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OTTAWA, MAY 31st, 1901.

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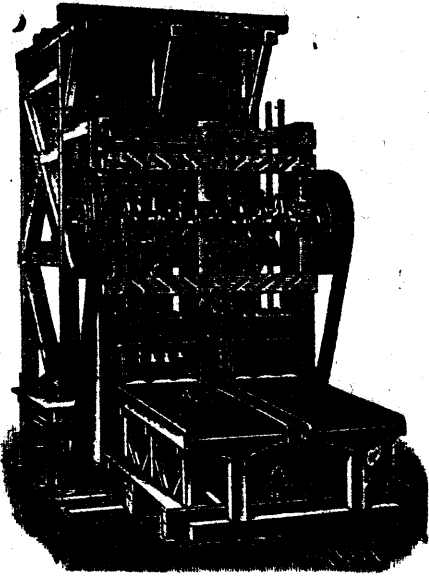
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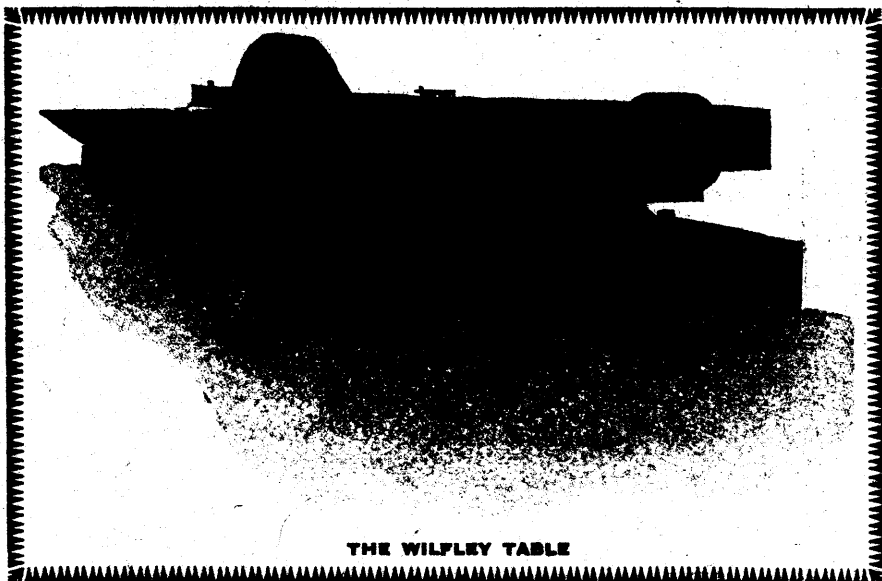
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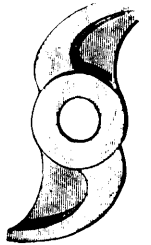
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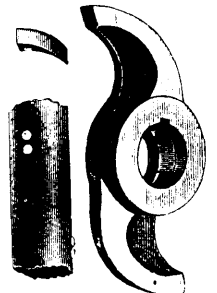
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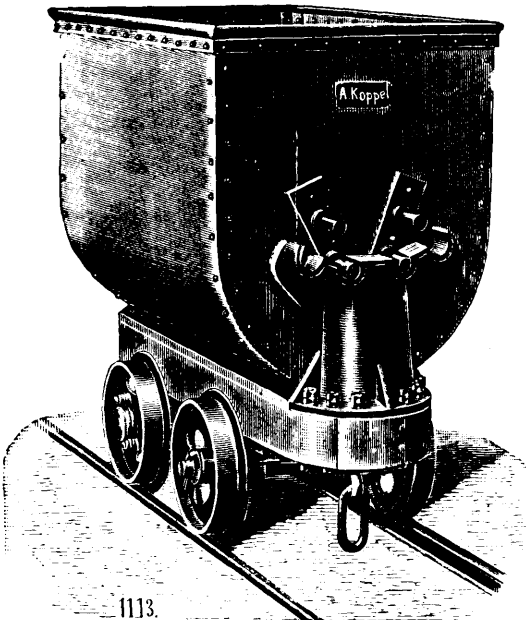
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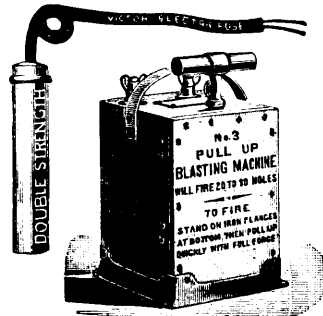
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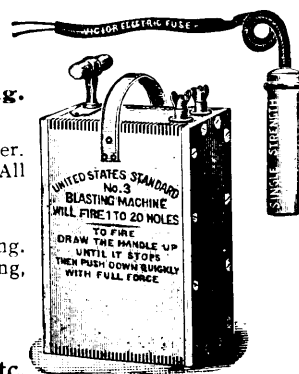
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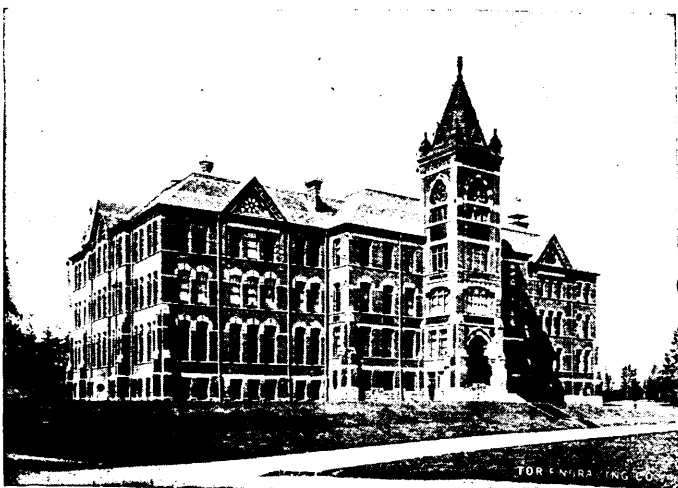
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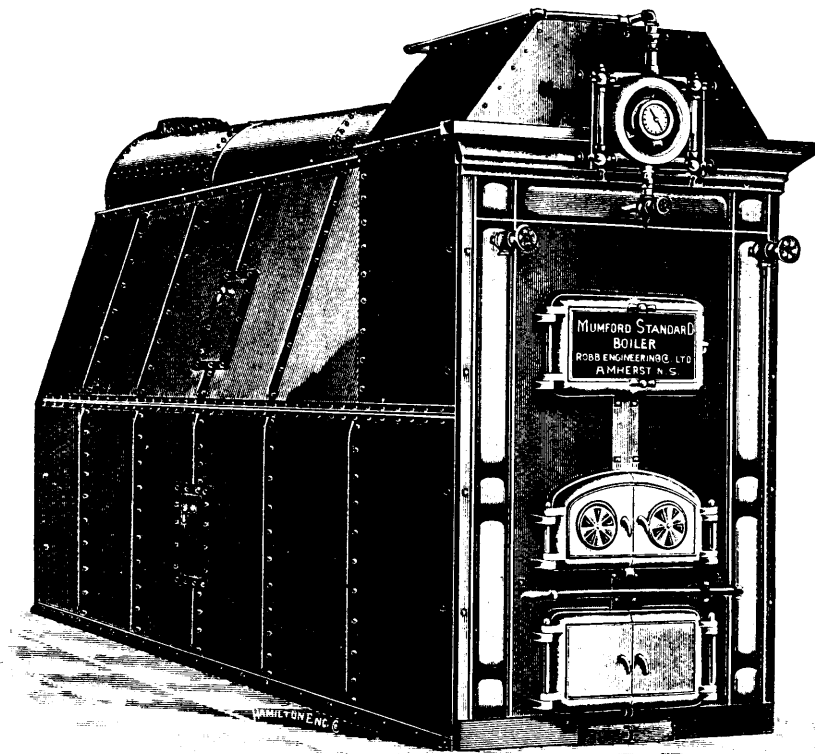
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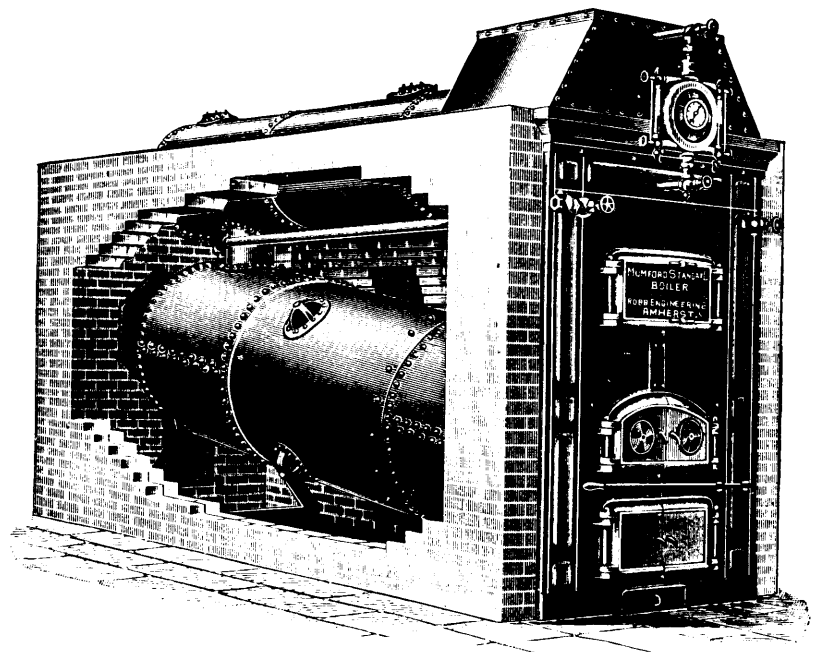
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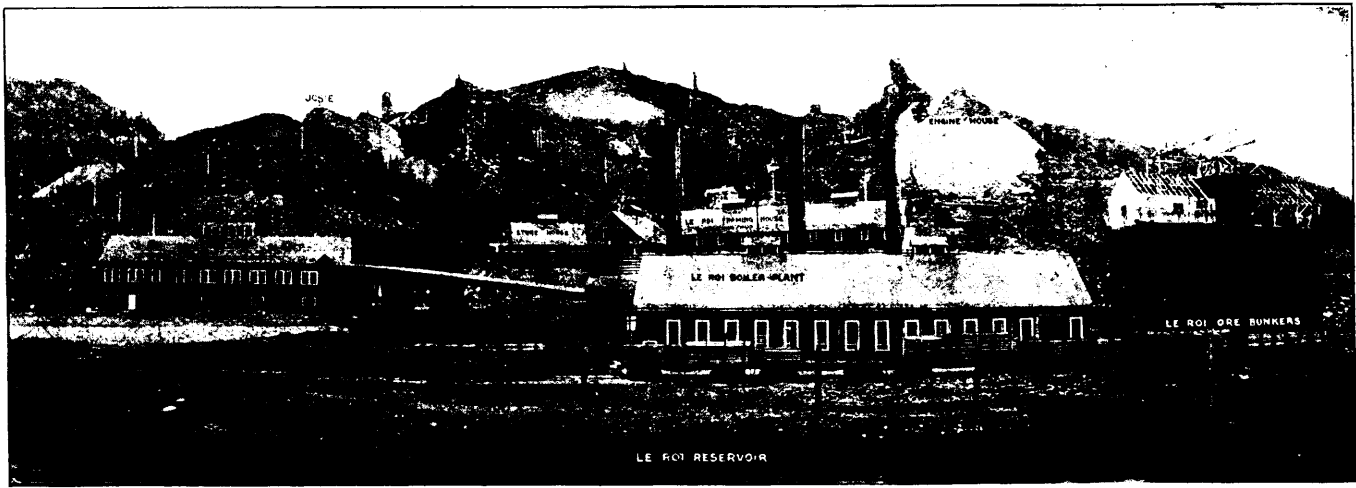
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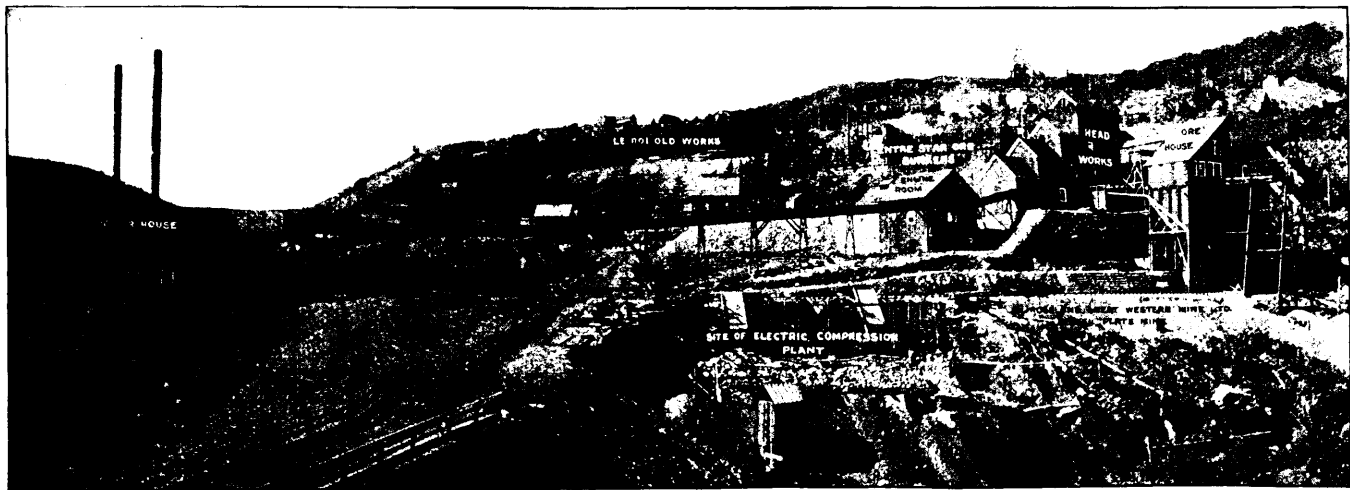
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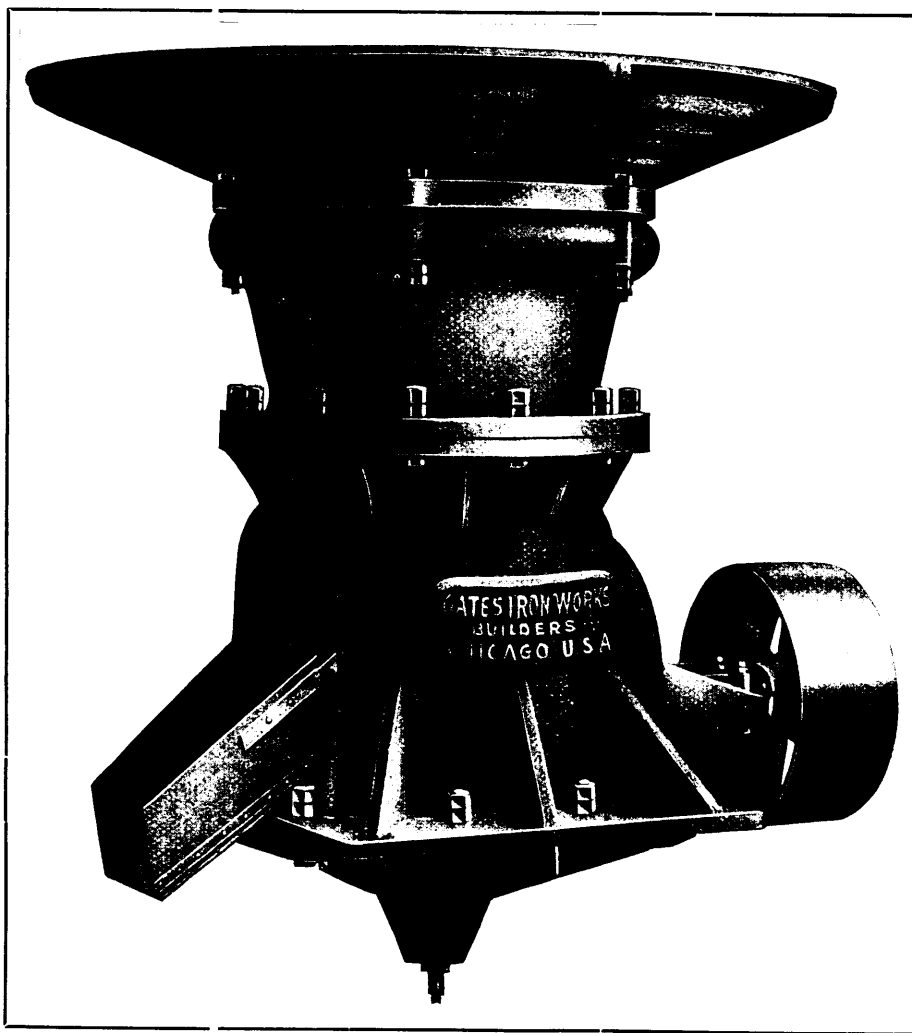
