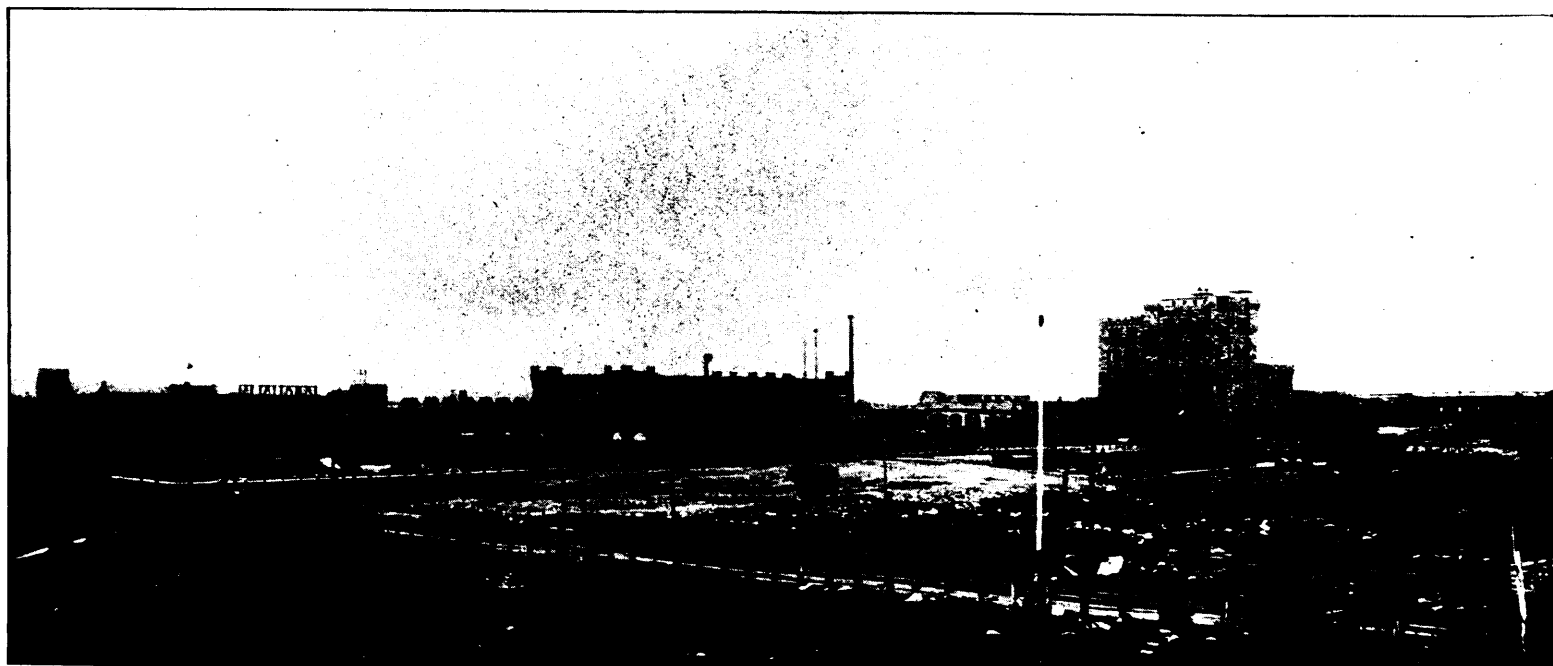


Gold Mining in the Yukon.—General View of Gold Hill.

COPPER MINING IN BRITISH COLUMBIA.



The Smelting Works of the B.C. Copper Company, near Greenwood, B.C.

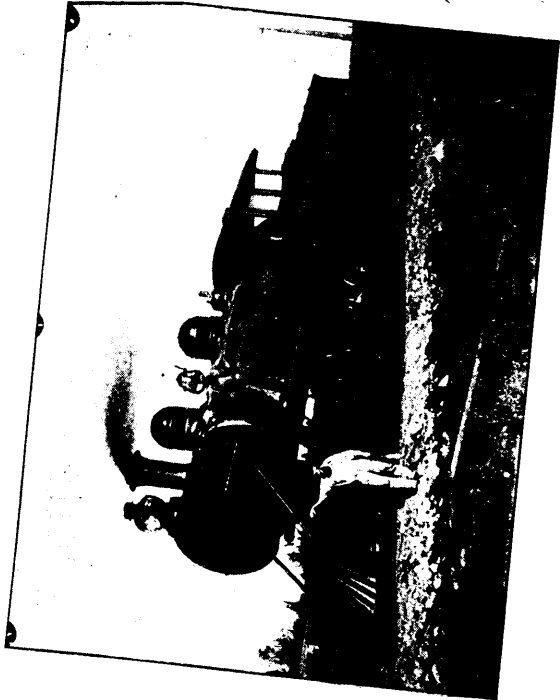


This photo gives a general view of the handsome large works built by the Clergue Syndicate at Sault Ste. Marie, Ont. On the left hand is the Canadian Electro Chemical Company's Square Tower, then the two mechanical pulp mills, in front of which is the new office building. Further to the right, occupying the middle part of the picture is the machine shop, and in front of the large sulphite mill is the old Hudson Bay Blockhouse, now the residence of Mr. F. H. Clergue. To the left of the sulphite mill is the Laboratory and behind and further to the left is the Foundry. To the extreme right is the Roasting plant and the Sulphurous Acid plant.

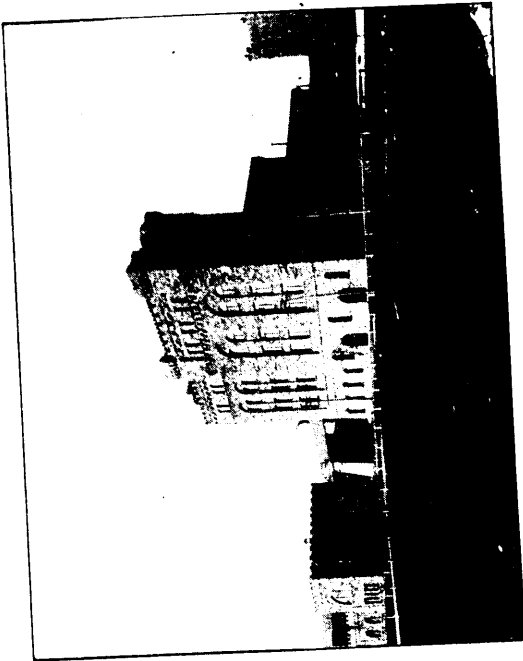
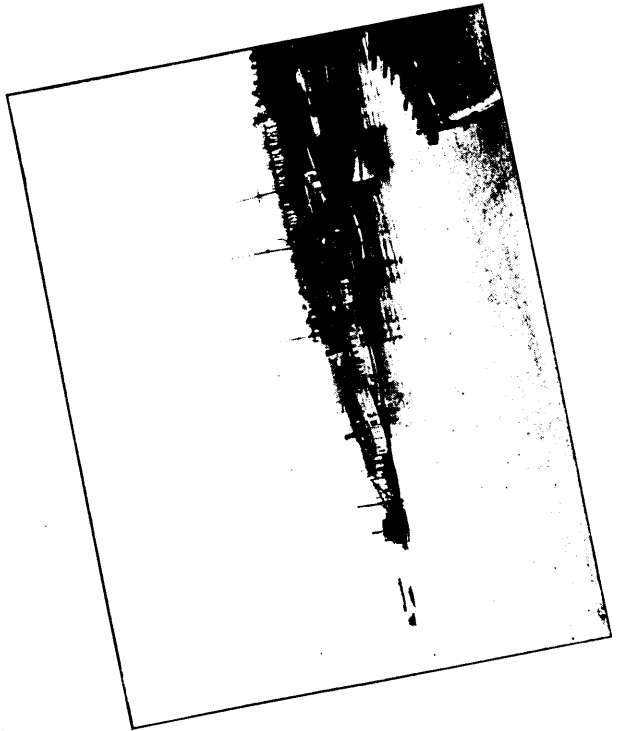
IRON MINING IN ONTARIO.



The celebrated Helen Iron Mine, Boyer Lake, Michipicoten District, Ontario, worked by the Clergue Syndicate.



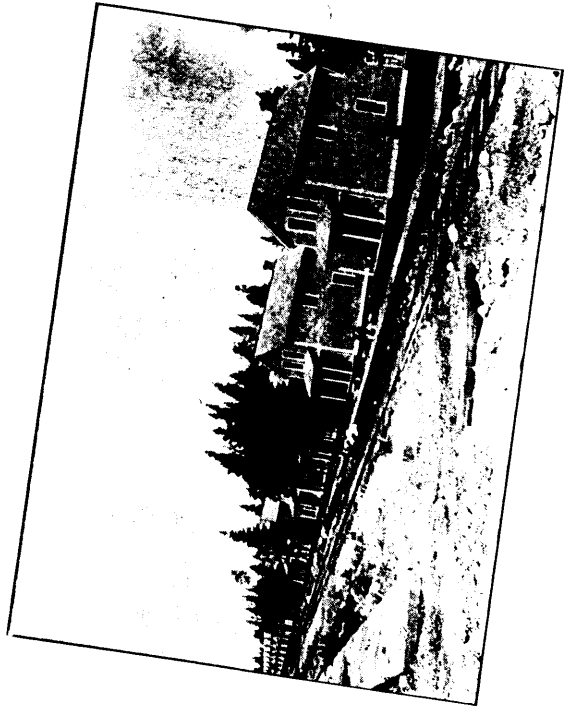
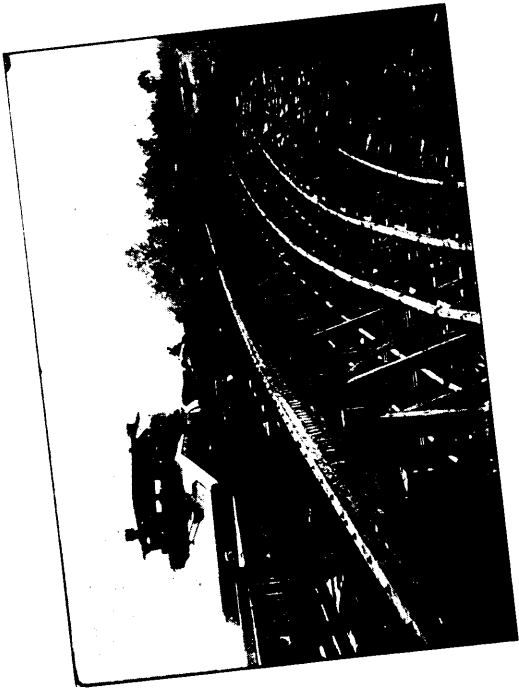
1.—137-ton Locomotive, No. 23, of the Algoma Central Railway.
2.—Ore Docks at Michipicoten Harbor, 12 miles from the Helen Mine.



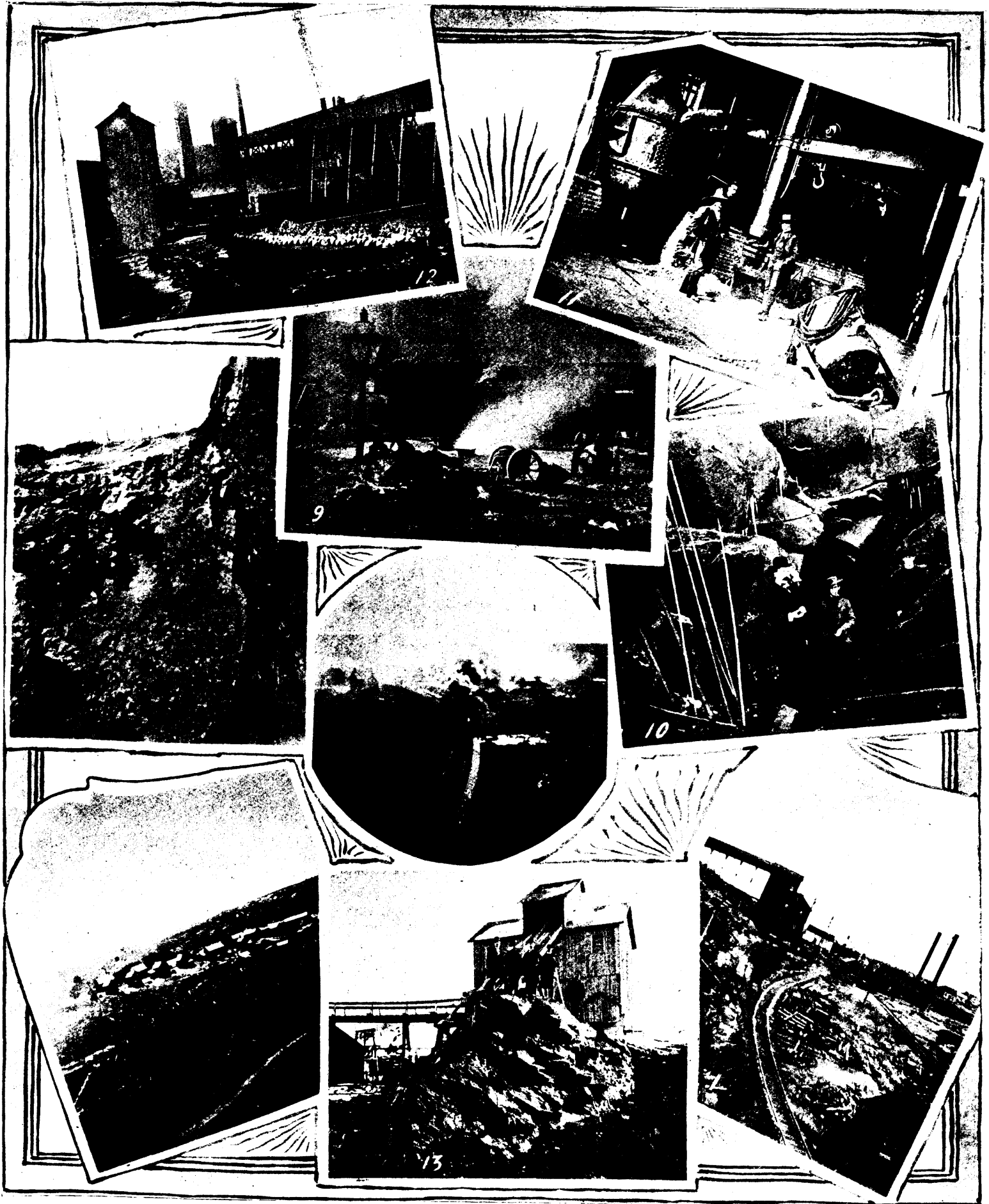
3.—Chemical Pulp Mill.
4.—Mechanical Pulo Mill.
5.—Sulphurous Acid Building.



6.—Log Train on Trestle, Algoma Central Railway.
7.—Streets of new town of Tagona, showing cottages built for employees of the Steel Plant.



COPPER-NICKEL MINING IN ONTARIO.



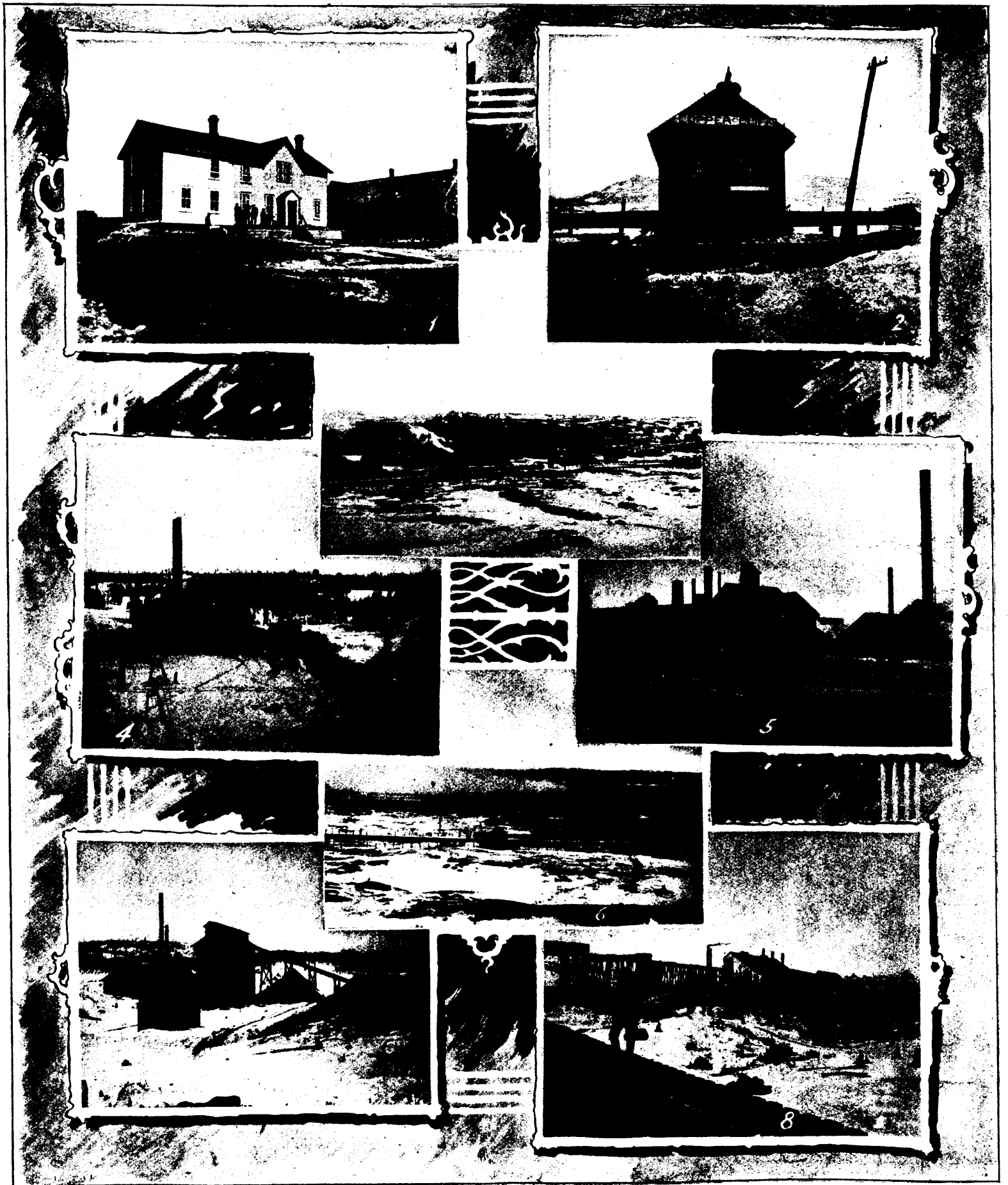
MINES AND WORKS OF THE CANADIAN COPPER CO. AT SUDBURY, ONT.

Matte Dump at Old Smelter.
No. 2 Mine.
Village of Copper Cliff.

No. 2 Smelter.
Train of Ore Cars running to Smelter.
No. 5 Mine and Rock House.

Interior Bessemer Plant.
No. 6 Mine.
Engine House No. 2 Mine.

COPPER-NICKEL MINING IN ONTARIO.



MINES AND WORKS OF THE CANADIAN COPPER CO. AT SUDBURY, ONT.

Club House at Copper Cliff,
Compressor No. 6 Mine,
No. 2 Shaft House.

Cinder Dump at Old Smelter.
Roast Heaps.

Copper Cliff Siding.
Old Smelting Works,
Trestle New Smelters.

A Few Notes Upon Gold Dredging.

By F. SATCHELL CLARKE, Vancouver, B.C.

A great deal of attention has been paid of late years to gold dredging upon the rivers and placers of the Pacific Coast and North-West Territories down to Lower California, and, generally, a quantity of literature has been published by various papers and authors upon this subject, but, with one or two exceptions, little has been written by those having a direct and intimate knowledge of this form of mining.

This is really what is to be expected in any class of tentative work, for that is what it really has amounted to in British Columbia. Any work in which the experts are few will always cause to arise a host of empirics willing to learn at the expense of others.

Gold dredging in British Columbia instead of being the leading mining industry owing to its enormous extent of auriferous gravels has been marred by such empiricism and marked with many failures by reasons so palpable to the writer, that it has often occurred to him to ask with amazement "what kind of business men are these who invest their money without having a consulting engineer in dredging to advise them." A consulting engineer is always necessary with other mining, yet in this instance, in work that above all requires a specialist to advise, matters are left to run with the promoter, or quondam manager who may be appointed.

In New Zealand, the home of this industry, the work of recommending the claim and the actual details and construction of the dredge with its design is left to the consulting engineer, who is necessarily an expert in designing and actually operating gold dredges, and stands between the owner of the claim, or rather, to speak more correctly, the intending buyer of the claim and all other parties, and is merely paid a salary for a specified time, or a fee to cover the intending operations until the plant is completed.

This proceeding saves both the buyer getting a claim sold principally by the silver tongue of an interested party, and in another case building a faultily designed plant, foisted upon the first party by some of the would-be experts connected therewith.

The chief and prime cause of these failures which form the subject matter of this article has been the appointment of managers who, prior to holding their position, were without the slightest knowledge of this class of work, simply because in most cases he is, or becomes, a stockholder, or had possibly sold the claim to the investor, and according to the old and obsolete custom still retained in placer mining, "who so able to manage a claim as the large shareholder, as he is looking after his own interests as well as ours." Never was a greater fallacy more exemplified than in dredge mining history in British Columbia. A little desultory reading in the mining papers and reports gathered of what other dredges are doing and the manager blossoms forth into the dredge expert.

After the appointment follows the usual trip to New Zealand, California, or other places, to investigate the best type of dredge suitable for the claim. It appears to the writer equivalent to appointing a manager to a quartz mine and then sending him round to other mines to find out the best way to work the mine. He may, of course, return with the right ideas, but in the confusion of different opinions and dredges he has seen, it would be a matter of chance than otherwise, and his advice to his principals would be merely "the blind leading the blind." In some cases he returns with exaggerated ideas that he is getting the right machine and no other, and of course probably has been talked into it by the ready-tongued agent of some manufacturing company, or taken by the advertisements of some concern. Now, no matter how excellent the work of the manufacturing engineers is, he is unable to tell from his inexperience whether they are right or wrong in the details or general design. Then another class of managers are the

persistent billet-hunters, who must be included among the causes of these failures, as these men are ready to take any job, provided there is a salary attached, no matter how ill their qualifications may fit in to the work.

Now, to turn to the different types of dredges used. There are many engineers and persons still in existence who cling persistently to the centrifugal pump as a means of dealing with auriferous gravels. This process has been exploded years ago in the great dredging centres. As a rule, with rare exceptions, gold gravels are composed of rough boulders averaging anywhere from 10 in. in diameter, and mixed up with a compound of sand, fine gravel and clay, forming what is known in mining parlance "a tight wash." It is almost impossible to work this by a pump, owing to the almost cemented qualities of this wash, and the throat of no pump has yet been made strong enough to stand the impact of the gravels, should the pump strike an occasional body of loose gravel, and then it is superfluous work as loose gravels seldom carries any gold.

In spite of the repeated failures in New Zealand, California, the Snake River, and many other places, even to the Mawdach Gold Dredging Co., in gallant little Wales, where an attempt was made to dredge for gold at Barmouth; an enormous amount of money was wasted at Ruby Creek, upon the Fraser River, in trying to make a centrifugal pump dredge for gold. Interluding a little foreign news, after having seen the Barmouth gold dredging claims, I will undertake to say that with a properly constructed dredge there should have been a handsome investment for the stockholders. This may seem news to some, but there is quite a large extent of auriferous country in Wales.

Next to the centrifugal pump came a giant clam-shell dredge which was built some years ago at Lytton upon the Fraser River. This was the old mud dredger system applied by a pair of semi-circular steel plate self-shutting shells, very like its patronymic in appearance, and lowered to the bottom of the river by means of chains. On lowering these into the river, two almost insurmountable difficulties were met with; in the first instance, the strong current carried the clams under the bottom of the scow upon which the machinery was placed, and rendered it nearly impossible to bring it up full. The next trouble was that when the clams did bite into the gravels, a boulder or large stone would be held between the jaws, and by keeping them that distance apart would allow the whole of the finer gravels and gold to escape back into the river. This experiment cost the unfortunate shareholders \$60,000 before knowing it was a failure.

After this came an attempt to exploit the gravels by means of a caisson or air-lock, by which men went down to the bottom of the river and by hand labour passed the gravel into an air-lock, and from there to the deck where it was treated by means of an ordinary rocker. Owing to the writer being brought into a controversy over this machine by the promoters, the project was killed by the caustic remarks made about the enormous cost in labour and steam to bring up a yard of gravel yielding probably 25 to 30 cents from the bed of the Fraser.

The writer was working a ladder dredge upon ground over which a pneumatic dredge had passed over and thoroughly prospected according to its ability and found too poor to work, which turned in to the shareholders for some years over 100% per annum clear of all working expenses.

Later upon the scene of dredging operations came the dipper dredge. This, as far as working a hole in the gravel, is moderately effective, and many of this type have been built and launched upon the the Fraser and the Saskatchewan rivers. Yet there are great stumbling blocks to the use of this type as a gold dredger. Chief among these are the want of mobility in handling it in a rapid river, the great cost in working them, (they require at the least 5 men per shift under favorable circumstances as against 2 men with the bucket and ladder type), the

intermittent discharge, the comparatively small cubic measurement of gravel actually worked in a week's run, and worse than all the inability to make a direct side cut across a river or bar, thereby enabling the ground to be worked upon a face and thus systematically clean up the bed-rock, or depth it is found necessary to go with the dredger. These points will always militate against it as a dividend-producing machine, except under very and exceptionally favorable circumstances.

All of this class of dredge which were built upon the Fraser and other places near have been started with a great flourish of trumpets (one was started last year) only to end disastrously. One manager of these dredges told the writer that his ground averaged 25 cents to the yard, and in the lower depths considerably more, yet he could not pay dividends owing to his intermittent digging. I understand that at 20 feet the gravel ran to as much as \$3.00 per yard, but he was unable to keep his cut open long enough to take more than an occasional bite at it, for the reasons mentioned above.

The first plant to work the Fraser river in its rapid current and heavy gravels successfully was one of the bucket and ladder type, built in 1899 in England under the writer's supervision upon New Zealand plans, altered slightly to suit the conditions met with in this country.

This is known as the Cobbledick dredge, and is now under another name, "The Fraser River Dredging Co." This plant failed dismally the first year to pay anything, although quite an amount of gold was won, owing to the want of experience of the then manager, who was also a large stockholder—made by selling the investors the claim. He was a clever man with extravagant ideas, and threw the old company into debt. It was re-organized, and under the present management is paying moderately well, and the writer has no doubt but that when those at the head of affairs have gained more experience, the company will pay handsome dividends upon its present capital.

Some Eastern capital after seeing this plant work, decided to place a similar type, but of more powerful design, upon the North Thompson river 15 miles north of Kamloops, and the writer was instructed to prepare plans for the same.

The whole of this machinery was built in Canada by the Wm. Hamilton Manufacturing Co. of Peterborough, who to their credit made a vast improvement upon the New Zealand and British work.

This dredge is capable of lifting from a depth of 40 feet below water, washing, treating, and stacking the coarse stones and boulders to a height of 30 feet astern of the dredge, a guaranteed capacity of 2,000 cubic yards of gravel per day, and cutting its channel through a flat of 20 feet in height. The girder, or ladder as it is known, for carrying the continuous bucket chain is of the box type, built of $\frac{1}{2}$ in. x 3 ft. 9 in. steel plate, tapering from the centre to a depth of 3 ft. at each end.

The lower, or digging end, carries a five faced cast steel tumbler which weighs over 6,000 lbs. (also cast in Canada). This ladder runs in a fore-and-aft line from a radius point 60 feet back from the forward end of the scow and extends forward and outside of the nose of the scow to a distance of 10 feet, this latter fact enables the dredge to cut its own way when necessary and keeps a channel open for the boat.

The bucket chain, or belt, consists of 35 heavy built up steel plate buckets, with their necessary connecting links, each having an approximate capacity or slightly less than 6 cubic feet. There are also at mid-distances upon this belt two large powerful rock picks for tearing up bed-rock.

The belt travels along the ladder upon rollers fitted upon the ladder itself. The buckets have hard steel links rivetted to the bottoms, which are bushed with manganese steel bushes to prevent abrasion, these bushes take the manganese steel coupling pins which connects the buckets to the connecting links between each pair of buckets. Manganese is the only metal so far known to be able to stand the enormous wear and tear that takes place in the couplings of the

buckets. At the mouth of each bucket there is rivetted a heavy steel reinforcement or cutting lip, which is detachable and renewable when worn out, thus retaining the life of the bucket.

The upper tumbler, which is the driving sprocket, is square and also is a steel casting; this is driven by a heavy, half-shrouded, square-gear wheel of 4 in. pitch keyed upon the tumbler shaft, and then by means of pinion gear and belting from the main engine. The speed of the top tumbler is $6\frac{1}{2}$ revolutions per minute, which gives a bucket speed of 13 per minute, or a theoretical delivery of 172 yards of gravel per hour. In practice it is found best to deliver about 120 yards per hour to enable the tables to clear themselves.

The gear is driven by a 22 inch belt from a tandem compound surface condensing engine 10 in. and 20 in. cylinders by 16 in. stroke, running 150 revolutions per minute.

The gravel drops into a heavy, steel-lined shoot, and falls by gravitation into the revolving screen 5 feet in diameter by 24 long, and perforated with graduated holes from $\frac{5}{16}$ in. to $\frac{7}{16}$ in. At the upper end of the screen is rivetted a steel gear for driving it the necessary revolutions, and this in turn is driven by a steel pinion keyed upon an intermediate shaft running from the main gear shafting. The screen is held in position by 4 rollers 24 in. in diameter, which revolve against a steel wearing band rivetted round the screen.

After the gravel has been sifted through this screen, the refuse is delivered into the stacker buckets by gravitation, and is conveyed by the stacker to the distance of 20 feet astern of the dredge and clear of any trouble the plant may experience by sitting upon its tailings.

The length of this stacker is 50 feet, and as it is little more than an ordinary elevator made much stronger for the large stones, etc., there need be no description given.

The water for washing the gravel, both in the screen and on the tables, is supplied by a 12 in. centrifugal pump, driven by a belt direct from the compound engine, and throws a body of water at the rate of 2,600 gals. per minute through the surface condenser, which has the effect of slightly warming the water to about 45° , thereby preventing it from freezing upon the tables in cold weather, thence through a perforated pipe leading down the whole length of the screen. The water and fine gravel carrying the gold then falls through the screen into a cast iron distributing box with shut-off gates each side, and through these gates evenly distributed to the tables set each side of the screen and at right angles to its length.

The tables for catching the gold are arranged in steps or drops similar to the deposition of a battery table, towards the sides of the pontoons, and the dirt is carried thence astern by a common launder. These tables have a width equal to the perforations of the screen, in this particular case 19 feet wide by 19 feet long, each respective table making a total superficial area of 361 feet exclusive of the launders and other catch-alls.

They are of wood, and in operation are first covered by calico, then cocoa-nut matting, overlain by expanded metal. This latter is found by long experience to be unexcelled for catching fine gold, in fact the percentage of gold which is lost upon dredges equipped in this way is very small.

That these tables are capable of saving gold extremely fine has been shewn by accurate measurements taken by trial from dredges actually in operation, by Mr. J. B. Jacquet, Government Geologist to New South Wales. A sample of gold from similar tables was weighed, and found to be about two grains in weight, which had been sifted through a sieve of 3,600 holes to the inch, was again sifted through one of 4,900 holes, and the gold which passed through sorted under a powerful lens. One hundred of the smallest of these pieces were thus selected and examined under a microscope. Measured with a micrometer their dimensions in fractions varied between 0.009×0.006 and

0.003 x 0.002, the mean of twenty measurements being 0.0065 x 0.0042. The hundred particles were then carefully weighed, and found to have a mass of 0.097 of a grain. The mean weight of the pieces was therefore 0.00097, or a little under one-thousandth of a grain. Several experiments also gave similar results.

As the life and working capabilities of a gold dredger depends upon the ease and rapidity with which it can be handled, especially in a rapid current, a careful design was shewn in the manœuvring winch. This is of most powerful design and construction, consisting of six barrels, self-contained within one frame. The first barrel is a double-gear drum to carry the 1,500 feet of $1\frac{1}{4}$ in. steel cable for the headline, which keeps the dredge up to her position in the face of dirt which it is working. The second drum carries the ladder hoisting line, and lifts or lowers the buckets into the gravel, being used extensively by the winch operator. The other four drums are in pairs, and are used for bow and stern lines respectively. The whole are driven by a pair of vertical 8 x 10 engines with reversing gear, whose main shaft is coupled direct upon a 6 in. worm shaft running the whole length of the frame carrying the drums. The worm shaft has three Hindley patent worms cut out of the solid shaft opposite each pair of barrels, and these worms revolve a 48 in. tangent wheel keyed upon the shaft of the drums. Each drum has patent friction clutches with powerful brakes attached also, and is therefore controlled independently of the others by the single operating winchman working a set of levers in a quadrant by the side of the frame.

The hull of this dredge is built of fir, and the frame is strengthened by heavy 10 in. x 16 in. chime logs running fore and aft, and braced by a semi-Howe truss of 6 in. x 8 in. timbers. The planking is 3 in. x 12 in., 4 in. x 12 in., and 6 in. x 12 in. The framing for carrying the top tumbler and gearing is brought up to a height of 40 feet above deck, and forms a main hogmast to both hold up the stacker and prevent the hogging of the pontoons, a frequent source of trouble with ladder dredges.