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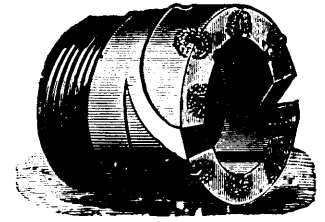
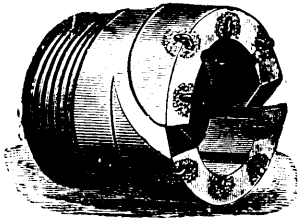
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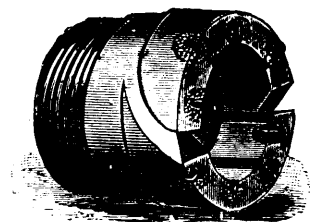
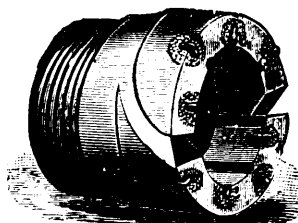
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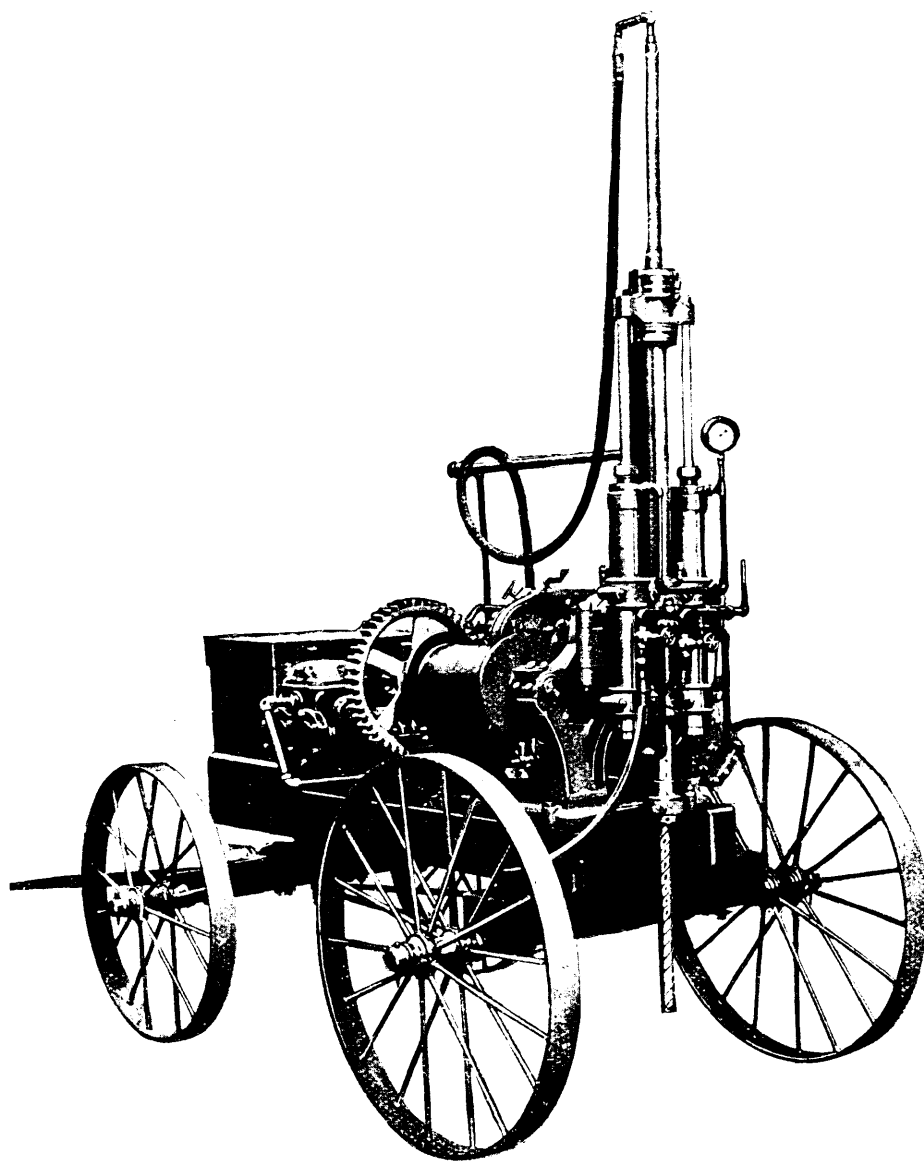
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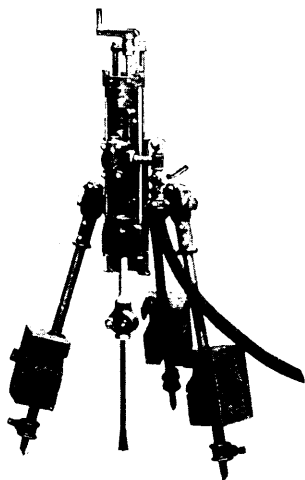
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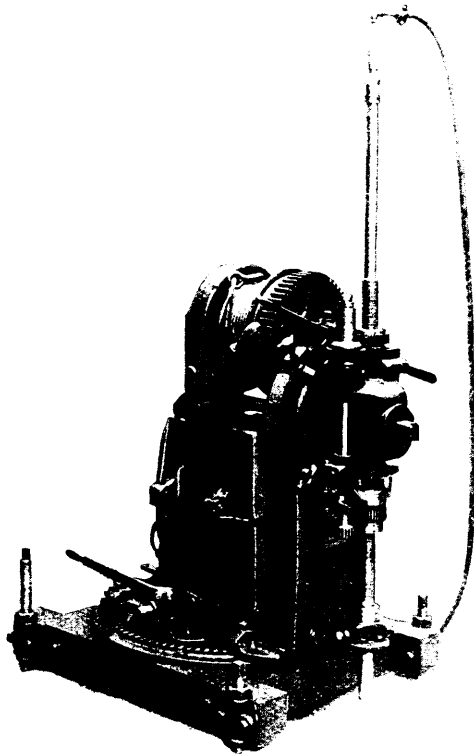
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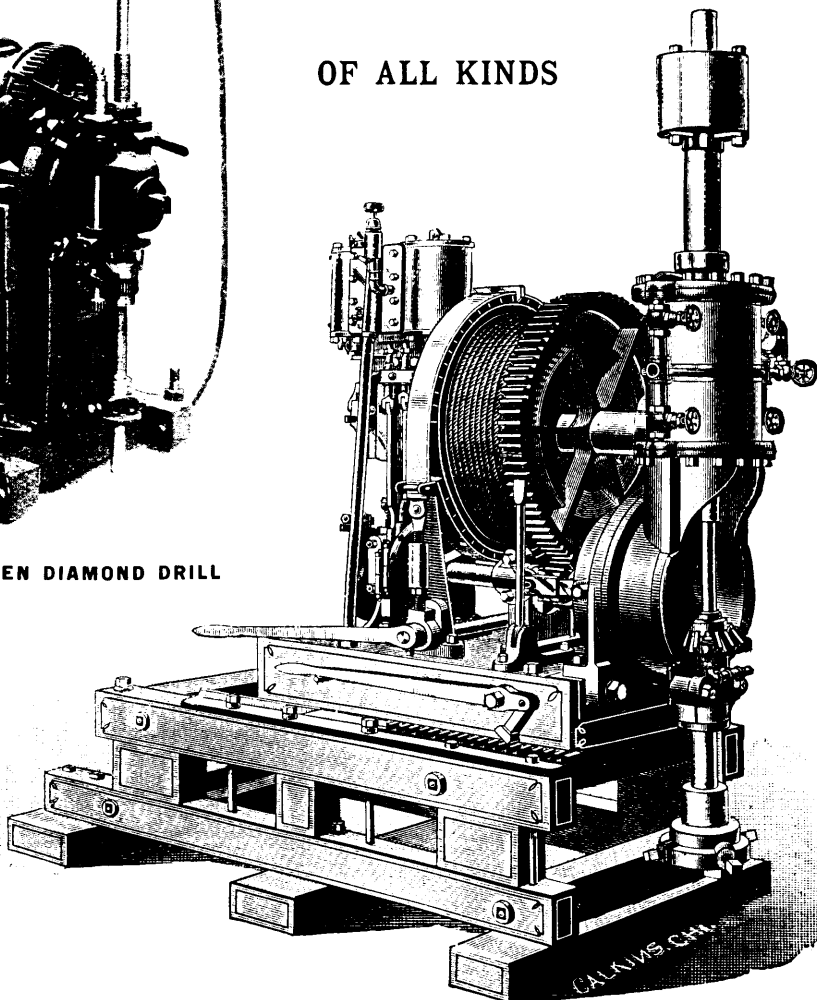
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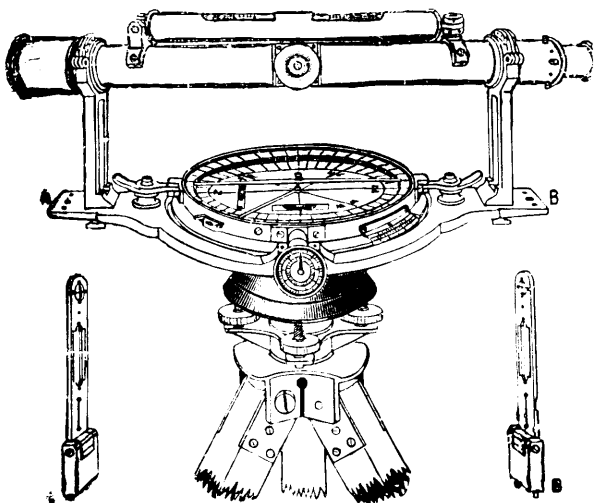
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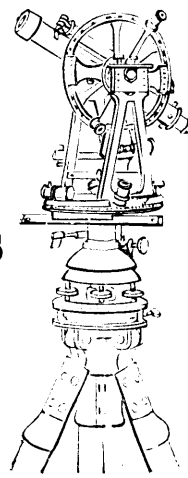
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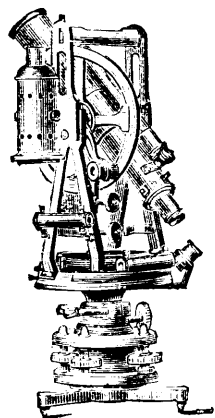
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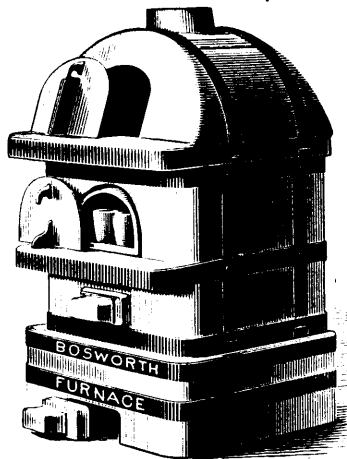
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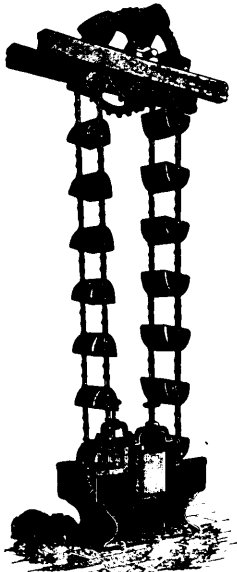
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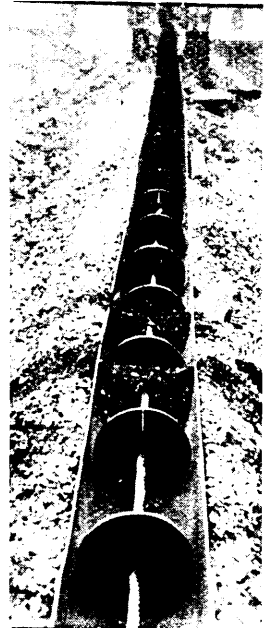