The total weight of the ladder, buckets, tumblers, and links is 43 tons, whilst the total weight of machinery is 150 tons.

After this description it would not be amiss to follow up a little of her career.

The plant worked well, but, alas! in this case, it was not the management that was in fault, as latterly they had a first class dredge operator from the Snake River, but the paucity of the claim in gold. As far as the writer's knowledge goes, the claim was bought principally upon the reports made by the sellers, and whether these were good or bad is not within the writer's province to discuss. It suffices to say that beyond a thin layer of sand and gravel of about an inch in depth upon the surface, no gold was found below that, neither disseminated through the gravel underneath this layer nor upon the clay bottom met with at a depth of from 15 to 20 feet. A further fact was brought to light during the operations of this dredger, viz.: that there was, with a few exceptions, no gravel met with in the middle of the river, nothing but a bare clay bottom into which the dredger dug for a depth of 8 feet to see if there was gravel underneath this strata.

Yet, showing how a dredger may fail with a fortune in sight, within a few miles was a mass of gravel which certainly carried a minimum of 25 cents per cubic yard, and the working expenses under careful management should not amount to over 3 cents per cubic yard. However, so disgusted were the owners with the financial results that as soon as winter came on they shut down without a further effort to look elsewhere.

As would be natural in this instance, the claim sellers around blamed everything and everybody except the paucity of gold in the claim. One quondam claim seller and expert went so far as to state that a large quantity of "invisible gold" was being lost in the tailings.

Another, after showing all and sundry visitors (before the dredge commenced operations) the brilliant showing their was upon the surface, stated all that was necessary to make the claim a success was a cyanide plant (!) to treat the gravel and black sands.

It shows how careful one should be in investigating the values of a claim, and not to rely upon the general remarks of those particularly interested.

As a rule, with rare exceptions, one certain sign of good payable dredging ground is the immediate vicinity of sluicing or rocking operations other dredging conditions being present. This, at any rate, determines the fact that payable gold is near, and there is a strong probability that a proposition may be looked into for dredging.

Upon the North Thompson River these operations were conspicuous by their absence. Upon the upper reaches of this river called the Clearwater, I understand there are claims worth looking into, and as to the Lower and South Thompsons no person can dispute their richness, but the gold seems to have been cut out from this river by the dividing range. As a matter of fact, there is no class of mining so profitable and so certain of financial results as gold dredging, provided the conditions given of gold present, workable ground and a good machine. These points can only be determined by the expert, and not by the average engineer, as is generally imagined. The business then really comes within the realm of an industrial proposition, producing large dividends for many years, being merely a question of value of ground in gold, with a constant factor of cost in production. The average figure for handling gravels with a bucket and ladder dredge should not at the outside limit exceed $3\frac{1}{2}$ cents per cubic yard, including labor, fuel, etc.

The writer some years ago dredged gold gravels for over twelve months at the rate of 2 cents per yard.

Given then the actual value of gravels by expert prospecting and drill holes in many number, it becomes merely the everyday industry of machine mining.

New Zealand has been quoted and referred to so often that one is almost afraid to mention that country in connection with dredging, but the Government returns of gold won and dividends paid by the whole of the dredges working there show an average of 30% profit. Some, in fact, of their dredges produce something like 600% per annum upon their capital. Members can judge what this means to the investor.

LeRoi No. II.—The Reports and Accounts submitted at the annual meeting of the LeRoi No. 2 Ltd., held in London on the 9th of January, have been received and call for little extended notice. The dividend, paid in June, 1901, does not appear to have been earned, and from the papers presented and the discussion at the meeting it would appear that the junior company (LeRoi No. 2) is disposed to lay all the blame coming to it on the shoulders of the LeRoi Company. Our readers in B.C. will know how much (or how little) credence to give to the chairman's statement that even at the present reduced price of copper the "Josie" and "No. 1" mines can pay "handsome dividends."

Velvet Rosland Mine.—The directors announce an issue of 199,986 £1 shares credited with 17s. 6d. paid, and seven shares with nothing credited thereon.

Hall Mining and Smelting.—The mine manager cables, under date of 1st February, as follows:—"Output of smelting ore for January, 1,224 tons; average assay 14 oz. 10 dwts. silver per ton, and 4 per cent. copper. No ore sold to smelter during January. New ore shoot No. 6 level east. south vein, winze, 2 ft. 6 in. in width; grade of ore is very good; the face improves as we go on."

Tilt Cove Copper.—The accounts dated 20th December show that the mines made a gross profit of £60,591 3s. 4d. leaving, after charging the account with interest and discount, payable to the Cape Copper Co., the rent representing the interest on the Company's debentures, prospecting costs, management expenses, etc., a net profit of £47,908 11s. 0d.

GOVERNMENT AID TO MINING.

Discussion Communicated in Advance of the Meetings of The Canadian Mining Institute.

MR. C. A. MEISSNER, Sydney, C.B.

The subject of Government Aid to Mining is one well deserving careful attention from the members of the Institute. It is one that has distinctly two sides, which need careful consideration of both their merits and demerits. To a certain extent, the whole system of bounties and Government action is involved in this discussion. On the one hand, opponents of the system claim that in principle it is wrong; that it saps the energy of the people in making them less self-dependent; that it is likely to cause an influx of foreign capital under unhealthy conditions, not because of natural resources and advantages, but for the purpose of taking advantage of such bounties or aid offered, and thus get what the opponents call a fictitious value out of the products, instead of a purely legitimate one obtained by the actual worth of the raw material or manufactured articles, and that in the course of time these will likely stand dependable on this outside aid, instead of strictly on their own merits. On the other hand, it is stated by those favoring reasonable Government aid and bounties, that while, theoretically, these objections have perhaps some basis of truth, yet practically they are entirely dependent on the actual existent conditions, and must be studied and carried out with these actual conditions in view.

Where a country is well populated, or the growth of population is noticeably rapid and steady from year to year, where the mineral resources are by nature good and inviting, and where distances from point of production to market, from raw material to finished product, are not too great, and where the home general market is large and active, or a foreign market is easily accessible, and distances to that market not too great, then it is quite possible that too much dependence on Government bounties and aid is a weakening factor, and likely to make the people neglectful in taking initiative, and create a tendency to look to the Government, making the latter more paternal than is generally good for the nation. The same may be said of the last objection, *i. e.*, the entry of foreign, or even domestic capital for the purpose of taking fictitious profits out of the producing power of the land, which, having to be paid by taxation of the inhabitants, are likely to drain the country without adequate return to it as a whole, or only to isolated sections.

In taking up this whole question, therefore, it is necessary to carefully keep a wise middle path, which avoids too great paternalism, and yet gives such encouragement that any natural resources which are not surrounded by great advantages for development, should be made available in such a way as to prove of real and substantial value to the people and to their Government which represents them.

It appears to me that in Canada we have conditions which are of such a nature as to distinctly call for some such Government aid, judiciously applied to the development of its resources, outside of that which private capital, whether individual or corporate, can give to it, even if, apparently, it draws by taxation from sections that are not directly benefited by such development. The consideration is simply one of the greatest good to the greatest number of people, and by doing this you have solved the problem for a self-governing nation. You can never hope to satisfy everybody, and frequently the individual is not in position to be able to judge for himself what really is best for him as a unit of the whole nation. If such Government action is of ultimate benefit to the whole nation, then sooner or later, each individual unit is bound to derive some small part of that benefit.

Taking Canadian conditions, therefore, as they are, considering the natural resources, the vast area, the scattered and frequently thin population, especially in districts not having the best agricultural conditions, or not having good or easy transportation facilities, too far apart to be in close touch with each other, or to the capital-furnishing world, then it does seem that those interested in industrial development are warranted in going to the Government and saying,—“We are unable to develop our country as we would. We lack the money, the knowledge and the facilities for placing our resources before the world; we lack transportation; we are practically isolated; we do not, as a fact, know what we have, and we cannot develop what we have, so as to show and convince the outside world, or the capitalists at our centres, that what we have is good and worthy of their attention. Come to our aid, therefore. We will do what we can, and you may apply

your resources as a government, and your facilities to get expert knowledge, and put us on a record of such nature as will inspire confidence in such capital to come to us.”

I think in this they are perfectly justified, and point for such justification to the Government railroad. That the West was developed by private railroads does not alter the argument, for here again it was purely a question of natural conditions. The early promoters saw, not only a vast country of great possibilities agricultural as well as industrial, but they also saw a great outlet to the Western Continents, which promised large returns. In the East, it was different. The country was not promising for large agricultural possibilities; it was not promising for large mineral or industrial developments, and it did not show large immediate possibilities as a carrier route to foreign countries, being too near the routes long established, and provided with all facilities and advantages of a large population behind them, which lay to the south of these Eastern sections. The Government railroad, therefore, became necessary,—was undoubtedly a heavy tax on the Central and Western sections,—but was the life-giving principle to the Eastern ones, and now surely has paid back to these more populous sections all the expenditure in taxation they made for it.

The same principle now applies, in many cases, to Government aid in mining, and while it applies more generally to the Central and Western sections than did the Government railroad, yet it specifically applies, just as did the Government railroad, to the Eastern sections. It is my object in this paper to take up the discussion more from the Eastern standpoint, and apply to it especially the suggestions I desire to make, and further, to more specifically confine myself to the practical metals and minerals, rather than to the precious ones, leaving these latter to be championed by those who are better posted and more able to discuss their merits than I am.

To begin with, my idea of Government aid is practically on the same lines as the Geological Survey, which is carried through all districts alike, at exclusive Government cost, but to be devoted more to economic and commercial conditions than is the Geological Survey, which of its nature is more technical and scientific, and not of a specific material value to the individual, as a mining department would be.

The Geological Survey has already been of inestimable value, as a whole, and in many cases has done scientific service which has carried with it great commercial advantages; yet it does not cover the ground sufficiently, and a mining department, giving judicious and cautious aid, in showing the number, location and valuation of the minerals, is the supplement that seems to be required for this and many other less favored or more isolated localities.

The difficulty lies in adopting a method which cannot be subserved too greatly to individual benefit, so as not to swamp the Department with demands that would wreck any treasury, or could be made to further political aims. Especially in New Brunswick and Nova Scotia have we natural conditions that are difficult for an individual to take hold of in such a way as to give permanent and practical results. Our mineral resources have only been scratched on the surface. They are evidently, with few exceptions, not of a very large nature, and even those that were beginning to indicate more valuable properties have for many years lain idle or been looked upon with a large degree of uncertainty. Nature has not been particularly kind in exposing her secrets underground, excepting, perhaps, in coal, and yet already, in several cases of local government aid, valuable results have been obtained, where private capital had not felt sufficient courage, from the indications, to do that exploring necessary to show what really was available. The population, also, is thin. There are few large centres, and there has been little opportunity for knowledge as to how to proceed when a mineral has been discovered. The result is, that already a vast amount of private capital has been misspent, and properties abandoned at the very beginning, owing to this lack of knowledge on the part of the early prospectors. Then again, money has been put into many properties that were worthless, and would have been determined worthless by men having knowledge of mineral formations. Unscrupulous prospectors, I regret to say, “experts” have even taken advantage of this lack of knowledge to paint deposits in glowing colors, being themselves utterly indifferent as to ultimate results, after they had been enabled to spend a certain amount of time and to pocket their fees. Then, again, transportation facilities are poor, and frequently what would be deserving properties are not looked into further, because, unless they are of a large nature, it would be manifestly impracticable to give them the necessary transportation facilities.

To cover the ground for such work, I have the following suggestions to offer: The mining department having in charge this work should be divided into minor departments, covering various sections, all through

Canada, each of which requires a competent, honest, well informed man; fearless, and as free from political affiliations as possible; broad minded, and of good judgement and insight into human nature. From him would emanate the work to be done in his section, and he should exercise great care in the selection of men who would do the actual prospecting or development work of his particular section. It appears to me, that for New Brunswick, Nova Scotia and Cape Breton, one such man, or commissioner, as I will call him, should be sufficient; and he should have under him one mineralogist for New Brunswick, one for Nova Scotia and one for Cape Breton. These mineralogists should be like our geologists—cautious, conscientious, and with a full realization of the import of their work. Above all, they should not be given to jumping at conclusions. They should understand the formation of ores, of mineral deposits, and their relation to the geological formations. In the present day, when this branch of investigation is being so thoroughly gone into, and so much having been written about it by such men as Posepny, Emmous, Beck, Van Hise, Kemp, etc., and the whole formation of ore deposits is being more and more clearly understood from day to day, there should be no great difficulty in finding men capable of filling these positions. It would be merely a question whether the Government, in undertaking this work, would be willing to go into expenditure to get good men, especially at the beginning, who would then train up under them a corps of assistants, who could, in comparatively short time, be drawn upon to fill either additional positions, or vacancies which would be constantly occurring. These mineralogists should be definitely assigned to their sections, so that they would make it their special work to study the section, first geologically, and with what knowledge is now available, and then from the special mineral standpoint, when they would soon become thoroughly familiar with the work required. All such work needs going over and over the same ground again, each time with some new information, which brings out points and data overlooked, or unnoticed, or not quite understood on previous visits. It is only by careful co-ordination of all available data that accurate practical results are obtainable in mineralogical work. We have all had the experience of examining a location or deposit, and coming back to it again some time later, after having given it more thought, and having obtained all sorts of data, etc., to find that we looked at it in a very different way, and that many of the important factors appear to us, on the later examinations, very differently and more clearly than at first.

Fully as great care if not greater should be taken in the selection of these men as in the Geological Survey. The information here is concrete, and such that upon it large amounts of money may be represented. These men must be incorruptible, conservative, yet not too timid, nor too confident. As a rule, actual immediate results will come from their work. This will be tested and checked by experts from any part of the world, and in this respect it differs from the Geological Survey work, which deals by nature more with the large general questions of the whole formation, detailed as finely as practicable, but not subject to that quick, decisive test or accuracy of judgment or of work, and definiteness of results that will characterize the work of the Government mineralogist. I enlarge on this somewhat because, to me, the character of the man seems the gist and crucial point of the whole question.

These men could further be used for the inspection of mines already in existence, without at all interfering with the system of inspection of coal mines, which, being of a well established nature, should be kept separate, and continued as now with whatever modifications are necessary or desirable.

The whole work would, of course, be under the direct control of the Mining Department, and this and the Geological Survey should work very closely together, and thus make the likelihood of success much greater.

Of course, we must look for occasional failure. There is no mineralogist who can look beneath the ground any deeper than any other man. He puts to use his knowledge and previous experience, but nature has a way of playing scurvy tricks, and she seems to be in a particularly tricky mood in these Eastern sections. The element of luck and good fortune rests, in a certain way, with all of us in our work, but this should be minimized by a well-planned, systematic course of work, and I only mention this because no man should be condemned too hastily, if he has been too cautious or too hopeful, as long as we see he has been conscientious in his work, and his reasonings have been logical.

Records, collections and general information all can be obtained from anywhere; yet the whole result hinges on the personality of the man. You can lay down no set rules. No definite lines of formation regulate them. They are only governed by general rules, and the specific information is always

the result of local conditions and disturbances, which are seldom alike in two places; hence the need of this extraordinary care in the selection of men, which, as a rule, we know Governments are not always inclined to exercise. Above all, there could be no greater misfortune than to endeavor to make this a political opportunity. This is, therefore, the most serious consideration that the Government has to keep in view in making its decision on this subject. It may probably be considered well to go slow, starting with certain sections, and let the work grow as the heads become familiar with the requirements, and as the results begin to show, and warrant further increase of force or work.

The matter of next greatest importance is the one of keeping proper records. There should be in the office of the commissioner a careful and complete record kept of every report made, giving in short detail the gist of the information, starting with the date of report, the name of mineral location, analysis, the owner the informant or examiner, the date of examination, estimate of quantity, and decision of examiner, with comments thereon; also a number corresponding to that of the report, for readily finding the latter in the files. The books should be sub-divided under the various mineralogical headings, thus: Coal, Iron Ore, Manganese, Limestone, Gold, Silver, etc., etc., Minor Metals, as well as such material of practical use as Sand, Building Stone, Clays, etc., etc.; so as to make it possible at any time to refer quickly to any subject, and get a general insight as to what it represents, and then be able, if desired to immediately get the full report. Reports should be printed at not too infrequent intervals, and not too long a period after they have been made out. How much of the mineralogist's report should go into print is a question for the Commissioner to decide. Reports of importance should be printed in full. Reports of failure to find available mineral, or of minor importance, should be printed in extracts, giving a general outline. Anyone desiring further information could obtain this separately from the Commissioner's office. There can be no objection to this on any individual score, as no one who does not desire the fullest publicity as to his property has a right to call upon the Government for aid in examination or report. Anyone desiring secrecy as to his property should be made to do the work at his own expense. I can see right here a very great advantage to the general public, as the habit is only too frequent of having properties examined time and time again that are utterly worthless, and which each time are represented as new discoveries, or even as having had previous favorable reports made on them. I know of cases where properties have been optioned several times, with cash payments for option, by such misrepresentation. A quick examination of the Government records would immediately develop such representation, and prevent the further investigation of many worthless properties, which frequently are likely to lead to the subsequent condemnation of the whole section, or even of its people.