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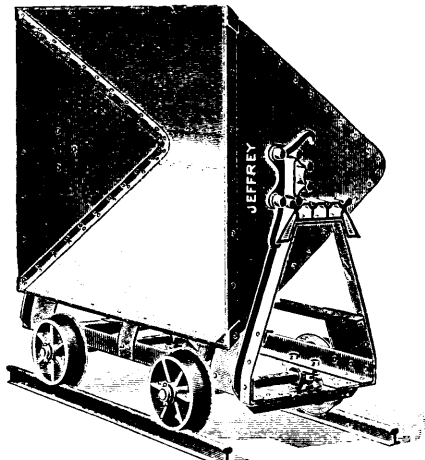


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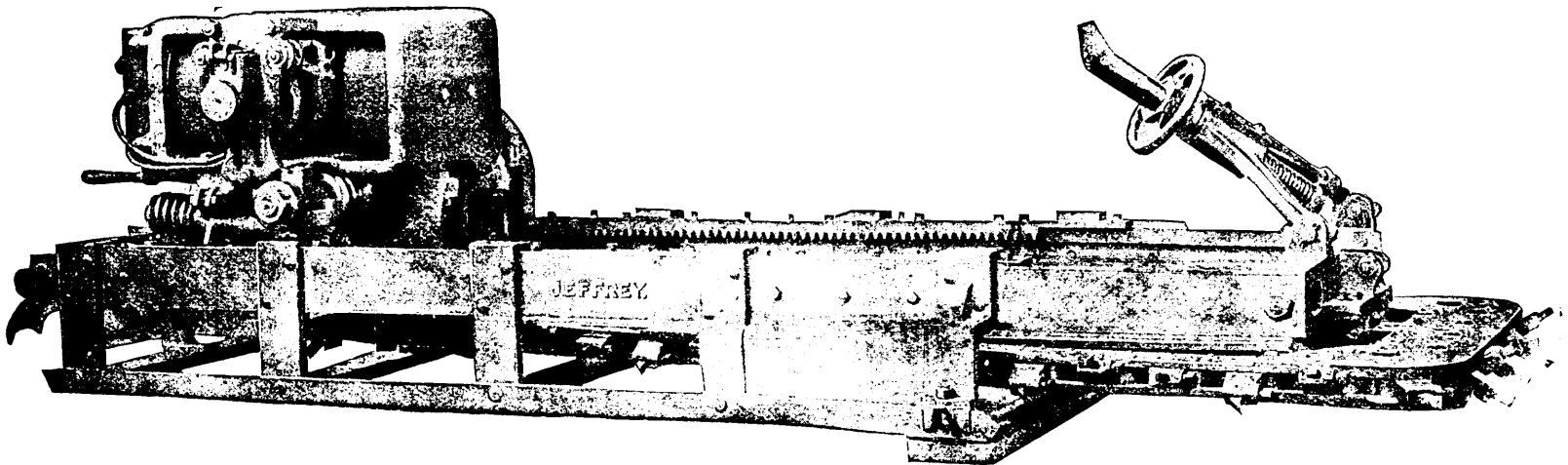