Particular care should be exercised in keeping the record of the drill holes. This is a matter in which we frequently come across cases of gross neglect, either purposely or unwittingly. I know of cases where drill work in very valuable measures was made absolutely worthless by the slovenly and incorrect manner of keeping the records. There should be specially printed and ruled sheets available at each drill, for the marking of every change in the core from beginning to end. Such sections should be blue-printed, and the blue-prints filed with the records. The compilations of such sections, when not too far from each other, are frequently of inestimable value in determining the strata and the thickness or continuity of ore bodies.

Another important feature is the proper keeping of collections, to which especial attention should be devoted. Accompanying the cores should, if possible, be samples of the foot and hanging walls. Specimens should be kept and carefully labelled from all properties examined, and also samples sent in should, in a separate place, be boxed and labelled, first, under locality, and second, under various mineralogical headings.

In the record book should also be kept a short outline of all information sent in to the Government, under the various mineralogical headings. This would include inquiries and statements of any nature, which may sooner or later become valuable to refer to.

The Commissioner's office should, in my opinion, be centrally located, so as to be as accessible as possible.

As to how far the Government should go in its expenditures on any one property, and what sort of compensation it should expect for its work, this is naturally largely dependent on circumstances. The rule adopted in many cases at present, I believe, is that the Government pays 45 per cent. of the expense, while the owners pay the balance. I am not quite familiar with what steps the Government takes at present to reimburse itself in full, in

case of valuable discoveries. As a rule the actual expenditure is not very great, and it would appear to me that the Government's expenditure, whatever it may be, should be practically a charge upon the property, to be paid for by this property, either in total, or on a species of royalty basis. In cases where the owners are manifestly unable to pay even 55 per cent. of the investigations, and yet the preliminary visit of the mineralogist indicates prospects that are worth while further investigation, then it would seem to me that the Commissioner, after referring the matter to the Head Department, should be permitted to make the Government investigation without calling upon the owner to participate in the expense, but in such cases, again, the whole expenditure should be a charge against the property, to be repaid to the Government out of any actual commercial results that arise therefrom, and an agreement with each owner to this effect should be entered into.

In such case, the Government assumes the full liability for only such investigations that prove valueless, and in thus wise directly carries out the whole essence of this proposition; namely, to develop what is good and what is worthless. It will also be a strong incentive to each section to be as cautious as possible in its expenditures and examinations, so as to have charged up to it at the end of the year the least possible amount of Government liability for which there can be no return expected.

An assay office or laboratory should be in connection with the work. Whether each section or Commissioner should have one under his control, or whether there should be one central Government laboratory, is a question for discussion. The central laboratory would be more economical.

The charges for Government samples would, of course, be included in the general charges against the property. For individual inquiries a fixed schedule of charges should be had, in order to prevent the swamping of this department with non-paying work. I have little to say about this subject, because all general rules governing laboratories and chemists cover it.

The great value of keeping careful records, for future reference, even of ores that appear too lean to be worked at present, is evidenced by the fact that Scotland smelted last year some 880,000 tons of ore containing only 30 per cent. in iron, while England smelted some 10,000,000 tons of ore running from 30 to 33 per cent.; these being mixed with richer ores, domestic or foreign, and in some cases smelted alone. Hence, low-grade ores in this country may in time become of value.

As to the equipment required for the exploration, the first is the ordinary list of tools for putting down trenches, pits, etc. Then, when the property has been superficially examined, and some definite idea obtained as to the course of the formation and the probable extent and direction of the deposit, it is for the mineralogist to determine whether he will put down a short shaft or drive a tunnel in-a-ways, or whether he will use the drill direct. The two classes of drill, diamond and calyx, are the most desirable to use. The diamond drill is expensive, on account of the high price of the carbons, the difficulty of obtaining good ones, and the much greater care and experience required to successfully run it without too great a loss of carbons. The core also is small and not so representative. It is more likely to break up and crumble, and more difficult to measure the angles of formation through which it passes. Its main advantage lies in the fact that it will permit drilling at almost any angle. The calyx drill gives a larger core—from 2½ to 5 inches—admits of the use of either the steel cutters or the sheet barrel, according as the rock is soft or hard, and requires much less experienced or skilled men to run it, and would appear to me to be the more available under the special conditions which would govern this work. As to the comparative cost, I have seen such low cost on both the diamond and the calyx drill that I draw no comparison between them.

The report of the mineralogist should contain a surface description of the locality, its distances from various shipping or consuming points, the geological formation; then deal in detail with the character and formation of the ore; should describe its availability for mining purposes, the most economic methods, and any data pertaining to the economical mining; it should, further, give the transportation facilities, if any, or what transportation facilities would be required; refer to the available timber, the available population for mining purposes, and be as general in its details as practicable.

In this paper, I have purposely not discussed the questions of Government bounty on ores mined, the reduction or entire cancellation of Government royalties, under certain conditions, or of Government encouragement to larger and better school facilities for technical education. Each of these are subjects to be taken up separately, while I have confined myself to practically but one phase of the problem. That my suggestions may meet with

opposition in some quarters, I have no doubt. Practising mineralogists and mining engineers may feel that it will interfere with their own work; yet why should it, any more than the work done by the Geological Survey interferes with practical geologists? On the contrary, I think it may stimulate private investigation on all properties that have shown favorable results, just as the work of the Geological Survey constantly leads to study and examination by others of such sections as indicate favorable conditions.

Of course, all of this is mere outline, subject to modification in many particulars, but it may act as a basis of discussion, and as such I submit it to the Institute, regretting extremely that I cannot be personally present to attend what I know will be a very careful and thorough elaboration of all matter bearing on this subject.

MR. R. C. CAMPBELL-JOHNSTON, M.E., Nelson, B.C.

The premises are granted, namely that Canada is more than favoured by Nature in minerals, these minerals to be regarded as raw material.

To promote the development of this raw material, the material must be wrought and manufactured as cheap or cheaper than in other lands, in order to share in the world's market. For cheap working the most skilled miners, workers and officials must be attracted to the country to secure the greatest output per man at least expense. To produce skilled workers technical education in the different branches of their labour is of paramount importance. To make life attractive to them, the conditions of working, sleeping and leisure hours must be made healthy, and the amount of wages saved above living expenses must be a considerable item. Therefore cheap living of good quality is essential, and inspection by Government of working and living places to ensure safety and health must be undertaken.

The law of universal habit to buy in the cheapest market and to sell in the dearest demands free trade in the supplies used to produce the raw material at the lowest cost. To encourage the manufacture *in situ* of the material, only when free trade exists to cheapen production, an export duty on raw material is a logical sequence, so that outsiders using our raw material are handicapped and pay a tax to ease our own. These factors, free trade and export duty, are indirect bounties of use when the raw material is in abundance; when the raw material is absent or scarce with the fuel to manufacture it, then no bounty can build up an industry.

The sturdy independence of Britons, who have made our Empire throughout the universe, must be continually encouraged, and not enervated by grandmotherly government, but by allowing private enterprise to work out trade problems untrammelled by interfering laws.

The living pictures of this are before our eyes, comparing Germany with her bounty-fed industries and Great Britain with her free trade (the greatest good to the greatest number). Who in troublous times weathers the storm most successfully?

Should a Government encourage cheap transport by controlling freight rates? Certainly, and even more so when the nation does not own its own transport facilities, since transport is one of the means of cheap production and manufacture.

A Government should insist on the employers furnishing statistics. It should then collect, tabulate, and widely publish the general results as an incentive both to fresh capital to invest here, and new buyers to do business here. Monographs, maps, and bulletins to advertise and facilitate the present and fresh production of mineral in a country can only be worked out by a Government.

Should a Government institute assay offices? By doing so it works a gross injustice to private enterprise. The profession of assayers and metallurgists protect themselves by forming associations and by getting private acts passed to weed out frauds and unskilled men. Let them be treated like other professions as doctors and lawyers, and let them work out their own salvation, and uphold their *esprit de corps*. Skilled metallurgists are scarce enough already, without a Government by competition discouraging new recruits.

A Government's duty towards mining is to allow it to be self-supporting, to enable it to produce cheaply at home by enacting light taxes, to collect and publish any data to push a market.

It should remember that the world is their market, and not only its own country. The working classes of the United States pay dearly among themselves, that their surplus products may compete in the world's market. This is a quixotic and shortsighted policy on their part to enrich their employers, and is not the greatest good to the greatest number.

MR. W. A. HUNGERFORD, Deloro, Ont.

I do not propose to go into all the many important questions, such as the laws, inspection, statistics, etc., but will confine my remarks to what I consider would be the practical result of a strong liberal mining policy. At a meeting held in Madoc on the 15th October of the representative mining men of this section, to consider the question of a bonus on arsenic, I stated what I considered the wisest and best policy our Government could adopt in order to open up and develop the mineral industries of Ontario, which, of course, would apply to the Dominion as well. My letters also appeared in the *Belleville Intelligencer*, *Marmora Herald* and the *North Hastings Review*, which have been commented on by many of the leading papers of the county. Having, therefore, already expressed my opinions on this subject, I must of necessity refer to some of my former remarks.

I have already advocated that the Government should assist mining along the lines that the Government of Australia assists that industry. And if you will consider this policy you will see how thoroughly in earnest they are, and how practically every detail in the interest of mining is assisted. Their policy has been successful, and it is safe to say Australia would not stand as high today as any of the great mining countries of the world, had it not been for the policy of their Government. The fact that the Government had faith in their mineral deposits and encouraged the mining industry in every legitimate way, gave capitalists confidence and the result has been success.

The mining policy of Victoria, New South Wales and West Australia are about the same.

New South Wales maintains public metallurgical works for treating all kinds of ore free of charge. They also maintain public assay offices, free assays to *bona fide* prospectus, charges to others.

An appropriation of \$125,000 yearly is made by the Government Prospecting Board to be spent in assisting *bona fide* attempts to sink shafts, and part of the money goes to keeping up at least 13 diamond and other drills which are used in locating and exploring the size of deposits, part is spent in assisting private miners to sink shafts, who for lack of means could not carry on the work. In case either attempts prove satisfactory and a mine is the result, a refund is demanded by the Government as soon as the industry is paying dividends.

4. A school of mines is kept up to train men in mining.
5. A full staff of geologists is kept up at the Government's expense.

West Australia besides maintaining assay offices and assisting in development work, maintains public stamp mills for treating ores in different parts of the country for the use of prospectors to test ores, and also for custom mills at no charge to prospectors. They also maintain a full staff of experts to do Government work.

It is difficult to imagine what better policy could be pursued to open up and develop their country than this. Apply such a policy to Canada, and I am not stating impossibilities when I say that there is no reason why we should not be one of the largest gold producing countries in the world. When you consider our mineral belts, reaching from Cape Breton to the Yukon, I doubt if there is any country that would compare with us.

Knowing how satisfactory the results have been in Australia, it is hard to understand if our Government had faith in the mineral resources of this country, why they have not had some such policy as this before now. It has not been for the want of information regarding our mineral deposits, nor is it from the want of satisfactory reports from the best experts in the Dominion. But from the fact that our representatives have not brought this question before the Government as they should have done.

What we want is practical assistance, on the lines mentioned:—

1. A Dominion Department of Mines.
2. Free assay offices for prospectors.
3. Government assistance in developing properties.
4. Government stamp mills in certain sections to test ores for prospectors free of charge.
5. A full staff of geologists kept up.
6. A staff of experts to do Government work.
7. A school of mines to train men in mining.
8. Government metallurgical work (as in New South Wales) for treating all kinds of ores free of charge and determining the process to treat the same.

If a policy like this were adopted and assistance given to those who from want of experience or want of capital could not develop their properties, I venture to say that in five years, mining would be established on a permanent and successful basis. The fact of the Government having confidence to expend money in developing a property, would be one of the

strongest recommendations for capitalists to invest in that property. The fact that the property had been examined and reported on by the Government expert and the work done by practical men, under the supervision of a Government mining engineer, with favorable reports would place the owner of the property in a position to sell at a figure that he could not otherwise expect to do.

If assistance of this sort were given to this district where we have large deposits of free milling as well as refractory ores carrying enough mispickel to supply the world's demand for arsenic. How long would it take to see a dozen mills in operation in North Hastings alone? All we want is developed properties in order to get capital to work them. Let the Government assist us in doing so and I have no doubt but that the experiment would be a success.

MR. JOHN McAREE, Rat Portage.

Inspection.—In addition to thorough inspection of the mine, mill and other works in order to secure the greatest protection against accidents, the sanitary condition of the camp should come under investigation to see that the sleeping and dining apartments are cleanly, and adequately ventilated. The system of water supply for the boarding camp should be carefully examined, especially as to the source of supply.

Statistics.—In addition to the usual information regarding the output of the mine, number of men employed, &c., an attempt should be made to collect statistics as to the cost of mining, sinking, drifting, explosives, duty of stamps, &c.

Monographs, Maps and Bulletins.—Monographs on various subjects connected with mining might be advantageously published by the Government. The little Manual on Explosives, by the Ontario Bureau of Mines, is a good example. A good manual on absolute mining is needed; also a manual for mining investors, giving such general information on the subject as will enable those intending to put money into mining ventures to secure an investment instead of a speculation. An intelligent mining investing constituency is one of the needs of the Canadian mining industry to-day. It is growing, of course, but it will pay to foster it.

The most complete maps obtainable should be accessible to all mining men, and to any who may become investors. In new districts, meridian and base lines, to serve as tie lines, should be run.

Bulletins should be issued monthly, and should appear in newspapers as well as in technical journals; this kind of news would be sought after and would cost the Government nothing for publishing. They should give information of working mines, new discoveries, laboratory work, etc. Those issued from the Government assay office at Belleville have been quite interesting.

Government Assay Offices—Are a good institution. The one at Belleville is a good example: there should be one at Rat Portage.

Duties—Should be removed from all technical literature, mining or otherwise. chemical and philosophical instruments and apparatus, engineers and surveyors' instruments, assaying apparatus and supplies, and be light on all kinds of mining machinery. An export duty may be advisable in certain cases.

Technical Education—Is, of course, very important; must be obtained at the mining school. Each school should have a professor of mining engineering—a practical man who has had experience in mining—not a mere chemist or geologist. There should be adequate laboratory room for assaying and analysis, and a large collection of minerals and rocks illustrative of mining geology.

The mining inspector should be a practical man and a mining engineer of experience, and a sort of consulting engineer for his district. Such an officer would be invaluable in a new region, such as Western Ontario, *e.g.*, in giving hints on mining generally, in laying out work, etc. If mining in the district of Rainy River had been conducted under such an inspector from the beginning many thousands of dollars would have been saved, and the mining interests would have been in a much more advanced state than they are. There are agricultural colleges, experimental farms, travelling dairies, farm instructors for the Indians, and why not also mining instructors? The Indians know about as much about farming as the average Canadian in Western Ontario does about scientific mining. The latest phase in educational methods is to send the teacher to the pupil—witness our summer mining school. The knowledge acquired in this way is that which experience has shown to be actually needed, and the circumstances under which it is acquired are such as to ensure its being mastered and firmly retained.

MR. J. C. GWILLIM, B.Sc., M.E., Nelson, B.C.

Monographs, Maps and Bulletins.—During the past few years there has been a great advance in the mineral industry in Canada, and with it an increase in publications concerning this industry. The Geological Survey Department has to some extent supplied special information concerning our mineral resources, in connection with the general working out of the geology and natural resources of the country. This work has given us maps of a very large part of the Dominion, and very useful they have been towards the opening up of new districts.

In the West there have been special and early reports and maps of Rossland and of the Yukon by Mr. McConnell, and others on the Yellowhead Pass and Crow's Nest coal fields by Mr. McEvoy.

These have been of great and timely use. It is necessary, however, to also let the people know where and how such information can be obtained.

Individual enterprise, and the various organizations interested in development, publish more or less inaccurate maps and accounts of new districts some time before these districts receive official attention. This material is well advertised and extensively used. It is perhaps impossible to get reliable information at the time of the first rush of prospectors into a new district, but its economic resources can be looked into at an early date and receive attention from some authoritative source.

It is not enough to get an accurate and full report upon a district several years after the examination is made, and as long after a pressing need for the economic portion of this report was felt. Such work has a scientific merit and is necessary, but its economical usefulness has lost much by its late appearance. It seems advisable to have the earliest possible maps and bulletins of the mineral resources, in a separate form.