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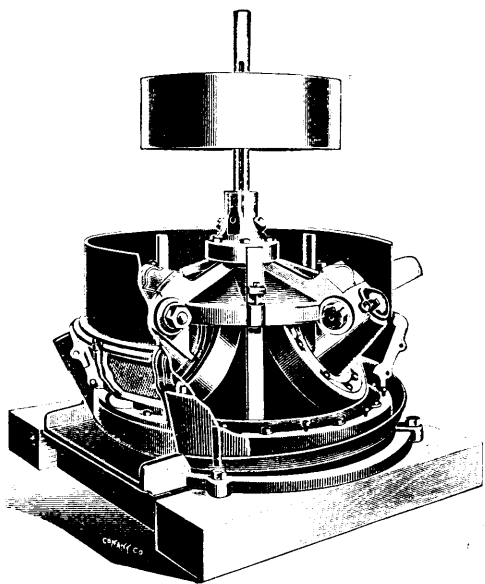
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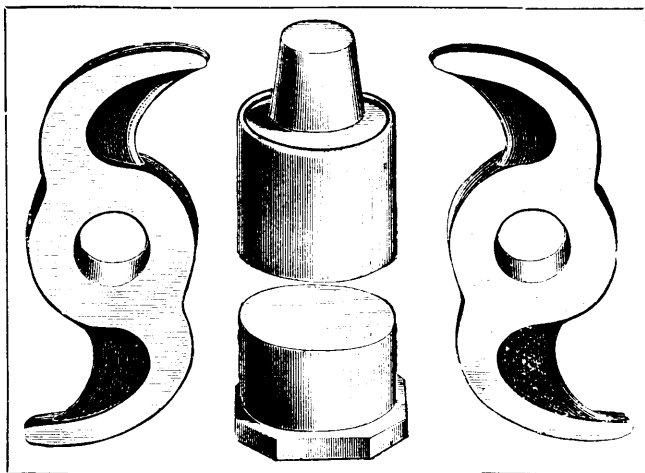
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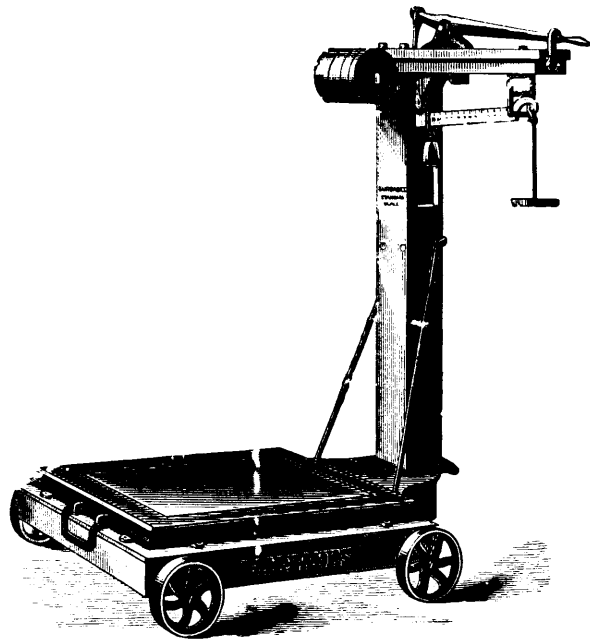
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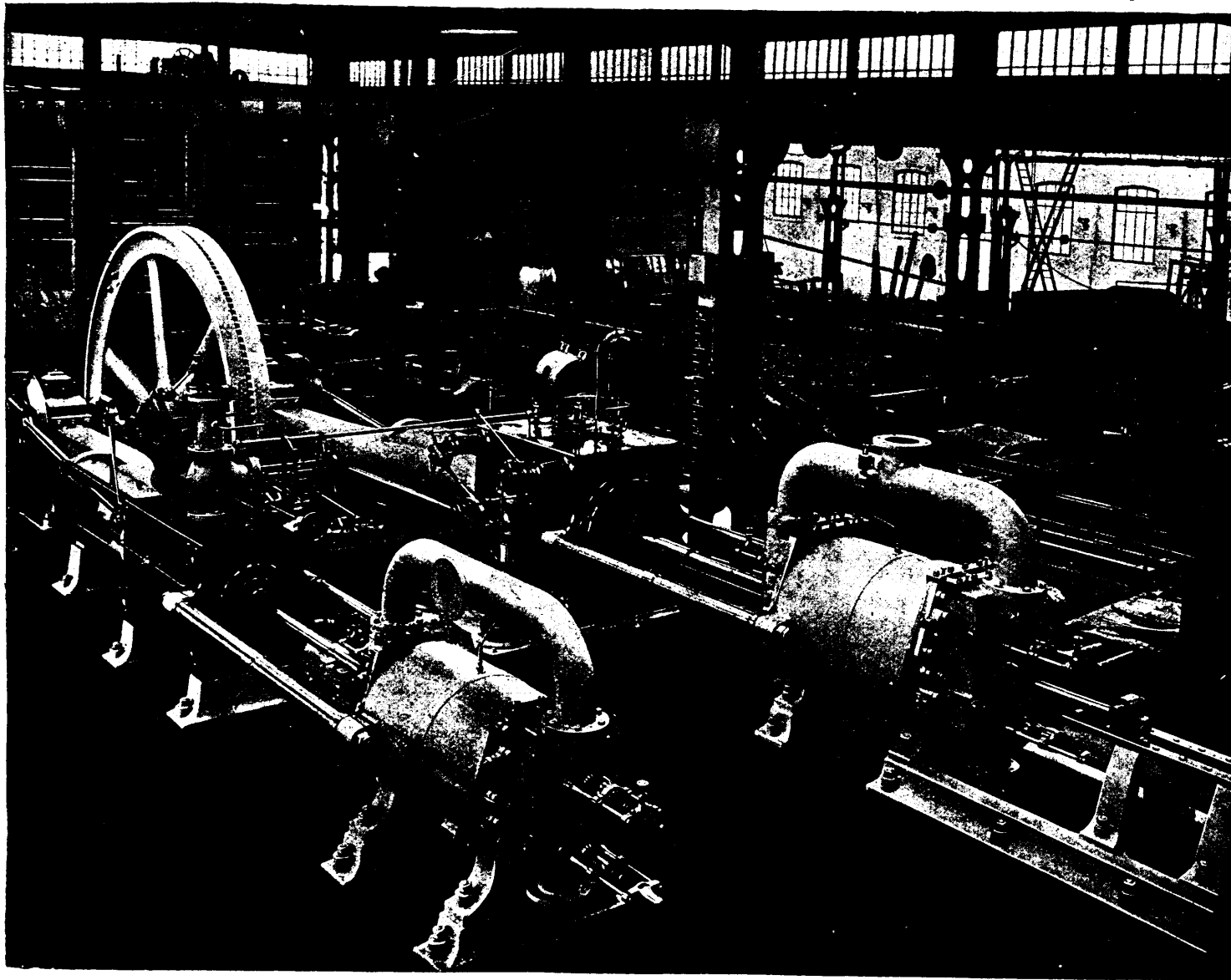
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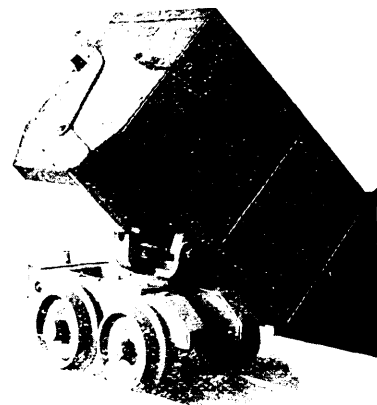
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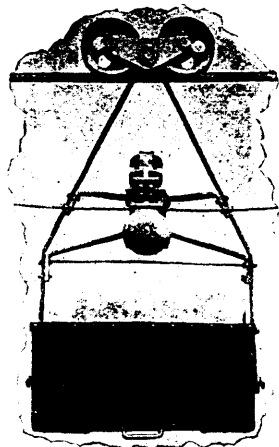
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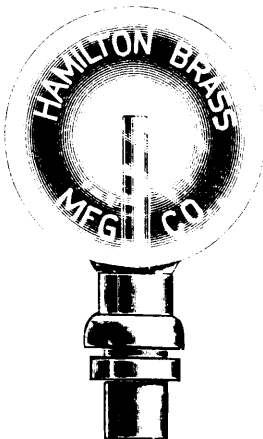
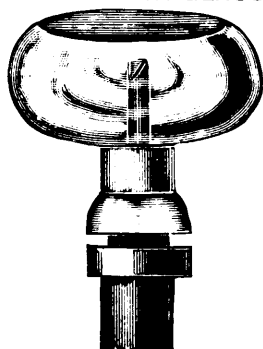
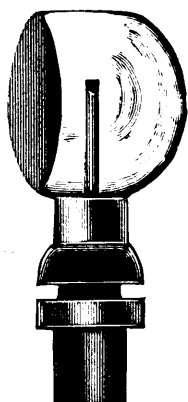
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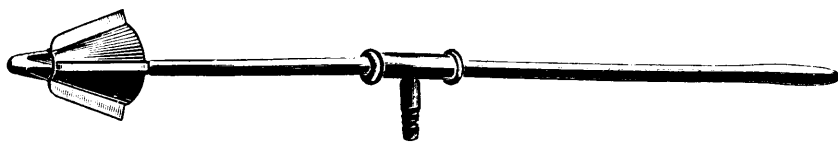
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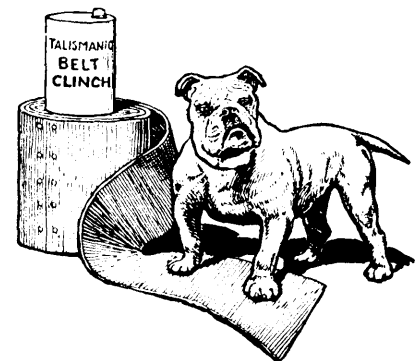
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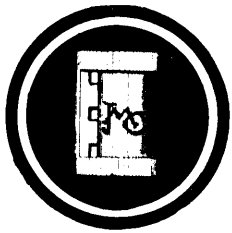
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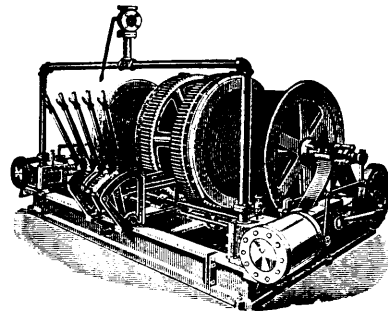
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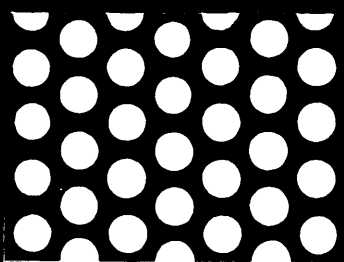
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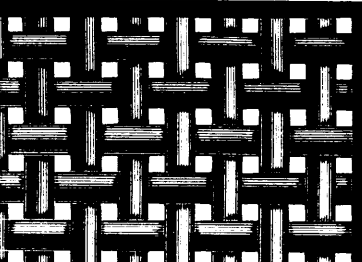
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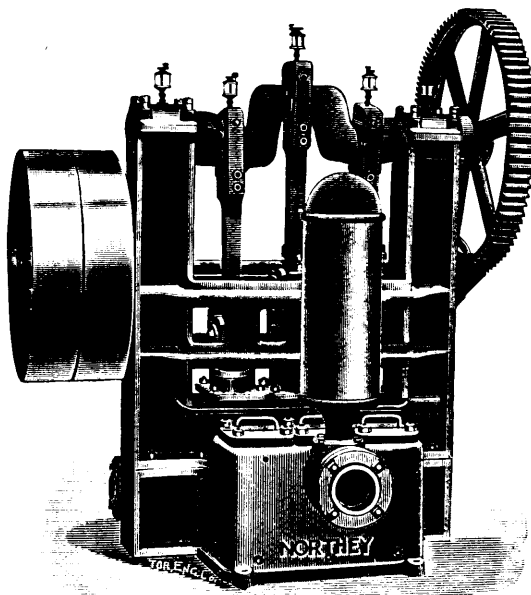
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We illustrate in this advertisement a typical Pump for Mine Work. This is our Triplex Power Pump, fitted with tight and loose pulleys as shown in cut. It is the regular Triplex type with the three cranks 120 degrees apart; crankshaft and connecting rods are of steel; gears machine-cut from the solid; plungers of brass and all details carefully worked out. This Pump is especially adapted for service with Electricity as the motor power.

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19th YEAR OF PUBLICATION.

The CANADIAN MINING REVIEW

Established 1882

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

Published Monthly.

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

VOL. XX., No. 5.

MAY, 1901.

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Stock Gambling vs. Mining as an Industry.

For the benefit of those who are suffering from the serious decline in mining shares on the Canadian market we wish to state that, taking the whole of North America, including Mexico, the value of the raw mineral output is second in importance only to that of the agricultural produce. No other single industry can compare in magnitude with either of these two. We believe the political economists are with us in affirming that the only two possible sources of wealth are the farm and the mine, taking these terms in their most broadly inclusive senses. These then are the bases upon which human industry depends.

It need hardly be said that the minerals of North America are not produced at a loss. On the contrary the mineral industry constitutes the legitimate source of revenue for a large proportion of the people of the western hemisphere. These people have cast their fortunes with the industry; they know that by following it they can do what men in other walks of life accomplish, viz., feed and clothe themselves and their families, and, if prudent and able, lay up a snug sum, or even grow rich. These men belong neither to the ranks of the gamblers nor the well-meaning adventurers. They are concerned as other men are in the simple business of gaining a sure reward for industry.

Now what about those who are so loudly denouncing mining as a gamble? How is it that so many shrewd business men, merchants, lawyers, doctors and others, smile a knowing but sickly smile when you question them on mining investments? The fact is they have not been in mining at all. They have been gambling, and furthermore they know they have been gambling. The good deacon dare not play poker, but he can buy mining shares. We presume the original sin must have its safety valve. The savage loves to gamble, and civilization has not rooted out all our primitive traits. But the savage playing at "moccasin" or the gambler staking his pile in a "freeze out" does not imagine that he is engaged in business. There is a difference, and a big one. We should know what we are about, and be careful not to call things by the wrong names.