In the publications of the Geological Survey Department and the various Provincial Mining Bureaus we can get, on application, a great amount of information, courteously given, or at a nominal price. Ransacking this mass of information the mining public can get much that it wants, but the phases of mining are many, and while these reports are good for the time of examination, they fall short in describing mining development after a time. The geology and resources other than mining, once worked out in detail after several years' study of the districts, may be given in a standing report, good for all time.

Many of the mines and mining districts of the United States have received special examination from specialists in mining geology. Their work has done much to enlighten us concerning the economic and scientific aspects of mineral deposits. Evidence of the usefulness and demand for early bulletins upon mining operations may be seen in the publication of Mr. Carlyle's Bulletins of Trail Creek and Slocan, in 1896. Messrs. Schrader and Brooks, of the U.S. Geological Survey, published an account of the Nome gold fields before the second season opened in that district. This was very useful to the few who read it.

At present there is some demand for information concerning the Horsefly River district of British Columbia, but there is very little of a reliable character to be obtained.

Canada in the East has some mineral resources which are both valuable and uncommon, such as the asbestos, nickel, mica and corundum. Coal and iron in both east and west are very important. The gold, silver, copper and lead of British Columbia and the Yukon is a great mineral asset.

A better knowledge of these mineral resources is needed. Information contained in statistics, maps and bulletins, prepared from reliable sources and *widely distributed* will do much to relieve the mining industry of the gambling element.

The Provincial Mining Departments do very well in collecting statistics and accounts of the year's progress in the several Provinces, but they lack unity, and depend largely upon correspondents and inspectors. Office work takes up much of the time of those who are qualified to make field examinations. There is no central office from which the latest information concerning mineral developments throughout the Dominion can be obtained. When it does exist it should be well advertised.

MR. E. A. SJOSTEDT, Sault Ste. Marie.

In expressing my opinion in reply to this wide and important question I will avail myself of treating the subject in the order and from the different standpoints suggested by our Secretary, merely limiting the same to the more specific question, How the Dominion and Provincial Governments may promote the interests of mining and the development of the Canadian

mineral resources—by the judicious framing and liberal interpretation of their mining laws, by the intelligent inspection and safeguarding of the mining operations, by the systematic use of mining and mineral statistics, by the issuing of monographs, maps and bulletins, by maintaining an efficient assay office, and a high standard of their technical schools, by a careful and just but always most liberal consideration of the demands—in the way of light royalties and duties, and sufficiently high bounties and protection—of every individual or corporation with a *bona fide* proposition to establish a new industry or the opening up of a new mining district.

Laws.—Owing to the diversified character of the mineral resources of Canada only a very general Dominion law would apply and be effective only in the unorganized portions of the older provinces and in those provinces which are not as yet vested with full legislative powers. The mining interests of this country would, therefore, be best promoted by laws framed by each province to meet the local requirements, and by legislatures fully conversant with those conditions. Such laws should aim to simplify the formalities by which a secure title to a mining property may be obtained, avoiding as much as possible the triune control of the lots, resulting from the sale of the timber to one person, the agricultural right to another, and the mining right to a third party.

Inspection.—The inspection of mines should be under provincial control, and the regulations for the guidance of same should be prepared by a special board appointed by the Premier of the Province, composed of the Director of the Bureau of Mines, one resident mining engineer and one resident mines' operator, of such wide range of experience as to make them familiar with the different kinds of mining as well as with every detail of the same. The Director of the Province should be a mining engineer of high repute, by preference a graduate from a Canadian Mining School, or else from an American or European College of high standing; he should also have been actively engaged, and have held responsibilities as mines manager. Among his duties would be to make annual visits to each and every active mine, assist in advice wherever requested, and in general take an interest in the development of the same. Subject to the approval of the Premier, there should be appointed by the Director a sufficient number of district inspectors whose duty it should be to make frequent visits (not less than four a year) to each mine, besides keeping the director posted on any new mineral discovery made in his district, stating character and importance of the same. The district inspectors should be practical miners of wide experience and with sufficient education to know the more general minerals and rocks, and to enable them to report intelligently the conditions of the mines and the compiling of statistics (in regard to number of men employed, their different nationalities, quantities and qualities of material raised, number and cause of accidents occurring, etc.) They should also be residents of the district to which assigned. All orders or instructions to the mines owners as regards the safety and precautions to be observed at the mine should come direct from the Director, but the district inspector should be vested with full power for inspecting mines under his jurisdiction at any and all times, and the mines owners requested by law to give the inspector (after his credentials having duly been presented to the manager in charge) a courteous reception and ample opportunity for carrying out his duties, including the obtaining of maps and data for statistics desired.

Maps, Monographs and Bulletins.—All efforts should be made on the part of the Government to secure and make public the geological conditions at each mine as developed, and through the Geological Department and the Provincial Mines Office aid in the work in making such maps and plans as would be best calculated for the intelligent prosecution and the further development of the mineral leads discovered. A great assistance in this respect would be a more detailed work by the Geological Department which possibly could be accomplished by offers from mining corporations to bear a portion of the expense so far as their individual holdings may be affected.

The issuing of monographs and bulletins on any subject of interest to the mining fraternity and their *early publication* and *free distribution* to every mines owner and professional mining engineer in the Dominion would be a great boon, and an advantage which would greatly assist in promoting the development of the mining industry. Mines owners should be compelled to make proper surveys and accurate maps in connection with the progress of the mine work and to furnish copies of such maps to the Director whenever so requested; and copies of these maps, as well as reports about any mine or mining prospect recorded in the Director's office should, for a small consideration, be provided to persons making such requisitions and having consent thereto of the mines owner.

Government Assay Office.—A Dominion Government Assay Office, well equipped and in charge of a competent staff is an essential auxiliary to the Geological Survey; but for the accommodation and advantage of the prospector and mines owner in determining the value of any mineral find, a Provincial Assay Office in charge of the Director is necessary, and the same should be maintained at such a point of efficiency as to secure quick returns from samples submitted. Such replies should aim more at giving practical information than abstract results, however, and should be free of cost; but more specific information, entailing minute investigation and accurate quantitative analysis should be given only at the discretion of the Director, he being guided in such matters by the general importance and interest of the subject matter to the mining industry generally.

Royalties, Duties and Bounties.—The question of royalties, duties and bounties is one of political economy principally. To promote the interest of the mining industry the royalties should be made light and be assessed per ton saleable product recovered from the properties operated under lease from the Government; and on a patented property a tax proportionate to that of other taxable estates would seem proper. Duties on all mining and smelting machinery, as well as on apparatus for the manufacture of coke, charcoal and peat, should be of the lowest; and in cases where the machinery and apparatus required are not made in Canada but as a specialty at the factory of a foreign country from which they are ordered and imported, the same should be admitted free of duty. Bounties should be given to mine owners in the way of Government assistance in construction of good roads and their maintenance or any other transportation facilities, at the recommendation of the Director. Such assistance would not only help in the development of the mines, but also in opening up the country for settlers and thus be a lasting incentive to other new industries.

Technical Education.—It is hard to over-estimate the benefit to the mining industry generally, and the metallurgical industry particularly, that will result from the paternal care and liberal expenditure of money by the Government for the technical education of a sufficient number of mining and metallurgical engineers. As a rule the man who has acquired his knowledge of mines and minerals by years of practical experience only has at the same time fallen into grooves and ruts which seriously handicap him in his efforts to obtain successful results; and the guidance by a broader and more enlightened brain is becoming more and more essential in these days of competition and close margins. Whatever the Government can do, therefore, to raise the plane of intelligence of the men engaged in mining and allied industries would doubtless tend to promote the development of its mineral resources. The strength and prosperity of a country rests to a very large extent on its mineral wealth and the degree of development of its mineral resources, and to attain this in the highest degree the whole educational system should be on the highest plane, to reach which the liberal support of the Government and individual endowments to high institutions of learning as well as to the great common school system would be a necessity.

Technical schools and universities of the Dominion should be sufficiently equipped and endowed to provide the best course in mining, engineering, metallurgy and chemical and electrical engineering, and the endowments of the chairs should be large enough to attract men who already hold lucrative positions as captains of industrial enterprises. The establishment of closer relations between the university and the mine and factory namely is of the greatest importance. The fact that instructions were to be given by professors who themselves have participated in active operations instead of by book worms possessing no knowledge of the practical side of the subject would be an incentive to a class of young men eager to lay hold on the world of industrial activity, which in itself would be a great stride forward in an educational system of this kind. The courses referred to should be of a practical as well as a theoretical character, so as to not only equip the student with a broad, firm, scientific knowledge as a basis for further work, but also afford him the time and opportunity necessary for a certain amount of practical experience which will give him some kind of "working idea" of his profession. For instance, a chemist on graduation should not only have a theoretical knowledge of his subject, but he should be required to understand the reactions involved in the assays and analyses of the various types of ores and technical products. He should also have such a drill in these manipulations that he will know the various "short cuts" and "quick methods" which are required in the technical laboratory of today. Unless a graduate has had some such drill it takes nearly as long to "break him in" in a technical laboratory as it does an uneducated boy.

The summer vacations during the college years in question should be

devoted not only to visiting mines, furnaces and mills for a stipulated number of weeks, but in performing actual work and detailed duties in connection with certain specified operations in mining, smelting, converting and refining—this to be necessary part of the course, just as is the practice in some of the European countries where the standard of technical education is the highest, and where the advantages of this practice have been fully demonstrated by the high degree of perfection reached in the industries mentioned.

DR. W. L. GOODWIN, Kingston.

In reply to your request for my views upon the ways in which a government may promote technical education, I wish in the first place to point out that the word *technical* is used in two senses,—(1) As covering manual training and what may be described as trade schools, and (2) as referring to higher education in applied science. Governments have duties in both these directions; and both Provincial and Dominion Governments have so far been active in the discharge of these duties, as witness the agricultural college and schools, the experimental farms, the dairy schools, the travelling dairies, and the Ontario grants to schools of practical science, and to secondary schools (to aid them to establish technical courses). But if Canada is to keep pace with the rest of the industrial world, much more must be done by Governments to forward not only technical education in both senses, but also scientific education in the broadest sense of that term. For *applied* science implies *pure* science; and the nation which relies on others to carry on scientific discovery, and thus borrows its science for application, is in a position which is neither advantageous nor self-respecting. Through lack of scientific schools and colleges and of the scientific spirit among her manufacturers, Great Britain has lost industry after industry which rightly belonged to her. She is now in the humiliating position of supplying the greater part of the raw material (anthracene) to Germany for the manufacture of olizarine, a manufacture worth \$20,000,000 a year; and her dyers import the manufactured article. She is in the same position now with regard to the manufacture of indigo, which has heretofore been a distinctly British industry with a turn-over of more than \$15,000,000 a year. But the German dye manufacturers have spent \$5,000,000 and twenty years of research in finding a manufacturing method for converting naphthalene (largely from British coal tar) into indigo; and they have succeeded. The statistics of trade show that the German synthetic indigo is rapidly taking the place of the product of the plantations of India. Already one-fourth of the world's supply is synthetic indigo. These are two instances of the way in which those British industries have suffered which depend more particularly upon scientific research for their advance. At least a generation has been lost,—three decades of apathy; but at last an earnest effort is being made to retrieve the position; and three great forces have been brought to bear: (1) Imperial legislation and grants of money, (2) municipal aid, and (3) private munificence. In all these respects we in Canada have made a beginning, but *only* a beginning, and I shall confine my letter now to a short discussion of the directions in which the Dominion Government might reach out to aid technical (or preferably, *scientific*) education. It is quite plain that the resources of the provincial treasuries are very limited, and that the provinces unaided will not be able to keep pace with the needs of education in applied science. While education is set down in the British North America Act as in the jurisdiction of the Provincial Governments, there is nothing in that Act to prevent the Dominion Government from giving aid to education. Indeed it has already adopted the principle in establishing the Royal Military College (which has turned out more engineers than soldiers), the marine biological station, the experimental farms (stations for scientific research in agriculture), and the other means for disseminating a scientific knowledge of agriculture and forestry. But it should now turn its attention to manufactures and to metallurgy and mining, and formulate a comprehensive policy of aid to scientific education, and particularly to those parts of it which have more direct connection with industries. It is always good policy to strengthen the forces already working. The Geological and Topographical Surveys are in reality institutions of scientific research. The same may be said of the corresponding parts of the Departments of Fisheries, Agriculture, and the proposed Department of Mines. Much can be done to strengthen these, by providing greater facilities for work, particularly for research, and by paying such salaries as will attract and keep men of the first rank. Following the example of the Imperial Government, the Dominion might well establish in existing scientific colleges regius professorships of subjects bearing upon industries of national importance. The founding, equipping and main-

tenance of research laboratories would be a paying investment of public money. Governments are wont to plead that in such matters they must not be in advance of public opinion. But there is public opinion *and* public opinion, and in this case the matured opinion not only of scientific men but of the leading manufacturers is in favor of a vigorous and expansive policy. The Canadian Manufacturers' Association has recently been instrumental in forming a Canadian branch of the Society of Chemical Industry, a British institution which has done much to awaken interest in scientific education in Great Britain. The Manufacturers' Association has also asked the leading Canadian Universities to make provision in their curricula for the special education of men for a business career. Manufacturers, mine owners, and others requiring men with technical skill and education are everywhere calling for applied science graduates to fill the most responsible positions. Here is the kind of public opinion which will justify action on the part of the Government.

Germany spends freely upon both universities and technical high schools. The latter should rather be called engineering colleges. They rank with the universities and grant degrees in engineering. The University of Berlin has an income of \$715,000 a year, and the Government contributes 83 per cent. of this. Another at Bonn receives from the Government \$250,000 a year; and similarly for other towns. The technical high school of Berlin receives \$165,000 a year from the State, that in Hanover \$75,000, and the Aachen school \$80,000. In Great Britain the direct grants to universities and technical schools are still small, ranging from \$10,000 to \$12,000 a year for each of twelve university colleges receiving them. But large annual incomes available for technical education are now being derived from the operation of the Customs and Excise Act of 1890, by which a sum of about \$3,750,000 was set aside for this purpose. There is also an annual grant of \$750,000 divided among the four Scottish universities. In the United States scientific education is generously supported, not only by the State legislatures but by Congress. The Morrill Bill of 1862 provided funds for "colleges for agriculture and mechanic arts" by the sale of public lands. The amendment of 1890 provided for making good any deficiencies by direct payment from the United States Treasury. The Congress of 1900 passed a bill providing appropriations "to establish and maintain schools or departments of mines in connection with colleges and universities."

It may be urged that Canada is too young to begin this kind of work and that it should be left to gradual development by private enterprise and individual munificence. This is the policy which Great Britain has pursued up to the last few years, with the disastrous results already indicated. On the other hand Germany initiated her system of technical education more than one hundred years ago. At an even earlier date the University of Göttingen had a course in technical chemistry and technology, and Beckmann (1777) published the first text book on the subject. It dealt with weaving, dyeing, paper-making, brewing, starch, oil, tobacco, glass, sugar, gun-powder, &c. In 1796 this university (in a comparatively small town) had two professors of chemistry and one of technology. Before many years had passed, the other German universities had followed Göttingen in making provision for the technical side of science and in particular of chemistry; and in addition the technical high schools had been founded. Many of these have been in existence for more than half a century; and, in the words of a recent British consular report, "it has been found that the foundation laid during the scientific courses at the technical high schools formed the soundest basis for the practical experience to be gained during professional life." How these results are attained may be indicated by a glance at the staff of instructors as compared with the number of students in the chemical departments of some of the technical schools. The Berlin school has 44 instructors for 278 students; the Stuttgart school, 10 for 88, and the Karlsruhe, 15 for 139. Compare these figures with those for some of our universities. Toronto has 9 instructors for 594 students of chemistry; Queen's has 5 for 220; and McGill has 14 for 410. It appears, then, that we have very much to do and a long road to travel before we can take our place with the most enterprising manufacturing peoples.

But will it pay? In chemical manufactures alone Germany produces about \$250,000,000 annually. If, as Beaconsfield held, "The chemical trade of a country is a barometer of its prosperity," Germany has become very prosperous. Her chemical trade grows. The present crisis is an incident merely and the chemical trade is the only one not seriously affected by it. The electro-chemical industries of the United States are now worth \$100,000,000 a year. These are examples of industries which can be built up only upon a foundation of scientific education. The latter is a direction in which Canada is certain to make great advances, if her population receives a suffi-

ciently thorough and widespread education. There is no other country with such a great amount of water-power available; and this will inevitably give us the advantage over those manufacturing peoples which depend on coal. The cheapest way of generating electricity is by a favorably situated waterfall. Thus, given raw materials of the right sort, and Canada can compete successfully with the world in electro-chemical industries. But the application of electricity for such purposes is comparatively new, and advances must be made by devising new processes and new applications, such as, for example, the reduction and refining of metals which are now worked by other and more expensive means, and the decolorizing and purification of beet sugar. Each country has problems of its own to work out, differing according to the varying conditions; and no country can afford to depend upon help from without to solve its problems. England is now importing 90 per cent. of the dyes used in her dyeing industries, although the beginnings of the manufacture of artificial dyes were made in England, and it only required a widespread appreciation of the value of scientific education and research to have secured for her this immense industry. As it is, she exports the raw material and imports the manufactured articles. Germany solved the problem of finding uses for England's immense supply of coal tar, and Germany reaps the benefit.