There are men who gamble in mines without speculating in stocks. They buy large, often controlling, interests in so called mines. They know nothing about mines or minerals. They are easily fooled by promoters and by men who profess to know how to manage mines. They hope for large profits on relatively small investments. They expect by burnishing an old rusty Aladdin's lamp to see the genii come with unearned riches. It is contrary to nature's law to gain without giving a fair equivalent. It matters little whether this equivalent be hard earned money or harder earned experience. Of the two it is the latter which counts most, which reaps the larger reward. The

fortunes of the great men in the mining world were not accidents, but came because they had learned to know a good mine when they saw it, and how to make it pay when they acquired it. This is not gambling; it is not luck.

We wish to insist that gambling in mines is not mining, and that men who lose money in such speculation are not deserving of any sympathy. A mine conducted in a proper manner is very rarely capable of forming a basis for stock gambling. Such a mine will have a large amount of money annually expended in development work, blocking out ore reserves far in advance of the production, so that the prospects for some years ahead can be accurately estimated, not guessed at. There is no more certain indication that a mine is unsafe as a business proposition than the announcement of rich "strikes" heralded by the press and circulated on the stock exchanges, for the purpose of influencing the price of shares. A rich "strike" is of no value whatsoever until the new find has been thoroughly prospected, and it takes many weeks to block out any respectable body of ore large enough to warrant a change in current values of the stock. If the anticipation of possible large blocks of richer ore from the finding of good values at the end of a 5 ft. x 7 ft. drift, by a sudden elevation of the quotations on stock, is not gambling, pray, what is it?

Speculation of this sort is particularly harmful to the mining industry because the public confuses trading in shares with actual mining investment. The result is that conservative men gain the impression that mining is essentially risky, and in consequence will not even investigate the merits of sound enterprises which need capital to put them on a producing basis.

What we wish to insist upon is that the public shall, in the first place, discriminate sharply between mining and gambling, and in the second place realize that they can guard themselves against unprofitable investments by obtaining reports by mining engineers of experience and reputation. The peculiar character of the mining world, with its admixture of the good and the bogus, has resulted in the development of two classes of men assuming to report upon mines, corresponding in their characters to the phases of the industry to which they respectively devote themselves. But the prudent investor can easily investigate his engineer, if he chooses so to do. Any reputable engineer is sure to be a member of one or more of the great institutes of mining engineers of the world, and the secretaries of these institutes can always give information concerning their members, and refer inquiries to well known capitalists who may be able to vouch for a man in good standing.

There would seem to be no reason why a capitalist should not know the character of the man on whose judgment he risks his money

in mining as he would do if he were going to invest in a manufacturing enterprise. In this way lies safety, but if he rushes blindly into a field concerning which he knows nothing, and where he provides no safeguards, he need only expect the reward of folly. But then let him at least be honest enough to upbraid himself instead of the whole mining world.

Just now this question of mining investment in Canada is a serious one. The country has suffered from a boom. A boom inevitably means business conducted under the influence of temporary insanity, stimulated by more or less knavery. The harvest is according to the seed sown. In this particular case the losses have been estimated to amount to something more than \$30,000,000. This figure has been arrived at by a recent writer in the *Montreal Star* by taking the difference between the highest prices and the recent low prices of stock. The tables which he has prepared are of such interest that we reproduce them below:—

PRICES OF MINING SHARES.

	Highest.	Lowest.
War Eagle.....	\$3.83	.14
Centre Star.....	1.70	.30
North Star.....	1.00	.60
Republic.....	1.40	.15
Virtue.....	1.20	.10
Payne.....	1.68	.25
Mont.-London.....	.96	.02½
Big Three.....	.38	.01½
Brandon & G. Crown.....	.30	.05
California.....	.14	.04
Fern.....	.75	.02
Gold Hills Dev.....	.08	.01
Iron Colt.....	.18	.01
Iron Mask.....	.85	.35
Knob Hill.....	.95	.50
Monte Christo.....	.30	.01
Montreal Gold Fields.....	.30	.01
Noble Five.....	.35	.07
Old Ironsides.....	1.15	.80
Virginia.....	1.10	.01
Rambler-Cariboo.....	.35	.20
Slocan Sovereign.....	.38	.03
Golden Star.....	.70	.02

LOSSES FROM INFLATION AND DECLINE OF VALUES OF SHARES.

Name of Mine.	Capitalization.	Inflated Value.	Deflated Value.	Difference.
War Eagle.....	\$1,750,000	\$6,790,000	\$245,000	\$6,545,000
Centre Star.....	3,500,000	5,950,000	875,000	5,075,000
North Star.....	1,300,000	1,300,000	780,000	520,000
Republic.....	3,500,000	4,900,000	525,000	4,375,000
Virtue.....	2,000,000	2,400,000	200,000	2,200,000
Payne.....	2,500,000	4,200,000	625,000	3,575,000
Mont.-London.....	432,000	414,000	15,120	399,600
Big Three.....	3,500,000	1,330,000	52,500	1,277,500
Brandon and Golden Crown.....	1,500,000	450,000	75,000	375,000
California.....	2,500,000	310,000	60,000	250,000
Fern.....	250,000	187,500	5,000	182,500
Gold Hills Dev.....	2,500,000	200,000	25,000	175,000
Iron Colt.....	1,000,000	180,000	10,000	170,000
Iron Mask.....	500,000	425,000	175,000	250,000
Knob Hill.....	1,500,000	1,425,000	750,000	675,000
Monte Christo.....	2,500,000	750,000	25,000	725,000
Montreal Gold Fields.....	800,000	240,000	8,000	232,000
Noble Five.....	1,200,000	420,000	84,000	336,000
Old Ironsides.....	1,000,000	1,150,000	800,000	350,000
Virginia.....	500,000	550,000	5,000	545,000
Rambler-Cariboo.....	1,000,000	350,000	200,000	150,000
Slocan Sovereign.....	1,500,000	570,000	45,000	525,000
Golden Star.....	1,000,000	700,000	20,000	680,000
	\$38,232,000	\$35,190,220	\$5,804,620	\$30,197,600

A bad feature of all this is that the excitement in mining stock speculation has been assiduously fomented by the newspapers, and it

is a misfortune of a very considerable portion of the public to credit as truth every news item because it is printed in a newspaper. We are willing to believe that the average respectable newspaper would exclude any items its editor knew to be untruthful, and in some cases an effort to ascertain the truth is made. But we doubt whether any editor ever investigated the truth of a boom item on mining, and in consequence the most that he prints is false. We are not referring to the local press of the mining regions. These papers of course would not offend local patriotism by any adverse criticism on mines in the district. Sometimes they make unsavory remarks upon rival camps that are worthy of more or less attention. But the leading journals of the country should consider that they exercise an influence for good or ill upon the investing public, and they should be held responsible for news items that affect the stock market or, what is better still, they should suppress all mining news as being foreign to their field, and print only the quotations in their share list.

We quite believe that this has worked detrimentally to Canadian interests, as stated by Mr. J. H. Curle, E.M., in his recent volume, "The Gold Mines of the World": "Day by day an astonishing mass of crude, irresponsible gossip, and a great quantity of lies, appear under the guise of accurate mining intelligence. Anybody with a special purpose to serve can in the shape of an interview, have his views on any given mine printed by the column, while an honest critic venturing an unfavorable opinion, is fiercely denounced both by the press and the public."

A Far Cry for Money.

Will not some generous soul in Rossland please pass the hat, take up a subscription, in the name of charity, and turn the proceeds over to The Big Four Consolidated Gold Mining Company, Limited! You will find the company sitting desolate on the side of Red Mountain, for it has no fixed abode, pays no office rent, pays no salaries, but needs money for dynamite and bacon and boom literature. It has just made a pathetic appeal to its 100 stockholders to do something, to put the shoulder to the wheel, and by a valiant effort sell 500 shares at 6 cents a share! "This will enable us to complete and pay for 200 feet of tunnel work now under way, which work is absolutely necessary to place this splendid property on the London market without delay"—so reads a special printed bulletin of the company. Not long ago it cried out for \$1,500, which it affirmed would put the property on a self-supporting basis.

Now, we have infinite sympathy with struggling humanity, and would not injure any man's chances of success. This may be a most deserving enterprise, but its promoters are not men of good judgment, to say the least. A company that only needs \$1,500 as a maximum for putting a mine on a self-supporting basis has misused what funds it did possess, when, as witness its own confession in a circular dated January 1, 1901, it has done the following: "We have advertised in fifty newspapers, large and small, from the Atlantic to the Pacific, likewise sent out over 5,000 circulars, letter-heads, prospectures, etc., and we venture to say have done more work with less money than any company in British Columbia."

We might point out absurdities and conflicting statements in its voluminous "literature," and even show that it practically needs no money at all, since "the Great Northern Railway runs three times through the ground.....and we are now ready to start shipping ore," but we have already given the company enough free advertising. For the sake of the good name of Rossland and British Columbia let some of the kindly-disposed Rosslanders give these poor people a few cents with which to start shipping ore, and put an end to the circulation of this printed nonsense that can only become a reproach to the district.

Amendments to the British Columbia Placer Mining Law.

A very commendable effort is being made, largely under the leadership of Mr. John B. Hobson, Manager of the Consolidated Cariboo Hydraulic Mining Company, to secure an amendment to the Placer Mining Act of 1899, in the interest of the poor prospector primarily, and incidentally in the interest of the development of the hydraulic mining industry of the province. Under existing regulations the holder of an 80 acre leasehold on deep placer mining ground must pay an annual rental of \$50, a fee of \$5 for the issuing of papers, and in addition must do development work of the value of \$1,000 a year. Manifestly this law was not framed for the encouragement of prospectors, upon whom alone every mining region depends for its reconnaissance and initial development. Only large syndicates or corporations could perform development work under the onerous conditions imposed by this Act. The proposed remedy is to practically copy the law which went into force in California in 1872, which permits any person to locate 160 acres of land on the payment of a small fee and to hold the same by performing work thereon of a value of \$100 annually.

As pointed out by Mr. Hobson, the result of that law was to bring into California \$100,000,000 which in ten years was paying a profit of about \$15,000,000 per annum. As opposed to this in British Columbia only about \$6,500,000 has been invested in deep placer mining, although the district of the deep placer grounds is believed to exceed in importance that of central California.

Much fear is expressed in certain quarters that a liberal law in British Columbia would result in the acquisition of extensive mining territory by powerful corporations, which would hold it idle for a long period. Perhaps this might be the case if title were easy to acquire, and taxation light. The remedy for this, suggested by Mr. Carter-Cotton, is not to grant titles at all, but to lease the properties under satisfactory safeguards to ensure continuous development work. Even this has its disadvantages, especially for a company doing bona fide work on a large scale, unless the expenditure at the point of actual operation were to be considered as applying to the entire tract constituting the reserves of the corporation.

It is folly to take a petty view of deep placer mining conditions. Their successful operation demands costly preliminary works in the form of flumes, sluices, etc., an installation which necessitates a large area of gravel which can only be worked as a rule at one point, but which will progressively be washed until the deposit is exhausted. We cannot see any cause for alarm if a company should consolidate a large number of separate claims, nor any reason why it should be required to waste money in useless expenditures upon each and every 80 acre lot in the piece, since for practical mining purposes it must be viewed *en bloc* as constituting a single property of large enough dimensions to warrant the provision of suitable facilities of economic exploitation.

Certainly the law of 1899 was prohibitive of new enterprises. It operated against both prospector and mining company. In an excess of zeal to prevent monopoly it stifled enterprise. Monopoly it is well enough to avoid, but this can be prevented without denying to the public opportunity to profitably employ time and money in unfolding the resources of the country. This condition seems to be fairly met in the draft of the proposed amendment which limits a claim to 80 acres, requires the payment of an annual rental of \$25, work to the amount of \$100 per year, and the privilege of obtaining a concession until worked out on the payment of \$500 cash, and subsequently of \$25 a year rental.