A few examples of what might be done:—We have some of the largest and best deposits of pyrite to be found anywhere in the world. One of these is now being worked and the raw pyrite is shipped to the United States for the manufacture of sulphuric acid, &c. We import the acid for the manufacture of nitro-glycerine, &c. The pyrite is worth three or four dollars a ton. Each ton will make about 1½ tons of acid, worth \$40.00. It would certainly be a great advantage to make our own acid and even to make it for export. If this were once begun it would be the basis for a dozen other chemical manufactures in which sulphuric and sulphurous acids are used. Another problem—one involving both mechanical and chemical engineering—is the utilization of our immense peat bogs. This problem is being worked at in Europe, particularly in Norway and Sweden, where peat is becoming constantly of more importance as a fuel. It is also looking up as raw material for the manufacture of paper. Experiments have been made by the Rathbun Co. in Deseronto to test its value in the charcoal retorts. But we are still far from a solution. Again, Canada is certain to become a great pulp manufacturing country. Immense quantities of sulphite waste will be produced. What is to be done with this waste? Although there has been much investigation, no process of utilization has yet been devised which gives complete satisfaction. For such investigations as have been indicated here, the highest scientific skill is required, and this must be combined with a knowledge of the economic conditions prevailing in Canada. All this implies that the work must be done mostly by Canadians, and that they must be educated in Canada. Our duty to ourselves seems plain. We must devote to scientific education a sufficient part of our revenue to provide the best scientific and technical schools and colleges for the youth of Canada. Such education is necessarily expensive; but the experience of those nations which have tried it prove that it is cheap at any price. The Canadian statesman who is far-seeing enough to inaugurate an adequate system of Dominion aid to scientific and technical education will win his place in the history of Canada.

MR. JAMES McEVOY, Fernie, B.C.

In considering this question, it will be admitted, in the first place, that such aid should not, except perhaps in the commencement of an entirely new enterprise, take the form of a spasmodic attempt to foster any particular industry. The plan of action should be broad enough to include all.

The great successes of to-day in mining are generally due to the proper application of knowledge gained in many previous attempts. Even the complete failures of the past often materially help to present success. They have been as danger signals on the road, and at least enable the new comer to avoid falling into the same errors of his predecessors.

So much being admitted, it will be seen how useful a careful monograph of some of our older mines would be. It should contain an honest criticism of their workings, wherein they failed, as well as where they were successful. The effect should be to stimulate the miner of to-day to better efforts in the right direction. It is certainly within the functions of a government to do this, in fact it has been done to some extent at least by the United States Geological Survey.

It is necessary, however, to do more than look backward if we are to



MR. R. D. FEATHERSTONEHAUGH, M.E.,
General Manager, Atlin Mining Company, Atlin, B.C.

accomplish much. The best methods of mining and treatment must be studied, and the knowledge made available to the operators, and then the necessary raw material to work upon must be found. By helping in the discovery of such suitable material a government can best promote the mining interests, and it seems to fall naturally to the lot of the Geological Survey Department to furnish the information required. There is no disputing the fact that this department has done, and is still doing, really good work, but the complaint is made that it is too hard to get at. Very often there is as much reason for the complaint as there is for admitting the fact. To illustrate the point, let us take for example the industry with which the writer is best acquainted, viz., coal mining in the west. Supposing some one wished to get a general knowledge of the coal deposits in that part of the Dominion, and consulted the Geological reports for that purpose. What information there is, has been published of course, but it is scattered in fragments through about twenty huge volumes, to the last fifteen of which there is not even a general index. Even a man who has spent years of his life in the department will find it difficult to discover any particular reference. Imagine then the predicament of an outsider.

Now, if the whole of this information were concentrated in a monograph or bulletin on the Western coals, and the bushels of chaff fanned away, it would be possible for anyone with ordinary intelligence quickly to see just how much was known about the subject. The work should be freely illustrated by diagrams and sections, and as much as possible placed before the public in a graphic form.

The same reasoning will apply with equal force to any other mining industry in the country.

Even if all this were done, however, it does not by any means meet all the requirements of the case, as it only makes available the information of the past. It is necessary to reach out after new discoveries. More particular attention might well be called to places where, owing to the geological conditions, further discoveries may be reasonably expected.

In order to have a reliable account of our mineral wealth, it is necessary to have more geological field work—good work, and more of it by experienced men. Then have it placed before the public in an available form.

It need not be inferred from the foregoing that purely scientific research should be abandoned or even neglected. Such work often leads to the most practical and important results. The theoretical and the practical should go hand in hand.

The separation of these into two departments, or separate branches of the one department, unless closely in touch with each other, would be a grave mistake, as in such a case neither branch would be likely to avail itself promptly of the information gained by the other. It would also mean a duplication of work, and the unnecessary and wasteful expense of duplicate laboratories and libraries.

Until there is some definite plan of action decided upon, and there is a reasonable hope that suitable men can be found to fill the different parts, it would be useless for a government to pass any largely increased vote of money. One thing at least is certain, something should be done. It is possible that by picking out the best points in the various opinions on the subject a decision may be arrived at, which, if carried out, would greatly benefit not only the mining industries, but the whole of our Dominion.

MR. J. T. DONALD, M.A., Montreal.

By these I understand offices where any individual can have samples of ores assayed free of charge or at a nominal cost, *i.e.*, in reality at the public expense. Although I am an assayer myself, I am in favor of equitably conducted Government Assay Offices. These if properly carried on should be a boon to prospectors and residents of regions where economic minerals are likely to be found and in no wise harmful to the private assayer. From the point of view of a private assayer, the only fair way in which to conduct a Government Assay Office is to man the same with a staff, the members of which receive a fixed and adequate salary and devote their whole time to the work. They should not enter into competition with private assayers in canvassing for the assay work that is required by those engaged in mining operations. A Government Assay Office will undoubtedly take away from the private assayer work that would naturally go to him, but in the end the private assayer will be more than compensated for such loss by the demand for assaying that will arise as a consequence of the work done by the Government office.

MR. J. WALTER WELLS, Belleville, Ont.

In my opinion the proper function of such offices or testing laboratories is that of acting as referee or umpire in cases of disputes between different assayers who may report differently on the same sample, and also in case of disputes as to grades or qualities of ore between shippers and the smelters. A large proportion of the work done by Government Provincial Assay Office here is umpire or checks on assays in case of parties buying properties, or ore, who may wish to check the reports of the owners of the property or ore. I would like to see more done along this line.

Coal and Iron Production in 1901.

The following returns have been received of output of Canadian collieries and blast furnaces for the year ended 31st ultimo. We hope to complete the list in our next issue:—

DOMINION COAL CO.		1900.	1901.
Dominion No. 1	.....	538,237	641,543
" " 2	.....	610	23,635
" " 3	.....	68,831	308,964
" " 4	.....	25,428	8,341
Caledonia	.....	511,874	640,688
Reserve	.....	632,056	730,378
International	.....	222,703	208,234
Total tons raised	.....	1,999,737	2,561,783

Recapitulation

Shipped	.....	1,829,199	2,345,645
Land Sales	.....	2,438	2,514
Collieries, Railways	.....	81,075	123,022
Employees	.....	24,258	27,732

DOMINION IRON & STEEL CO.

Iron Ore mined in Newfoundland	.....	385,329
" " from Spanish Ports	.....	23,411
" " U. S.	.....	16,428
" " Cuban	.....	11,191
Pig Iron made	.....	111,014
Coke made	.....	192,873

ACADIA COAL COMPANY.

	1900.	1901.
Total Coal raised	286,045	270,253
" " sold	247,274	230,567
" " Coke made	18,637	11,738
" " sold	18,624	11,736

Disposals

To Nova Scotia	142,352	136,365
To P. E. Island	24,301	16,805
To Québec	31,888	28,514
To Ontario	2,842	
New Brunswick	18,937	25,845
Colliery Employees	5,526	5,653
Engines and Coke Ovens	60,012	55,349
Total tons	285,858	268,531

INTERCOLONIAL COAL COMPANY.

Total output	204,402
" shipments	197,957
" Coke made	5,305½

Coal Disposals 1901.

Sold to	Round.	Slack.	Total.
Nova Scotia	62,171.11	13,778.04	75,949.15
New Brunswick	17,015.03	868.02	17,883.05
Prince Edward Is.	8,983.00	1,974.10	10,957.10
Québec	50,807.03	14,075.01	64,882.04
St. Pierre			
Coke Ovens		9,398.00	9,398.00
Colliery Employees	3,615.08		3,615.08
Colliery Engines	4,049.15	11,221.03	15,270.18
Totals	146,642.00	51,315.00	197,957.00

CUMBERLAND RAILWAY & COAL COMPANY.

Coal Sales 1901.

	Round.	Run Mine.	Slack.	Even.
Nova Scotia	41,830¼	3,544½	14,457¼	47,452¼
N. Brunswick	124,110	16,061	15,857¼	18,237¼
Québec	38,189¼	7,314¾	558	1,495¼
United States		526		12 1/4
	204,129½	27,446¼	30,873	79,328 = 341,776¼

CANADA COALS & RAILWAY COMPANY.

Coal Disposals 1901.

New Brunswick.....	38,415
Nova Scotia.....	3,300
Quebec.....	14,643
Employees, etc.....	11,697
Total tons raised.....	68,055

ALBERTA RAILWAY AND COAL COMPANY.

	1900.	1901.
Output.....	181,801	217,034
Shipments.....		178,599
Labor employed on surface.....		62 persons.
" " underground.....		306 " "

GOWRIE & BLOCKHOUSE COLLIERIES, LTD.

Output sales, 1901.....	20,700
Labor employed.....	170 persons.

INVERNESS-RICHMOND COLLIERIES & RAILWAY CO.

Output.....	13,500
Shipments.....	3,000
Labor employed.....	160 persons.

The work at this colliery has been mainly development and construction.

DESERONTO IRON COMPANY.

Canadian ore used.....	98,115
Foreign ".....	17,602
Charcoal iron made.....	9,975

CAPE BRETON COAL COMPANY.

	1900.	1901.
Quebec.....		1,546
Newfoundland.....	183	1,585
Nova Scotia.....	1,700	5,010
P. E. Island.....	5,767	1,519
New Brunswick.....	173	84
St. Pierre.....	327	.....
Labrador.....		350
Colliery consumption.....		{ 1,640
" employees.....	2,250	{ 1,020
Total.....	12,500	12,754

HAMILTON STEEL AND IRON COMPANY.

Canadian Ore used.....	50,093
Foreign ".....	56,849
Pig Iron made.....	67,512

LAKE SUPERIOR POWER COMPANY.

Iron Ore mined in 1901.....	261,203
" shipped.....	230,941
" exported.....	161,384

CANADA IRON FURNACE COMPANY.

Midland Furnace.

Canadian ore used.....	53,964
Foreign ".....	9,725
Flux charged.....	18,520
Coke received.....	40,149
Pig Iron produced.....	33,648

Radnor Plant.

Ore mined.....	11,808
" purchased.....	1,500
Charcoal made.....	6,628
Charcoal Iron made.....	5,400
Ore charged.....	13,308
Fuel.....	6,396
Flux.....	1,737

NOVA SCOTIA STEEL AND COAL COMPANY.

Iron and Steel Output.

Nova Scotia ore used at Ferrona.....	18,619
Wabana hematite (Newfoundland).....	32,801
Other foreign ore consumed (Cuba).....	117
Limestone quarried.....	23,771
Coke made.....	23,540
Pig Iron made.....	26,793
Steel Ingots made.....	25,678

Coal Disposals.

Shipped.....	200,214
Intercolonial Railway use.....	2,888
Local sales.....	8,177
Workmen at colliery.....	5,214
Coal gifts to widows.....	229
Colliery consumption.....	16,157
Locomotives, shops, &c.....	1,108
Coke ovens and washer.....	2,622
On bank.....	575

Total coal raised..... 237,104

PEOPLE'S LIGHT AND HEAT COMPANY, HALIFAX.

Total coke made in 1901 from Nova Scotia coal. 8,480

H. W. MCNEILL COLLIERIES.

Coal raised from Anthracite Colliery..... 14,742
 " " Canmore " " 88,499

NEW VANCOUVER COAL MINING AND LAND COMPANY.

Total coal raised..... 593,608
 " shipped..... 507,734

SYDNEY COAL COMPANY.

Total coal raised..... 8,949
 " shipped by water..... 4,292
 " land sales..... 2,549
 " workmen..... 159
 " engines..... 96

BRITISH COLUMBIA COLLIERIES

Total output coal, 1,529,210 tons, of a value of \$4,587,630.
 Total coke made, 134,760 tons, of a value of \$673,800.

LEGAL.

Interesting Case to Mine Owners—Adams v. Culligan—
 Howe v. Culligan—Judgment Given by Chief Justice
 Falconbridge at Toronto, January, 1902.

Adams and Howe were employed to do work in a mine in the Rainy River district. One night, when the engineer blew the whistle for the men to go to work, the bucket was hanging over the open shaft, having been left by the men when they came up at 6 o'clock. The men, believing that the engineer was at his post, and that the brakes and machinery were properly applied, stepped into the bucket—four men in all—and it commenced to move, and in a moment fell away and fell down the shaft. It was stopped by the engineer after it had descended about 90 feet, but the sudden drop no doubt threw three of the men out of the bucket, for they were found at the bottom of the shaft, one of them dead and the other two dying shortly afterwards.

The representatives of Adams & Howe, two of the men thus killed, brought actions for damages against the owners of the mine (alleging that their negligence was responsible for the accident, on the ground that the ladders and hoisting apparatus were in a defective condition at the time of the accident.

The evidence given at the trial proved that the brake, which was supposed to be strong enough to hold any weight that the hoist was capable of lifting, had, possibly by means of wear, become loose, so that when locked in place it was not sufficient to hold the bucket with the men in it. There was some additional means used for holding the bucket in place, namely, a friction clutch, which threw the machinery into gear. If both brake and friction clutch were applied they together would hold any weight. The engineer stated that the brake was properly locked, but he could not tell the position of the friction clutch. The cause of the accident no doubt was that the brake, while locked, was not sufficient to hold the bucket with the men in it, and that the friction clutch was not properly set, and therefore the bucket fell away when the men got in.

Those suing as representatives of the deceased men alleged (1) that the ladders provided for use by the men in going into the mine were in a defective condition, inasmuch as (a) they did not comply with the requirements of the Mines Act, and (b) that they were insufficient in number to enable the employees to enter the mine safely. (2.) That owing to the defective condition of the ladders they used the bucket to go down the shaft, and that the management authorized its use; that the bucket being a common ore bucket, was unsuitable for the purpose, and the mine owners were negligent in not providing a suitable means for the men getting to their work. (3.) That the hoisting apparatus was defective in that the brakes were not in proper working order, and had not been in proper working order for some time prior to the accident, to the knowledge of the mine owners or their foremen. The defendants denied negligence, and alleged:—(1.) That as the mine was in process of development, the ladders were as good as could reasonably be expected, and having regard to the mine that they were suitable for the purpose, and that there was no occasion for the men to use the bucket. (2.) That the men using the bucket did so at their own risk. (3.) That the men were guilty of contributory negligence in getting upon the bucket on the night of the accident without first ringing the bell so as to make sure the engineer was in his place.

The trial judge decided that the facts were as alleged by the representatives of the deceased men, and that the accident was caused by the defective machinery and plant of the mine, for the unsafe condition of which the owners were responsible. It was also held that the deceased had not been guilty of any contributory negligence. Judgment was therefore given against the owners of the mine, who were directed to pay certain sums as damages to the representatives of the deceased.

MONTREAL AND LONDON.

Report of the Committee of Enquiry.

The special committee appointed to enquire into the affairs of this company have reported :—

The causes which have produced the present depression by which the Company's shares have become practically unmarketable, may now be summarized as follows :—

1st. The failure, possibly under present conditions, the permanent failure of earning power, consequent upon the fact that as regards the mining operations of the Company, the ore and especially that recently treated, is both lower in assay value than was expected and is of such a character as that the gold cannot be extracted except at a loss by present methods, while the Company has neither the capital nor the credit necessary for the erection of a more suitable plant. As regards the trading operations of the Company, its financial condition would render impossible its business of buying and selling mines and mining stocks quite apart from the fact that no market now exists.

2. The losses upon capital account, arising from the great depreciation in market values, both of the Dufferin mine and of the mining stocks and locations belonging to the Company, and in a lesser degree to losses upon the equipment of the Dufferin mine which will require costly additions before it can be worked to full advantage.

3. The practically total loss of the Company's credit both with its bankers, the investing public, and its own shareholders, in consequence of which neither ordinary loans nor further capital, urgently needed, can be obtained. No industry in Canada has ever experienced such sudden inflation as that of the mining of gold and silver, and none has ever suffered such utter collapse. It is a regrettable fact that both these results may in the case of this Company be traced in a great degree to the extravagant estimates of profit, submitted by at least two of its mining engineers, made no doubt in absolute good faith, but made, nevertheless, with regard to possibilities and even to impossibilities, rather than probabilities and consequently grossly inaccurate and greatly misleading. The losses which have been suffered by the shareholders of this Company are not to be measured by the losses of the Company itself, since in many cases the stock nearly valueless now has been purchased by its present holders, at a price twice, thrice, or even four times its par value.

As the shareholders are already aware, an option of issue, and a further option of purchase have been given upon the Dufferin mine. The period of the option having expired without any advice of its acceptance having been received from the holder, it now becomes necessary to provide for the payment of the outstanding liabilities of the Company, and, in case of its continuance, for the establishment of a cyanide plant which is regarded as absolutely essential to the possibility of the profitable working of the Dufferin mine.

Four courses of action have, so far, been suggested.

1st. To allow the Company to go into liquidation and its assets to be sold for the benefit of the creditors and preferred shareholders. There is reason to believe that in utter lack of confidence in the possibility of future profit, or in a petulant feeling of disappointment, many of the common stockholders will feel inclined to take this course, which can only result in total loss to them all.

2nd. To accept the suggestion of reorganization offered in the circular issued on the 27th November last. The objection to this plan is that a large number of the common stockholders will, for the reasons already stated, refuse to pay the proposed assessment, and will consequently forfeit their shares, losing the whole of their investment.

3rd. A suggestion offered to the committee by Mr. Copland, one of the directors, to the following effect :—

That the proposal of the directors in regard to new company be agreed to, with the proviso that any shareholder unwilling or unable to accept to the new stock on terms proposed, will be allowed to retain his or her stock, and will be entitled to his or her share in any dividend declared after the stockholders who have put up money to place the Company in working order have received double the amount paid in. It is quite understood that these stockholders who have paid the call are not to be regarded as creditors.

4th. That the common stock of the Company remaining in the treasury, and amounting to 3,051,025 shares be issued at three cents per share to the stockholders, proportionately to their present holdings. It appears certain that if the shareholders generally decline to furnish further capital, the total loss of the common stock must speedily and inevitably follow. It is, however, the conviction both of the directors and of the members of your committee that the value of the assets is considerably above the total amount of the liabilities, and that by a wise expenditure of further capital the Company may yet in time be placed upon a dividend paying basis. The prospects of the Dufferin mine have been already stated, but it should not be forgotten that the Company has also other valuable assets. The shares which it holds in the Slocan Sovereign Mining Company would at once become of value if it were

possible to resume the working of that company's mines, and the returns which have been laid before us support the conviction of the directors that with the lower charges for treatment which can now be obtained, these mines might be made immediately profitable if the necessary capital could be provided.

We beg to present for the information of the shareholders the accompanying summarized statement of the Profit and Loss Account from April, 1897, to October 31st, 1901.

Premium upon shares.....		\$68,160 11
Profit on Slocan Sovereign property.....	\$189,623 90	
Less not yet realized (see below).....	89,452 98	
Amount realized in cash.....		100,170 92
Received for services of mining engineer.....		5,820 32
Total gross cash profits.....		\$174,151 35
<i>Less</i>		
Expenses of flotation.....	\$20,009 76	
Expenses of prospecting.....	2,404 77	
Legal expenses.....	\$15,588 96	
Less transfer fees.....	845 19	14,743 77
Total expenses.....	41,957 69	14,852 43
Interest.....		17,380 76
Losses on stock transactions.....	14,190 92	
Less profits.....		3,189 84
Loss on Klondike expedition.....		31,601 82
Working expenses Dufferin mine..	77,452 07	
Less value of bullion extracted....	54,121 85	23,330 22
		114,932 00
Total net profit realized.....		\$59,219 35
Add the following estimated but not realized :—		
On Slocan Sovereign Mining Co. shares....	89,452 98	
On Bullion Mining Co. shares ..	25,000 00	
		114,452 98
Total profit realized and estimated.....		173,672 33
<i>Represented by</i>		
Dividends paid.....	117,767 89	
Balance at credit of Profit and Loss Account...	25,904 44	
Contingent account.....	30,000 00	
		173,672 33

WAR EAGLE.

The following is excerpted from the Annual Report of the Directors submitted at a meeting of the shareholders on 25th instant :—

As explained in the last Annual Report the pay ore of the main shoot changes to low-grade in the block between the 6th and 7th levels at a depth of about 800 feet. There was no evidence to indicate that this change was permanent, or anything but one of the usual low-grade stretches found in ore shoots, and every effort has been made to push exploration work at high pressure. A plan of deep and large scale development is being carried out, in the course of which the branching of the vein, together with complications caused by a system of heavy faults and dykes has greatly increased the delay and expense of exploring the vein.

The closure of the War Eagle mine by a general labor strike has restricted the mining of the past year to a period of about seven months. This further loss of time leaves us still short of decisive results from the great depth of vein made accessible by the rapid shaft sinking. The shaft, 1499 feet deep on December 31st, will reach the 11th level point at 1580 feet by the end of February, and sinking will then be suspended until decisive results are secured from the vein area then accessible.

The levels are as follows :—

6th Level.....	754 feet in depth
7th ".....	881 " "
8th ".....	1057 " "
9th ".....	1228 " "
10th ".....	1378 " "
11th ".....	1580 " "

The 7th level is sufficiently developed for the present, showing the ore to be low-grade.

The 8th level exploration is not yet completed. The vein exposed by it so far is low-grade or barren, but the work has not progressed far enough to be decisive, and there are still fair chances of finding pay.

The 9th level is well under way, but has not yet reached the positions where ore is expected.

The 10th and 11th levels have not yet been started.

Thus from the 7th to the 11th levels a new depth of 700 feet on the vein is now accessible, and its exploration by levels is fairly under way. What its contents may be as yet unknown and is a matter of luck. That its possibilities are great is evident from the fact that the main shoot down to the 6th level, a depth of 754 feet, has contained about 165,000 tons with a smelter's gross assay value of \$3,100,000. From the nature of the ground it is impossible to see ahead or to make any prediction as to the chances of success or failure. That these chances justify the cost of exploring it to a decisive point is beyond question. Its contents, whatever they may be, will be reached as promptly and as cheaply as possible.

Ore shipments began January 3rd, 1901, continuing until the strike July 12th, and were restricted to a rate sufficient to meet current expenses; On resuming work in December the Canadian Smelting Works found that its sampling plant, which was being reconstructed, had been so delayed by the failure of manufacturers to deliver machinery that it would be necessary to postpone the receipt of ore for several months.

The ore shipments for the year amount to 19,864 tons, averaging \$15.64 smelter's gross assay value. The average contents were 0.633 oz. gold, 1.08 oz. silver and 2.1 per cent. of copper.

The ore reserves now on hand in the mine are estimated at about 25,000 tons of about \$14 smelter's gross assay value, (valuing copper at the price of 16.25 cents, which it has hitherto maintained).

The following is excerpted from the accounts for the year ended 31st December:

ASSETS.	
Mines and Mineral Claims	\$1,699,329 39
Cash on hand and in Bank	2,579 72
Stores on hand as per Inventory	18,122 44
Machinery, Buildings and Equipment	224,300 91
Furniture of Offices	1,882 04
Monita Gold Mining Co's Stock	89,589 94
Mugwump Gold Mining Co's Stock	28,275 68
Rosland Red Mountain Gold Mining Co's Stock	56,190 20
War Eagle Hotel Co's Stock	12,500 00
Accounts Receivable	25,734 14
Profit and Loss	242,730 54
	<u>\$2,401,235 00</u>
LIABILITIES.	
Capital Stock Paid Up	\$1,750,000 00
Bank of Toronto, Rosland	256,171 07
George Gooderham	385,347 37
Accounts Payable	9,716 56
	<u>\$2,401,235 00</u>
PROFIT AND LOSS ACCOUNT,	
<i>Dr.</i>	
To Balance brought forward	\$197,514 93
" Cost of mining and developing WAR EAGLE MINE	\$143,051 56
" Fixed and General Expenses while mine closed down	19,445 63
" Rental paid Centre Star Co. for use of power plant for year	3,989 34
" Loss of Value, defective Hoist and Compressor, replaced or reconstructed	26,424 64
" Diamond Drill Prospecting	13,757 64
" Interest and Exchange	16,786 95
" Managing Director's Salary (2 years)	5,000 00
" Toronto Office Expenses	1,166 43
" Auditor's Fees	300 00
" Travelling Expenses	200 00
" Legal Expenses	176 91
" Trail Smelter Examination Expense	1,335 40
" Crown Point Expense	528 95
" Richmond Group Expense	34 18
" Sundry Expenses	875 16
	<u>233,072 79</u>
	<u>\$430,587 72</u>
<i>Cr.</i>	
By Net Proceeds from Ore Sales	\$191,579 88
Less Provincial Ore Tax	3,840 95
	<u>\$187,738 93</u>
" Transfer Fees	118 25
" Balance	242,730 54
	<u>\$430,587 72</u>

ANGLO-KLONDYKE.

The Directors' report and accounts submitted at the Annual Meeting on the 31st December state that the operations carried on between the 1st January and 30th September resulted in wiping off a loss of £7,000 brought forward from the previous year and a profit of £9,313, after writing off considerable sums for depreciation and for redemption of development. The total amount of gold recovered and other revenue during the past season was as follows:—

Fox Gulch Mines	\$100,560 16
Goheen	51,502 53
Bonanza Lay's	12,956 71
J. F. Goheen—Lay	7,803 30
W. H. Brown—Settlement	2,200 00
Water Sales	7,859 66
Mint Returns—Silver	244 37
	<u>\$183,126 73</u>

GRANBY SMELTING.

The smelting works of the Granby Company, at Grand Forks, in British Columbia, have already been described in these columns. The latest addition to these works is a converting plant, which was put in operation January 13. Previous to this the works have shipped the copper and other metals in the form of matte, but now shipments are made as blister copper, which is sent to eastern works to be refined and have the gold and silver values separated. Including the matte from the Granby furnaces with that from the Greenwood smelter and the Hall mines, it is expected that about 1,200 tons of blister copper will be shipped monthly. This will be increased to 1,500 tons when the two additional furnaces, now under construction at Grand Forks, are completed.

The converter building is a steel, fireproof structure, 160 by 68 feet, its height in the main portion being 35 feet. This building contains two stands of converters of the horizontal-barrel type. The shells are 72 inches in diameter by 100 inches in length. A 40-ton travelling crane, worked by electricity, handles the shells and matte, and a 20-ton reverberatory tilting furnace. The plant also comprises a quartz-crushing machine and grinding pan for mixing the converter linings. There are three mould carriers under each converter stand, and they are operated back and forth by a hydraulic ram.

Adjoining is the engine room, containing the blowing engine for blowing the converters, as well as the hydraulic pump that furnishes the pressure to operate the plant in the converter building. The blowing engine is run by a belt from a 200 h.p. alternating motor. It is of the power type, has an air cylinder 36 by 36 inches, and has a special unloading device attached, so that when the pressure reaches a maximum of 12 pounds the valves remain open, and no power is used when the converter is not using air.

A 10-ton travelling electric crane connects the converter building with the furnace building, 100 feet distant. The crane takes the molten matte and conveys it to the converter building, where it automatically pours the matte into the tilting reverberatory furnace. When the converter is ready for a charge the 40-ton crane places a large matte ladle in front of this furnace and by hydraulic power the furnace is tilted until there is enough for a charge.

The large crane then transfers this hot matte to the converter, into which it is poured. The converter is thereupon turned into an upright position, and the blast turned on. The blast pressure is 10 pounds per square inch, and it is maintained until such time as sufficient slag has formed. Then the blast is turned off and the slag skimmed into a large ladle. This ladle is then carried by a crane, and the slag is poured hot into a tilting furnace. The converter is next blown for a short time, when the matte is converted into metallic copper, still retaining its gold and silver values.

The moulds on the carriages are now brought into position by the hydraulic ram, and the copper is slowly poured out of the converter into the moulds. The converter is now ready for another charge.

The time occupied in converting a charge into metallic copper varies from 2 to 4 hours, depending upon the grade of copper matte. This process effects a saving of 50 per cent. in the weight of metal that has to be shipped to the refinery. Each member of the set of converters has a capacity of from 50 to 70 tons of matte daily.

The plant in the power house has been increased by a 250-h.p. horizontal turbine waterwheel and a 250-h.p. electric generator, directly connected with the waterwheel.

For the purpose of supplying water to granulate the slag, there have also been installed two additional triplex power pumps, each with a capacity of 750,000 gallons daily.

The construction and installation have been under special charge of Superintendent A. B. W. Hodges, to whom credit is due for many details of the plant, as well as its general design.

WHITEWATER MINES.

The annual general meeting of the Whitewater Mines, Limited, was held in London, on December 9th, Mr. H. W. Forster, M.P., (chairman of the company) presiding.

The Secretary (Mr. E. R. Tasman) having read the notice convening the meeting and also the auditors' report.

The Chairman said: I will first deal with the accounts, and the principal item I am sure you will recognise is the item of profit for the year. This profit appears at £3,939 8s. 8d., of which the dividend declared on December 11 last absorbed £3,125, leaving a balance of £814 8s. 8d., to be carried forward. It is only right that I should explain to you that this profit was arrived at after treating the accounts in the most drastic manner; for not only does this profit represent the revenue for only ten months, but it is arrived at after deducting from the year's work £2,623 5s. 10d. brought forward from the development account of the previous year, charging the whole of the costs of development for 1900 (less £1,000 carried forward) amounting to £3,987, and depreciation amounting to £701 1s. 1d. In other words the operating profit for the year 1900 has been debited in the accounts before you with a total amount of £7,221 6s. 11d., after which deduction a profit of £3,939 8s. 8d. still remains. From this explanation you will see that the work done during 1900 was considerably more profitable than the accounts now before you would seem to show. The amount expended upon development—that is to say, in driving tunnels for opening up further ore reserves and other work of a similar character—amounted during the year to £4,897, the advantage of which is explained by there being, at the end of 1900, 40,500 tons of ore opened up, which Mr. Fowler (our engineer) estimates at a gross value of over £50,000. Against this large value in ore reserves only £1,000 has been carried forward, and here again I am sure you must agree with me that the accounts have been treated in the most conservative possible manner. The general expenditure in British Columbia may appear to be somewhat high; but upon investigation you will find that this is really not the case, as under the item of management, office and engineering expenses are included the salaries of the mining superintendent and his clerk. The other items under this head need no further comment from me, they being for the most part payments over which we have no control. The amount of general expenditure in London cannot be considered high, and were it not that your directors are in a position to deal with such matters themselves this item would have to be swelled to the extent of the cost of employing engineers to advise them at this end.

I may explain to you that the Whitewater vein is one which varies considerably in value, consisting as it does of bodies of high-grade ore embedded in other ore of a lower grade, and consequently the future of the mine depends upon the proportion in which the high-grade bodies of ore stand to the poorer quality around it. From Mr. Fowler's report you will notice the remarkable fact, that although the average gross value of the ore mined and treated last year was only \$6.68 per ton, a profit of nearly 67 cents per ton was derived from it. This will show you how economically the mine is being worked, and the immense possibilities which would arise from any increase in the value of the ore, as the expense of attending the mining and treatment of the low-grade ore is practically the same as it would be for the higher-grade material. Mr. Fowler's figures explain that the cost of mining and treating the ore has been reduced to a minimum, and I can assure you that your directors have been careful to institute economies in every possible quarter, and with this in view I may say that our patrons, the London and British Columbia Goldfields, Limited, are assisting us in every way. At the end of last year your directors had hoped that the mine had entered on a dividend-paying basis, with every prospect of its continuance. It was therefore with considerable consternation that we were met with the decision of the American smelter people to cease taking lead ores from British Columbia except upon exorbitant terms. We thought, however, that this condition of things would be of short duration, and consequently, continued full operations at the mine and mill until March last, when the mill was shut down and work confined to development only. In April all hands were discharged except the small force necessary for keeping the workings in good order, and it was not until July last that we succeeded in making terms with a local smelter for the treatment of our ore, which terms Mr. Fowler describes as more favourable than those we had been having from the American smelter. Operations were continued with one shaft until August, since when full operations have been resumed. I think also that we may look forward to considerable improvement in the smelting position, in the first place owing to the liberal action of the Dominion Government in granting a subsidy upon lead locally refined, and secondly, from the competitions of local smelters with those of the United States which is likely to follow. In fact, we understand that a local refinery will before long be established at Nelson, which place is no great distance from our mine. Our difficulty has been that there was practically no demand for the ore such as Whitewater Mine produced in Canada itself. Almost all the ore from our part of British Columbia has had to go to the United States, and we have had to take what terms

the American smelter could give us. We hope, however, that the outcome of the establishment of a local smelter and refinery I have referred to will be to promote competition and to offer a ready market for our productions.