The Egerton Syndicate, a Glasgow corporation, has acquired, and is now working, the well-known gold properties at 15 Mile Stream, N.S., formerly successfully worked for many years by the New Egerton Gold Mining Co.

Mining Progress in Ontario.

The output of the metalliferous mines and works of Ontario for the three months ending 31st March, 1901, as returned to the Bureau of Mines, was as follows:—

	Quantity.	Value.
Iron Ore tons.	36,503	\$ 44,106
Pig Iron "	28,694	438,659
Nickel lbs.	1,805,691	190,858
Copper "	1,680,391	75,625
Arsenic "	236,054	12,046
Gold ounces.	3,150	54,520
Silver "	20,077	12,046
Total		\$827,860

The total value of the above products for 1900 was \$2,541,131, consequently the output for the first three months of the present year shows a proportional increase of about 30 per cent. The largest increases are in iron ore and pig iron; nickel and copper remain at about the same level of production; arsenic shows a decided increase, while gold and silver have fallen off.

The quantity of iron ore smelted into pig iron at the three furnaces of Ontario, all of which are in steady operation, was 48,663 tons, of which 21,083 tons were from Ontario mines and 27,580 were imported ore. The proportion of native ore smelted during the quarter rose to 43 per cent. of the whole, as against 23 per cent. in 1900. In addition to the ore 3,486 tons of scale and mill cinder were smelted.

The total quantity of nickel and copper ore mined during the period was 72,036 tons, being a proportional increase as compared with the whole of 1900 of 31 per cent. The new nickel-copper and copper mining companies are beginning to raise considerable quantities of ore, but not much of it has yet been smelted.

The quantity of gold ore crushed was 10,174 tons.

On the whole the outlook is for a decided increase during the present year in the quantity and value of the product of Ontario's metalliferous mines and furnaces.

Mining Progress in Quebec.

The annual report of Mr. Obalski, Inspector of Mines, covering the year's mining operations in the Province of Quebec, has just been issued and contains, as usual, a large amount of serviceable information concerning the iron, asbestos, mica, chromite, pyrites, graphite and other important mining industries in the Province. Mr. Obalski reports an increase in the value of the total production over the previous year, estimating the value of all products produced in 1900 at \$2,546,000, but, at the same time, he is careful to point out that these figures would be much increased if the value of the manufactured products were given.

The industry employed 5,400 persons, the wage earnings for ten months being estimated at \$1,300,000. The following amendments to the Mining Act were passed at the last session of the Quebec Legislature:—

1. The Crown abandons its rights to mines, except as regards gold and silver, on lands patented previous to 24th July, 1880, but only in the townships and on those in connection with which all the conditions for obtaining letters patent had been fulfilled prior to that date.

2. The right of pre-emption granted to surface-owners is abolished for all mines belonging to the Crown in townships as well as in seigniories.

3. In the case of private lands, whether the mines belong to the Crown or to any person other than the surface-owner, expropriation is effected in the manner set forth in the Mining Act.

4. The provisions of the Act of 1892 remain the same with regard to the price of mining lots, licenses, etc.

Lead Bounty.

As a result of the interview of the Kootenay delegation, reported in these columns last month, the Dominion Government has granted a bounty on lead to be refined in Canada.

The resolution brought down by the Hon. the Minister of Finance reads:

Resolved, that it is expedient to provide as follows in order to encourage the refining of lead in Canada:—

1. That the Governor-in-Council may authorize the payment of the undermentioned bounties on lead refined in Canada from materials produced in Canadian smelters from Canadian lead ore; (a) on every ton of lead so refined during the calendar year 1902, \$5; (b) on every ton of lead so refined during 1903, \$4; (c) on every ton of lead so refined during 1904, \$3; (d) on every ton of lead so refined during 1905, \$2; (e) on every ton of lead so refined during 1906, \$1.

2. The said bounties shall be payable half-yearly on the first days of July and January in each year.

3. The total sum payable in such bounties shall not exceed \$100,000 in any year. If the sum payable at the rate per ton mentioned in resolution (1) on lead refined during the half of any calendar year shall exceed \$50,000, then and in such cases the bounty payable per ton shall be reduced as regards that half-year to such rate per ton as shall make the amount of bounties payable in respect of such half-year not more than \$50,000.

4. If the sum paid for such bounties in any half-year shall be less than \$50,000, the unpaid balance (being the difference between the sum so paid and \$50,000) shall be carried to the credit of the bounty fund for the next succeeding half-year, and may be paid out in such succeeding half-year, in addition to the \$50,000 herein before provided.

5. The Governor-in-Council may make such rules and regulations (including regulations as to rates and charges for refining) as may be deemed expedient in the public interest, for the carrying out of the purposes of this Act, and all payments of bounty shall be subject to the due observance of such rules and regulations.

6. All bounties payable under these resolutions shall cease and determine on the thirty-first day of December, 1906.

Dawson & Selwyn Memorial Portraits.

In recognition of the invaluable services rendered towards the development of the mineral wealth of Canada by the late Dr. George M. Dawson and his predecessor, Dr. A. R. C. Selwyn, late Directors of the Geological and Natural History Survey of Canada, the Canadian Mining Institute invites subscriptions from the Canadian mining public towards its fund for the purpose of presenting suitable portrait paintings of the late Directors to the Museum of the Survey with which their life work has been so prominently identified. Remittances marked "Dawson and Selwyn Memorial Portraits" should be sent to the Treasurer of the Canadian Mining Institute, Mr. J. Stevenson Brown, Temple Building, Montreal, or to the undersigned. All subscriptions will be acknowledged in these columns. The following amounts have been subscribed to date:—

B. T. A. BELL,
Secretary.

Canadian Mining Institute.....	\$100.00
Officers of the Geological Survey.....	54.00
Hon. Sydney Fisher, M.P., Ottawa.....	25.00
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NICKEL LEGISLATION.

A Review of the Grounds upon which the Dominion Government was asked to Disallow the Ontario Mines Act.

[In consequence of the urgent and emphatic representations of the mining men of Ontario for the disallowance of the "Act to amend the Mines Act," passed by the Ontario Legislature a year ago, the Dominion and Ontario Governments have conjointly agreed to submit the constitutionality of the Act to the Supreme Court of Canada.]

To show that the imposition of the license fees authorized by the said Act would be a breach of faith towards all those who have acquired mining lands in the Province of Ontario under Letters Patent issued prior to the 4th day of May, 1891, all that is necessary is to quote the declarations of the Province made by Her late Majesty, by and with the advice and consent of the Provincial Legislature.

By the Mines Act of 1892, 55 Vic., chap. 9, it was declared that:

"All royalties, taxes or duties, which by any patent or patents issued prior to the 4th day of May, 1891, have been reserved, imposed or made payable upon or in respect of any ores or minerals extracted from the lands granted by such patents, and lying within this Province, are hereby repealed and abandoned, and such lands, ores and minerals shall henceforth be free and exempt from every such royalty, tax or duty."

The said declaration was embodied in the Revised Statutes of Ontario, 1898, chap. 36, in the following words, referring to all lands granted by patents issued prior to the 4th day of May, 1891, that "such lands, ores and minerals shall be free and exempt from every such royalty, tax or duty." Similar declarations have, since Confederation, been repeatedly made. See, for instance, 32 Vic., chap. 34, sec. 3.

In the first reading of the present Act, the word "tax" was used, but, subsequently, the phrase "license fee" was substituted. But inasmuch as a license fee is a tax, and moreover just such a royalty tax or duty as was covered by the legislative declaration, that such lands, ores and minerals "shall be free and exempt from every such royalty, tax or duty," such a transparent disguise does not alter the fact that the Act now complained of is a gross breach of faith to all who hold lands affected patented prior to 4th May, 1891.

This was made the ground for the disallowance of the Act of British Columbia, 37 Vic., No. 1 (See Dominion and Provincial Legislation, 1867 to 1895, at pp. 1024 to 1028.) At page 1028 the ground for the disallowance is shown to be the honor and good faith of the Crown. The precedent so established should, it is respectfully submitted, be followed in the present case.

ACT IS CONFISCATION.

The license fees authorized to be imposed by the said Act complained of are as follows :

"(a) For ores of nickel, \$10 per ton, or \$60 per ton if partly treated or reduced ;

"(b) For ores of copper and nickel combined, \$7 per ton, or \$50 per ton if partly treated or reduced."

These amounts exceed the value of the ores or matte so taxed, so that what is authorized is plainly confiscation without compensation, and moreover the lands so to be confiscated were granted under the Great Seal of the Province of Ontario unconditionally in fee simple.

This follows from common knowledge of the value of such ores, but is conclusively shown by the official reports issued by the Province of Ontario. The report of the Bureau of Mines, published in 1899, for the year 1898, states that 120,924 tons of nickel and copper ore were smelted, producing 21,101 tons of matte valued at \$782,300.

The above tax of 21,101 tons of matte would amount to \$1,055,050, being in excess of the total value of the product by \$272,700.

Further, according to the same report, the amount paid out in wages alone was \$315,501, which means that the amount of duty and wages would exceed the value of the product for that year by \$488,201.

For the year included in the report of 1900 (at page 18), it is stated that the total quantity of the ore smelted in that year was 171,230 tons, yielding 19,215 tons of matte of a total value of \$702,440. The duty on 19,215 tons of matte at \$50 per ton would be \$960,750, the duty thus being greater than the total value or product in that year by \$258,310.

Further, the report shows that the wages paid in that year amounted to \$443,879, so that the duty and wages for that year would, if the Act were enforced amount to \$702,189 more than the total value of the product.

It is further to be pointed out that these licence fees are declared to be a charge upon the land, and that if same are not paid power is given to the Attorney-General of the Province to foreclose the estate and right off all persons claiming any interest in the property from which the ores to be taxed are mined or won. It is pointed out that this confiscation is not for the purpose of producing Provincial revenue or for the purpose of dealing with property and civil rights within the Province, but for the purpose of attempting to regulate trade and commerce, a matter committed to the exclusive jurisdiction of the Dominion Parliament.

The present Act is, therefore, an attempt to do indirectly what would be wholly beyond the power of the Province to do directly.

In view of the mischievous consequences which will flow from such trenching upon Federal authority, the present is pre-eminently a case in which the power of disallowance, which involves a corresponding duty, should be exercised.

To quote the language used in a report confirmed by the Governor-General-in-Council in reference to a previous unsuccessful attempt to encroach upon Federal jurisdiction, the Act now complained of is "objectionable in principle, and calculated to produce a feeling of insecurity abroad with reference to Provincial legislation."

VESTED INTERESTS THREATENED.

It follows from the above that the vested interests of all who had acquired lands patented prior to the 4th of May, 1891, are threatened by this legislation, and if the present Act is not disallowed the security of all Canadian investments under Provincial control, and particularly of all Canadian mining investments, will be sensibly diminished.

In Provincial and Dominion Legislation, 1867-1895, p. 1048, the section of the British Columbia statute there referred to is said to be

objectionable "because it may be an interference with the vested rights of individuals without providing any compensation therefor."

The same view was expressed in the report of 19th of May, 1893, adopted by order in Council of 2nd June, 1893, where it is said on the assumption thus expressed, that "the case would appear to be that of a statute which interferes with vested rights of property, and the obligation of contract without providing compensation, and would therefore, in the opinion of the undersigned, furnish sufficient reason for the exercise of the power of disallowance.

TRENCHES ON DOMINION JURISDICTION.

That the object and intention of the Act complained of is not to deal with any matter over which the Province have jurisdiction, but indirectly to attempt to regulate trade and commerce, has been clearly shown. This was the object stated in reference to the Act, both at the time of this introduction and of its being assented to, and the same conclusion results inevitably from a consideration of the circumstances under which the Act was introduced. In fact, it is obvious that under the guise of dealing with licence fees and property and civil rights, the purpose and object of the enactment is to deal with matters entrusted to the exclusive jurisdiction of the Dominion Parliament, and, as has been laid down in the Courts, however carefully such object or purpose is veiled, the foresight of those who framed our Constitution has led them to provide a remedy in the 90th section of the British North America Act by vesting the power of disallowance in the executive power of the Dominion, the Governor-General-in-Council.

The remarks made by the Hon. Edward Blake, as Minister of Justice, in his report of 11th of October, 1876, quoted in Dominion and Provincial Legislation, 1867 to 1895, at page 1043, are fully applicable to the present case. In that report, which was confirmed by the Governor-General-in-Council, it is said that "the unequal and discriminatory character of these taxes, and their injurious effect in the regulation of Trade and Commerce are very obvious." After calling attention to the express provisions of the British North America Act, by vesting exclusively in Canada the regulation of trade and commerce, the Minister of Justice said:—

"It is to be observed that that Act (the British North America Act) vests in that Parliament (the Parliament of Canada) the legislation on duties, customs and excise, and the funds produced thereby. It was also provided that all articles of the growth, produce or manufacture of any one Province shall, from and after the Union, be admitted free as to each of the other Provinces.

"The local Act now under consideration appears to the undersigned by reason of its peculiar provisions, both as to the claims of persons and the description of trade subject to taxation, to involve an attempt to regulate trade and commerce in excess of the powers of a local legislature, opposed to the spirit of the Union Act, in violation of sound principles of taxation, and of mischievous tendency."

That report was adopted by Order-in-Council and the Act there in question disallowed.

The reasons for disallowance are much stronger in the present case, and it is respectfully submitted that a similar course should now be pursued.

NOT A BONA FIDE EXERCISE OF PROVINCIAL JURISDICTION.

From the above it follows that the present Act is not a bona fide exercise of Provincial jurisdiction, and in the report of the Minister of Justice, dated 22nd December, 1875, confirmed by Order-in-Council of the 29th February, 1876, in discussing the principles upon which the power of disallowance should be exercised, it is said:—

"There may be a provincial jurisdiction for a particular purpose, exercised in fact though not in form, for the accomplishment of another purpose within Canadian jurisdiction.

See Dominion and Provincial Legislation, 1867-1895, p. 71.

A similar principle is pointed out by the present Chief Justice of Canada, at 2 S. C. R., at p. 109, in the following words:—

"However carefully the purpose or object of such an enactment might be veiled, the foresight of those who framed our Constitution has led them to provide a remedy in the 90th section of the Act by vesting the power of disallowance of Provincial Acts in the Executive Power of the Dominion, the Governor-General-in-Council."

LICENSE FEES IN REALITY AN EXPORT DUTY.

This appears clearly from the provisions of section 10 and the last part of section 13, sub-section 1, and attention is called to the last words of section 10, referring to the said license fees upon ores which are smelted or otherwise treated within the Dominion of Canada, etc., that they or such proportion thereof as may be fixed by the Lieutenant-Governor-in-Council "shall be remitted, or, if collected, shall be refunded under such regulations as the Lieutenant-Governor-in-Council may prescribe."

The confusion which would be created in the present case is shown by the fact that the Dominion Parliament have already covered the same field by Federal Legislation in the Dominion Act, 60-61 Vic., chap. 17, assented to 29th June, 1897. If, therefore, the present Act is not disallowed, there will be a delegation by the Dominion Parliament to the Governor-General in Council and a delegation to the Lieutenant-Governor of the Province of Ontario in Council, to deal with precisely the same subject. This is objectionable, and it is submitted that the appropriate remedy is disallowance.

LEGISLATION BY ORDER-IN-COUNCIL AN EVASION OF THE BRITISH NORTH AMERICA ACT.

The present Act virtually delegates the power of taxation and confiscation of mining lands and regulation of the smelting and refining industries, so far as nickel and nickel-copper ores are concerned, by order of the Lieutenant-Governor of Ontario in Council, and under the Constitution such Orders-in-Council are not subject to revision by the Dominion Government.

This is an evasion of the constitutional safeguard afforded by disallowance, and was made the ground for the disallowance of a British Columbia Act by the Dominion Government, as appears by the report of the Minister of Justice, dated 13th October, 1875. That report, at p. 1,038 of Dominion and Provincial Legislation, 1867-1895, says:—

"So long as local legislature keeps within its own hands the division of the districts and the alteration of their boundaries, this Government has, by virtue of the power of disallowance, some measure of control over such action, but should such Act go into operation, no such control could thereafter be exercised here."

That is, by the Dominion Government. The Act there in question was disallowed, the said report being adopted by Order-in-Council. The reasons for disallowance are much stronger in the present case, because the Act there in question dealt only with municipal boundaries, whereas the present Act deals with much more important matters.

It is to be added that such a delegation of legislative power, especially upon the subject of taxation, is completely repugnant to the spirit of our Canadian Constitution, and if in practice such a delegation is sanctioned the power of disallowance may be wholly evaded.

SAW LOG CASE NOT IN POINT.

It has been urged that the present case is similar to what is known as the Saw Log Case, but it is to be observed that there is no foundation in fact for this argument. There the Province was dealing with its own property. In the present case the Province had parted in the most absolute way, as above shown, with all proprietary control over the lands and ores now in question. This is made clear by the quotation from the judgment in the Saw Log Case of Mr. Justice Moss, one of the Judges of the Ontario Court of Appeal.

He says (Smylie versus The Queen, 27 Ontario Appeal Reports, 192): "I see no reason for thinking that the Legislature may not in respect of this property do what any subject proprietor might do when proposing to dispose of his property."

The basis therefore of that decision was that the property there being dealt with was the property of the Province, but it is an entirely different matter, the property has been granted unconditionally by the Province, and has in many cases passed into the hands of persons not resident in Ontario. This matter was discussed in the *Toronto Globe* of 11th April, 1900, where the well recognized principle was stated in the following words:—

"Had the minerals and mining lands been alienated unconditionally the Province could not now impose necessary obligations and taxes, for the mine owners would be in a position to claim immunity or compensation."

The mine owners who hold lands patented prior to the 4th May, 1891, do hold lands which had been patented unconditionally, and they are therefore in a position to claim immunity or compensation, and under the precedents the proper authority to grant such immunity is the Governor-General-in-Council, in whom is vested the power of disallowance.

DOMINION AND IMPERIAL INTERESTS PREJUDICED.

It is plain that if legislation such as the present is permitted, a precedent will be established for mischievous Provincial Legislation by Order-in-Council over which the Dominion Government will cease to have control but for which they will be responsible. The result will be that Dominion and Imperial interests may be greatly prejudiced.

The reasons for intrusting exclusive jurisdiction over such matters as the regulation of trade and commerce were well considered. If the present Act is not disallowed the efficiency of this necessary Federal control will be seriously impaired.

The present Act, if not disallowed within the time limited therefor, will enable the Ontario Government for the time being to frustrate, so far as nickel and copper ores are concerned, the policy of the Canadian Government, which has for its object the development of trade with Great Britain.

It authorizes discrimination against British industry and enterprise and tends to compel British consumers of nickel to look to foreign sources for supplies of nickel.

In fact, since the passing of the present Act, the nickel mining industries of New Caledonia, Norway and other foreign countries have been greatly developed at the expense of Canada.

PRECEDENTS JUSTIFY DISALLOWANCE.

The precedents above referred to and others too familiar to render citation necessary, fully justify the exercise of the power of disallowance in the present case.

The action taken by the Dominion Government with reference to the Quebec Mining Law, 54 Vic., chap. 15, is also relied on.

See Dominion and Provincial Legislation, 1867-1895, p. 440, section 1,426 of the Act there complained of, imposed on all mineral

properties a tax, therein styled a royalty, "of three per cent. of the merchantable value of the product of all mines and minerals."

As already shown, the reasons there alleged, namely, that the royalty was made applicable to lands which had been alienated unconditionally by the Province, exist in the present case.

And whereas, in the Quebec case only three per cent. was imposed, in the present case over one hundred per cent. is authorized.

NO PRESENT REMEDY IN COURTS.

This is not a case in which there is purely a legal question of *ultra* or *intra vires*, and, in any event, inasmuch as the Ontario Government and Legislature have formally declared that it is not in the public interest that the legislation in question should be enforced, it follows that there is no present remedy in the courts. On the other hand, the Act creates a cloud upon the nickel industry, and virtually a blanket charge or mortgage upon all nickel properties that may be worked, which should be removed.

The only available method of such removal is by the exercise of the power of disallowance.

The injury caused, not only to private individuals, but also to the trade and commerce of the Dominion, by the present Act has already been very great and will in the near future be much greater.

The presence of the Act upon the Statute Book will be a tremendous blow to the credit of Canada, and is very detrimental to the further investment of capital in Canadian enterprises.

The Act complained of is contrary to natural justice and equity, which the Governor-General-in-Council is entrusted with authority to disallow. To this authority, as pointed out by Chief Justice Draper, *re Goodhue 19 Gr., 384*, a corresponding duty attaches.

On these grounds, namely:—

1. That faith should be kept and the honour of the Crown maintained.
2. That the Act complained of amounts to virtual confiscation without compensation.
3. That vested interests are threatened.
4. That the Act complained of trenches upon Dominion jurisdiction.
5. That it is not a bona fide exercise of Provincial jurisdiction.
6. That the license fees authorized are in reality export duties.
7. That legislation by Order-in-Council, as proposed, is an evasion of the British North America Act.
8. That the Saw Log Case is not in point.
9. That Dominion and Imperial interests are prejudiced.
10. That the precedents justify disallowance; and,
11. That there is no present remedy in the Courts.

It is respectfully submitted that the Act complained of should be disallowed.

The Wetherill magnetic separator has recently been applied with success at Kalk-am Rhein, Germany in the separation of an ore containing galena, zinc, blende, and spathic iron, carrying as much as 12 per cent. of manganese, with a gangue of quartz. By ordinary mechanical concentration these could only be obtained an impure spathic iron, containing 15 to 22 per cent. of zinc and about 2½ per cent. of quartz. Using the Wetherill separator, the ore being crushed not to exceed 3 m. m. diameter, the blende concentrates showed 42 to 46 per cent. zinc, and the spathic iron, obtained as a separate product carried only 1 to 3 per cent. of zinc. The tension of the current was 65 volts, with 12 amperes. Each machine, with belts 14 inches wide, travelling 125 ft. per second, was capable of treating a little over 1 ton per hour, at a cost of 29 cents per ton.

COAL MINING AND TRADE.