Before I conclude I feel I must refer to the heavy slump in the price of lead and the somewhat smaller drop in the price of silver which have occurred since last I met you. Had this not been the case, I feel sure it would have been within my power to have spoken to-day in a far brighter manner than, under the circumstances, I am able to do. You must not, however, attach too much importance to this slump in prices, because I am hopeful—and many are agreed with me—that bottom prices have been reached, and that they may take an upward turn. As we are to-day earning profits at the mine, notwithstanding the low price of our products, it will require but a very small rise in the price of lead to produce a marked improvement in our position. It is also quite on the cards that in working the reef between the tunnels we shall encounter larger blocks of the higher-grade ore than has recently been met with, which again would tend to increase our profit. With this in view, I do not think we need despair. Adverse circumstances have given us some ugly knocks; but they have not ruined our mine. The mine is there thoroughly equipped with efficient, up-to-date plant, and we only want a slight stroke of luck so to improve matters as to altogether alter the aspect of affairs. Our capital is not large, the administration is efficient and economical, and therefore, although our past has been somewhat clouded, we have a much brighter future before us. I might say that the result of operations during September, which was the first month's work after the resumption, produced no profit, which was mainly due to the expenses for that month having to be debited with certain heavy insurance charges and taxes. The work during October gave a profit of \$2,000, which, although small, is, I think, a sign of general improvement. I wish I could have given you a more encouraging account of the mine; but I can honestly say that I believe there is no reason why we should despair as to the future. I now beg to move: "That the report of the directors and the statement of accounts to December 31st, 1900, now submitted to the meeting, be, and the same are hereby adopted."

Mr. Oliver Wethered, who has recently returned from a visit of inspection to the company's property in British Columbia, in seconding the resolution, gave an account of his recent visit to the mines. He said that the causes that had contributed to the present unsatisfactory position were, first, that the lead ore had not been so good in value of late as it was at first; secondly, the disorganisation caused by the strike; and thirdly, the difficulty with the smelter—the most serious of all. But, as the chairman had said, this last difficulty was being got over, and with the least advance in the price of the metals, he looked forward to an improvement in profits.

The resolution was put and carried unanimously.

NEW COMPANIES.

BRITISH COLUMBIA.

Bonanza Mountain Gold Mining Co.—Incorporated 10th January, 1902. Authorized capital \$1,500,000, in shares of \$1.00 each.

Comox Coal Co.—Incorporated 29th Nov., 1901. Authorized capital \$100,000, in shares of \$1.00.

Rock Creek Consolidated Placer Mining Co., Ltd.—Incorporated 10th December, 1901. Authorized capital \$7,500.00, in shares of \$25.00.

Relief Gold Mining Co.—Incorporated as an extra provincial company under the laws of B. C., 30th Nov., 1901. Authorized capital \$250,000, in shares of 50 cents each. Head Office in B. C.: F. H. Nettleton, Erie, B. C., Attorney.

Davenport Gold Mines, Ltd.—Incorporated 10th January, 1902. Authorized capital \$100,000, in shares of five cents each.

English and French Gold Mining Co., Ltd.—Incorporated 10th Jan., 1902. Authorized capital \$2,000,000, in shares of \$1.00 each.

Lardeau Smelting and Refining Co. of British Columbia, Ltd.—Incorporated 13th Jan., 1902. Authorized capital \$750,000, in shares of 50 cents each.

Hardie Cinnabar Mines, Ltd.—Registered in London, Jan. 27th, 1902. Authorized capital £50,000, in £1 shares. To acquire certain mineral and mining claims in British Columbia, and to carry on the business of prospectors, miners and metallurgists.

Velvet Rossland Mines, Ltd.—Registered Jan. 25, 1902. Authorized capital £200,000, in £1 shares.

ONTARIO.

Redeemer Mining and Milling Co.—Incorporated 29th Nov., 1901. Authorized capital \$500,000, in shares of \$100.00 each. Head office: Windsor, Ont.

Osawabik Mining Co., Ltd.—Incorporated 29th Nov., 1901. Authorized capital \$2,500,000, in shares of \$25.00 each. Head Office: Sault Ste. Marie, Ont.

Consolidated White Bear Mining Co., Ltd.—Licensed 29th Nov., 1901. Head Office: J. H. Starr, Secretary, Toronto, Ont.

Echo Lake Mining Co.—Licensed 5th Dec., 1901. Authorized capital, \$500,000. Head office: Moses McFadden, Solicitor, Sault Ste. Marie, Ont.

Canadian Steel and Wire Co., Ltd.—Incorporated 21st Dec., 1901. Authorized capital \$200,000, in shares of \$100.00 each. Head office: Hamilton, Ont.

Durham Natural Gas and Oil Co., Ltd.—Incorporated 20th Dec., 1901. Authorized capital \$10,000, in shares of \$10.00. Head office: Durham, Ont.

United States Gold Mining Co.—Licensed 20th Dec., 1901. Authorized capital, \$100,000. Head office in Ontario: Wm. McBrady, Barrister, Port Arthur, Ont.

Consolidated Copper Co. of Parry Sound, Ltd.—Incorporated 7th Feb., 1902. Authorized capital \$5,000,000, in shares of \$1.00 each. Head office: Parry Sound, Ont.

Sault Gray Copper Co., Ltd.—Incorporated 28th Jan., 1902. Authorized capital \$400,000, in shares of \$5.00 each. Head office: Sault Ste. Marie, Ont.

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Write "J.B.," *Canadian Mining Review*, Ottawa.

MINING STOCKS.

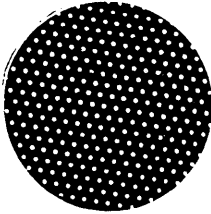
We are open to act as Fiscal Agents in Boston and New England for the sale of the Treasury Stock of a good Mining Company. Address with full particulars

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Tyee Copper.—The secretary issues the following:—"The main shaft has been sunk down to the 300 ft. level, and a cross-cut north from it has struck solid ore at 75 ft. in, and crosscutting is being continued in ore-bearing formation. On the 100 ft. level, where the large ore body was first struck, a cable has been received announcing that the east drift has been driven 145 ft. from main shaft, in solid ore, and that the west drive is also being continued in solid ore. Developments of a most hopeful nature have been begun on the newly-acquired claims."

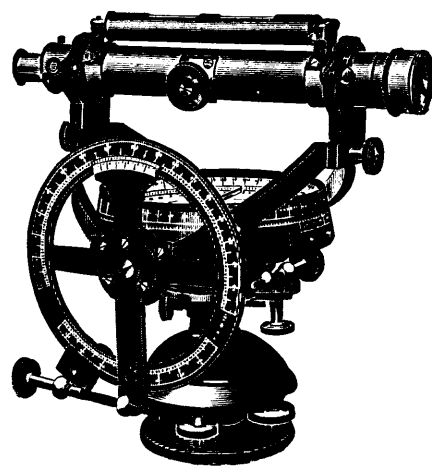
Hastings (B. C.) Exploration Syndicate.—The directors have declared an interim dividend of 5 per cent. payable March 1st.



General Mining Association of the Province of Quebec.

The Annual General Meeting of the Association will be held in the Library of The Canadian Mining Institute, Room IV., Windsor Hotel, Montreal, on Wednesday, 5th March, 1902, at twelve o'clock, noon.

G. E. DRUMMOND, *President.* B. T. A. BELL, *Secretary.*



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(B) Analytical Chemistry and Assaying.

2—Four Years' Course for a Degree B.Sc. in
(A) Mining Engineering.
(B) Chemistry and Mineralogy.
(C) Mineralogy and Geology.

3—Courses in Chemistry, Assaying, Mineralogy,
and Geology for degrees of Bachelor of Arts (B.A.) and Master of
Arts (M.A.)
For further information see the Calendar of Queen's University.

4—Post-Graduate Course for the Degree of
Doctor of Science (D.Sc.)
For further information see the calendar of Queen's University.

Next Session begins October 3rd,
... 1900 ...

**Matriculation Examination held at Queen's University, Sept. 20th.
Unmatriculated Students admitted to Special Courses.**

The School is provided with well equipped Laboratories for the study of Chemical Analysis, Assaying, Blowpiping, Mineralogy, Petrography and Drawing. In the Mining Laboratory the operations of Crushing, Amalgamating, Concentrating, Chlorinating, Cyaniding, etc., can be studied on a large scale.

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO 

Dr. W. L. GOODWIN,
DIRECTOR

SCHOOL OF MINING, KINGSTON, ONTARIO.

Did You Hear the Thunder?

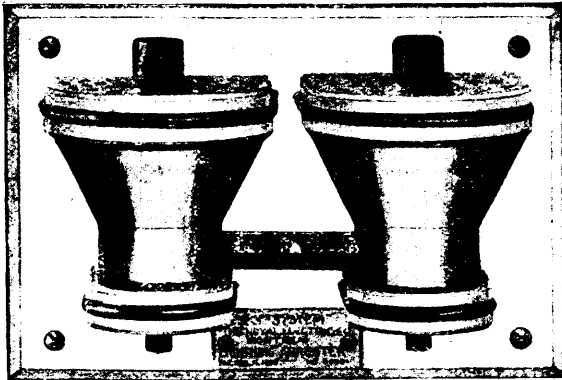
Where there is thunder there is lightning.
Every electric plant should be provided with
Lightning Arresters which will **PROTECT!**

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CANADIAN MINING INSTITUTE ANNUAL MEETINGS.

The ANNUAL GENERAL MEETINGS of the MEMBERS of THE CANADIAN MINING INSTITUTE, for the Transaction of Business, the Discussion of Papers, etc., will be held in the

CLUB ROOM, WINDSOR HOTEL, MONTREAL,

On Tuesday, Wednesday and Thursday, 4th, 5th and 6th March, 1902.

SINGLE FARE ON RAILWAYS.

Arrangements are being made whereby Members will be carried to Montreal and returned for a **Single Fare** on the Canadian Pacific, Grand Trunk, Intercolonial, Quebec Central, and Canada Atlantic Railways.

SPECIAL TOPICS FOR DISCUSSION.

In addition to a record programme of papers to be presented by the most eminent mining authorities in Canada, the following Topics have been slated by the Council for special discussion:—

GOVERNMENT AID TO MINING.

By Mr. JOHN E. HARDMAN, S.B., M.A.E., Montreal, Que.

COMPRESSED AIR.

By Mr. W. L. SANDERS, New York, N.Y.

COLLIERY VENTILATION.

By Mr. CHARLES FERGIE, M.E., Westville, N.S.

POWER DRILLS.

By Mr. C. C. HANSEN, Montreal, Que.

HAULAGE.

By Mr. WM. BLAKEMORE, M.E., Montreal, Que.

PUMPING.

By Mr. JOHN P. NORTHEY, Toronto, Ont.

Syllabus of papers and detailed programme of arrangements will be sent to members in due course.

CHARLES FERIE, *President.*

B. T. A. BELL, *Secretary.*

NOW READY

ELEVENTH EDITION

The **Canadian Mining Manual**

FOR 1901

Up to date particulars of the Organisation, Equipment, Operations, Output, Balance Sheets and Dividends of all Canadian

Collieries	Metal Mines	Stamp Batteries
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The most complete and handily arranged work of reference to Canadian mining undertakings extant.

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THE CANADIAN MINING REVIEW

OTTAWA, CANADA.



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 annually 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 acquire 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.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States
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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 and 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 mining 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 MINISTER OF LANDS, MINES AND FISHERIES,
PARLIAMENT BUILDINGS, QUEBEC, P. Q.



DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For Disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories, and the Yukon Territory.

COAL.

Coal lands may be purchased at \$10.00 per acre for soft coal, and \$20.00 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at such rate as may from time to time be specified by Order in Council shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding Free Miner's Certificates may obtain entry for a mining location.

A Free Miner's Certificate is granted for one or more years, not exceeding five, upon payment in advance of \$10.00 per annum for an individual, and from \$50.00 to \$100.00 per annum for a company, according to capital.

A Free Miner having discovered mineral in place may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is \$5.00.

At least \$100.00 must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When \$500.00 has been expended or paid the locator may, upon having a survey made and upon complying with other requirements, purchase the land at \$1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of royalty on the sales not exceeding five per cent.

PLACER MINING, MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

Placer mining claims generally are 100 feet square; entry fee \$5.00 renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

DREDGING IN THE RIVERS OF MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

A Free Miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental \$10.00 per annum for each mile of river leased. Royalty at the rate of two and a half per cent., collected on the output after it exceeds \$10,000.00.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed in the river below low

water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, \$100.00 per mile for first year, and \$10.00 per mile for each subsequent year. Royalty ten per cent. on the output in excess of \$15,000.00.

PLACER MINING IN THE YUKON TERRITORY.

Creek, Gulch, River and Hill Claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other Placer Claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end bearing notices. Entry must be obtained within ten days if the claim is within ten miles of Mining Recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim, and each person in his or its employment, except house servants, must hold a Free Miner's Certificate.

The discoverer of a new mine is entitled to a claim 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee \$15.00. Royalty at the rate of five per cent charged on the gross output of the claim, with the exception of an annual exemption of \$5,000.00.

No Free Miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and Free Miners, not exceeding ten in number, may work their claims in partnership, by filing notice and paying fee of \$2.00. A claim may be abandoned and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least \$200.00, or in lieu of work payment may be made to the Mining Recorder each year for the first three years of \$200.00 and after that \$400.00 for each year.

A certificate that work has been done or fee paid must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a Free Miner.

The boundaries of a claim may be defined absolutely by having a survey made, and publishing notices in the *Yukon Official Gazette*.

HYDRAULIC MINING, YUKON TERRITORY.

Locations suitable for hydraulic mining, having a frontage of from one to five miles, and a depth of one mile or more, may be leased for twenty years, provided the ground has been prospected by the applicant or his agent; is found to be unsuitable for placer mining; and does not include within its boundaries any mining claims already granted. A rental of \$150.00 for each mile of frontage, and a royalty of five per cent. on the gross output, less an annual exemption of \$25,000.00 are charged. Operations must be commenced within one year from the date of the lease, and not less than \$5,000 must be expended annually. The lease excludes all base metals, quartz and coal, and provides for the withdrawal of unoperated land for agricultural or building purposes.

PETROLEUM.

All unappropriated Dominion Lands shall, after the first of July, 1901, be open to prospecting for petroleum. Should the prospector discover oil in paying quantities he may acquire 640 acres of available land, including and surrounding his discovery at the rate of \$1.00 an acre, subject to royalty at such rate as may be specified by Order in Council.

JAMES A. SMART,

Deputy of the Minister of the Interior.

Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite ; copper in sulphide and native form ; gold, mostly in free milling quartz ; silver, native and sulphides ; zinblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc., apply to

HONORABLE E. J. DAVIS,

Commissioner of Crown Lands,

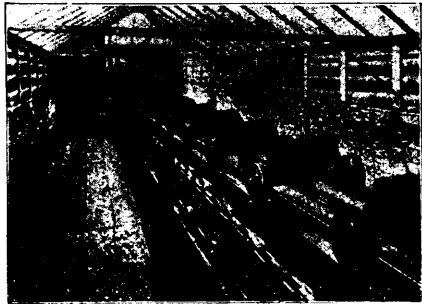
or

THOS. W. GIBSON,

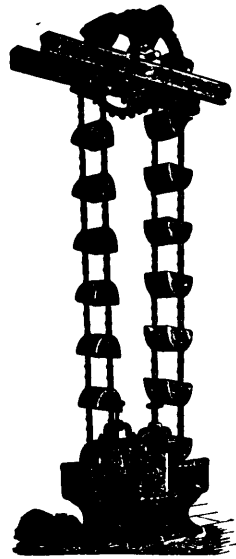
Director Bureau of Mines,

Toronto, Ontario.

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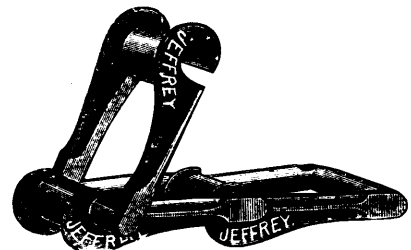
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Any size, shape or capacity.



Chains of Every Description

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THREE RIVERS, "
BRAND'S PILES, "
MIDLAND, ONT.

GEO. E. DRUMMOND, Managing Director and Treasurer.

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Manufacturers of "LANG'S" PATENT WIRE ROPES



FOR COLLIERY AND GENERAL MINING PURPOSES.

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