The advent of Mr. Christopher Shields, the new general manager of the Dominion Coal Co., has stimulated both curiosity and activity in coal mining circles. It is fully realized that a much larger output than has yet been estimated is expected from the Cape Breton mines in the near future. When in Halifax recently Mr. Shields stated that the present capacity of the Dominion Coal Co.'s mines was 12,000 tons a day and that the intention is to reach 20,000 tons as soon as possible. It may not be out of place to utter just a word of warning on this subject, not at all in a pessimistic vein but solely in the best interests of the coal trade and dependent industries of Eastern Canada. Development is a good thing, and one of the mistakes of mine operators in the past has been the backwardness of development and consequent inability to cope with any increase in demand. In the light of the evidence given before the Board of Arbitration last month it is clear that the Dominion Coal Co. lost at least \$1,000,000 in 1900 from this cause. We propose to say something later on the subject of the arbitration but it must be a matter of regret both in the interests of employers and employed that the mines after eight years' operation by the present company and the expenditure of more than \$7,000,000, could not respond to the demand which for the first time in their history would have taken every ton that could have been supplied at a clear profit of at least \$2 a ton. In a lesser degree the same thing is true of all eastern mines with the result that profits all round are far below what might have been expected with such prices as \$3.50 and \$4 ruling. All this is an argument for steady continuous development work in the full belief that sooner or later the boom time will come, as it always has done, and with it for those who are ready the golden harvest. Hitherto the trade of the world has always been subject to recurring cycles of prosperity especially affecting the coal trade. True, Canada, a non-exporting producer, (except to the United States) has not shared in the fabulous prices which at such times have ruled in the Old World, but things are changing, and it is not likely that in future booms we shall be outside the influences that make for high prices and excessive demand. This much may be deduced from recent events. How is this to be met? Not by mad speculation, and ill-considered exploiting of coal areas on every hand. There is not yet an assured market for more than a very moderate increase, say 20 per cent., on the production of last year. Such an increase would satisfy every requirement of the Canadian and American market and for anything in advance of this, an entirely new market will have to be found.

The possibility of exporting Nova Scotia coal to Europe was first ventilated in this column and since then the salient features of the scheme have frequently been discussed. It looks as if the discussion is about to bring forth fruit for, on good authority, we learn that the Nova Scotia Steel Co.—who have just bonded their properties to a London syndicate—are to be the pioneers in the exporting of coal to England as they were the first to send iron ore across the Atlantic. We understand that this feature has had considerable weight in the negotiations which have been conducted and is intended to form an integral part of the project. Other Nova Scotia mines are depending upon the possibilities of the same market, and while we stand by our previous statement that Nova Scotia coal can be delivered on the Thames at all times at \$3.50 a ton, it would be well to secure definite contracts before any large capital outlay is expended on this hypothesis. There is no doubt the market is there but it has to be captured and the most direct way to ensure this is that adopted by the Nova Scotia Steel Co., the enlisting of British capital. There are many large coal factors in London, to say nothing of corporations like the Railway and Gas Companies to whom the certainty of a good coal at \$3.50, year in and year out, would be a great boon, and once the matter can be demonstrated a steady trade can be established, but

there are many problems to be solved first, including careful selection, good screening, and special transportation, and, in the meantime, reckless and indiscriminate expenditure on the supposition that all is over but the shouting, in order to capture the European market, is to be deprecated. Development had better take the direction of more extended underground recoveries rather than the erection of costly surface plants which may not be required for years to come, or the opening up of difficult and uncertain seams which may have to be abandoned, like the Emery, as hurriedly as they are taken up.

Everyone interested in the prosperity of Canada realizes that a great opportunity now presents itself in the coal and iron trades of the Maritime Provinces and that upon the judicious handling of these enterprises, at the present critical stage, our future prospects entirely depend. We have long called for English capital, and now that there are many evidences of its arrival it behoves us to act with moderation and fairness if we would have it stay and increase. For this reason we deprecate rash development, over-production, and above all, extortionate demands for coal areas. The old country motto "feel your way as you go" is essentially the motto for the Nova Scotia coal trade.

The decision of the Court of Arbitration in the wages dispute between the Dominion Coal Co. and their workmen comes as no surprise to those who were acquainted with the trade conditions of last year. Briefly stated it is as follows:—"True the coal trade of Nova Scotia has been booming and prices in the open market have ranged throughout the year from \$3 to \$4 a ton, but not more than 15 p.c. of the output was sold at advanced rates owing to the heavy demands of the contracts, consequently the company benefited very little by the advance, and the margin of profit was so small that the company could not afford to pay the 10 p.c. advance asked for and it is therefore not allowed." This is a decision which however uncertain on equitable grounds will commend itself to common sense and all parties concerned are to be congratulated on an amicable settlement of the dispute and the loyal acceptance of the decision by the miners. Incidentally, also, the Province may be congratulated on the possession of such an excellent and practical Board of Arbitration.

Most of the evidence upon which the verdict was based was of course given under a bond of secrecy but, with the consent of the coal company, a few most important and significant figures were given to the public. Chief among these is the average selling price for 1900 which, for reasons stated above, only reached \$2.35, and the fact that the profit was only ½ a cent more than in 1899 when the selling price was about \$1.75. The increase in price was practically absorbed by the advance in wages granted during the year and the heavy increase in dead work and charges. It may be a little hard on the Cape Breton miners that they have to sit down to a lower rate of wages than the miners on the mainland, but in the end this is better than crippling the industry by exacting more than the financial position justifies, and no one who is acquainted with the vastly improved condition of the Cape Breton miner during the last few years, will question the wisdom of a counsel of moderation at the present time.

A suitable location on the Point Aconi areas has been selected for the Nova Scotia Steel Co. by Mr. H. S. Poole, and during the present season sinking operations will be commenced. This is one of the most extensive and promising coal districts in Cape Breton and can be developed within a few years to any extent required.

The borings conducted on the McVey areas have not been quite as favorable up to date as was anticipated. Although the bore-hole near West Brook is down 600 feet no seam of importance has yet been reached. The strata passed through consists chiefly of sandstone and

shales. At 500 feet a 2-ft. seam of coal was met with. It is not unlikely that the drill will shortly be moved several miles to the east.

Rev. John Murray has been more fortunate and has struck a good seam of coal, 6-ft. thick, on the old Cow Bay road, and, if it is not interfered with by the anticlinal, it will cover a large area.

We were rather startled the other day, though not unpleasantly, to find a Nova Scotia worthy who has hitherto confined his wanderings to the East, breaking up new ground in the far West. No one is better fitted to take a bird's eye view of a new country especially where there are black diamonds to be tested. What with recent travels in the Old World and the United States, our friend should by this time be pretty well posted on trade and labour problems, and we hope he will give the Government at Ottawa the benefit of his impressions whilst in British Columbia. They would certainly be interesting and might be valuable, especially if he adopted the invariable outspokenness and frankness of "the chiel amang ye takin' notes."

Nova Scotia Steel Co.

Just as we go to press we learn that the large and valuable properties in Nova Scotia and Newfoundland so successfully exploited for many years by the Nova Scotia Steel Company have passed into the hands of a British Syndicate. Particulars of the deal have not yet been made public. The profits of the Nova Scotia Steel Company for the year ended 31st December last were \$655,272.86. To which may be added the balance to credit of profit and loss account carried forward, amounting to \$47,883.38, or a total of \$703,156.24.

This was distributed as follows:—

Dividend Paid on Preference Stock 10th September, 1900, 4%.....	\$ 41,200 00
Interest on Mortgage Bonds.....	45,726 00
Reserve for Bad Debts.....	10,000 00
Depreciation.....	20,000 00
Plant Renewals.....	200,000 00
4% Dividend on Preference Stock, payable March 9th, 1901.....	41,200 00
10% Dividend on Ordinary Stock, payable March 9th, 1901.....	103,000 00
Balance carried forward at Credit of Profit and Loss Account.....	242,030 24
	<u>\$703,156 24</u>

The following method for the assay of the gold precipitates from the zinc boxes in the cyanide process has been described by Charles H. Fulton and Charles H. Crawford, of the South Dakota School of Mines, and recommended as giving more reliable results than either the scorification or crucible method. One tenth assay ton of the precipitate is treated with 20 c.c. concentrated sulphuric acid diluted with 60 c.c. distilled water. Boil one hour, cool, and dilute to 100 c.c. Add 75 c.c. normal salt solution, and 20 c.c. of lead acetate solution. Allow to settle one hour, filter, wash and dry the precipitate. Burn the paper off at a low heat, and scorify until half covered over in the scorifier. Pour; and cupel the button. Thirty to forty grammes of lead are used.

The well-known difficulties in soldering aluminum have apparently been overcome by W. C. Heraeus of Hanan, Germany, who has applied the method known as autogenous soldering, using no solder or flux of any kind. The surfaces to be joined are cleaned, laid together, heated carefully to the temperature at which the metal commences to soften, meanwhile hammering together to make a perfect weld. The success of the method depends upon maintaining a perfectly uniform heat. If too high the metal becomes granular, commencing to oxidize, which defeats the effort to weld the surfaces.



SECRETARY'S REPORT

- (a) Upon the Work of the Institute.
 (b) Reviewing Mining Progress in Canada during 1900.

MR. PRESIDENT AND GENTLEMEN:—

It is gratifying to be able to report the continued growth and prosperity of the Institute during the year.

MEMBERSHIP.

Notwithstanding a number of resignations, owing to members leaving the country and from other causes, our membership has increased to 323 (including fourteen student members) as compared with 277 in 1899 and 192 in 1898, when the Institute was reorganized under its present Constitution. That the membership embraces the best elements in the profession and industry of mining in Canada may be seen by a reference to the recently published list of members; its wide distribution and thoroughly representative character is shown in the following comparative table:—

Province or Country	At 31st Dec., 1898	At 31st Dec., 1899	At 31st Dec., 1900
Nova Scotia.....	16	16	19
New Brunswick.....	2	1	2
Quebec.....	66	77	77
Ontario.....	44	68	91
British Columbia.....	42	65	71
Newfoundland.....		1	2
North West Territories..	5	5	5
Great Britain.....	4	9	7
United States.....	11	17	26
China.....	..	1	..
Honolulu.....	..	1	1
Spain.....	..	1	2
S. Africa (seeing with colors).	..	..	4
Alaska.....	..	..	1
Mexico.....	..	..	1
Students.....	2	15	14
Dead.....	2	4	6
Totals.....	192	277	323

It is also pleasing to observe that, while we lose a number of members by resignations going into force at this date, our strength will be considerably increased by the acquisition of the new members whose election to-day you will be asked to confirm.

MEMBERS REMOVED BY DEATH.

We have again to deplore the loss of six members by death during the year:—

Mr. James King, of Quebec, was removed under particularly distressing circumstances, having been drowned early in the summer by a boating accident. By his death the Institute has lost one of its oldest and most valued members, a gentleman who took a lively interest in its affairs, and who had done much to advance the welfare of the mineral industry, particularly in his own native province, where he was prominently identified with the production of asbestos.

Dr. Carl Hoepfner, Hamilton, having only been a short time in the country, was not so well known, but he had achieved some reputation as a metallurgist and as the patentee of a number of processes for refining and treating nickel, zinc and other metals.

Mr. Ernest Bielenberg, of Greenwood, and Mr. Barclay Stephens, of Montreal, will be remembered as the promoters of a number of mining enterprises in British Columbia.

Mr. James Foley, Montreal, was the promoter and chairman of the Petroleum Oil Trust Limited, and other undertakings having for their object the Exploitation of the Gaspé Oil Fields.

And, gentlemen, I regret to say, no later than last week we have sustained a severe—I may say truly, a national loss, in the sudden and untimely demise of the honoured head of our Geological Survey, the late Dr. George Dawson, C.M.G., one of our Vice-Presidents, and a charter member of the Institute. As Dr. Ami will present a memoir of the late Dr. Dawson at a later session it will be unnecessary for me to refer here to the eminent services rendered by the deceased gentleman towards the development of the mineral and natural resources of the Dominion.

MEMBERS IN SOUTH AFRICA.

Four members, Major Hamilton Merritt, Lieut. J. Edwards Leckie, Mr. Thomas Brown and Mr. L. H. Webber were absent from Canada serving the Empire with the colours in South Africa.

MEETINGS AND PUBLICATIONS.

Our annual meetings were held as usual in Montreal during the first week in March and were exceedingly well attended, not only by local members, but by many mining men from distant sections of the Dominion.

The papers, discussions and business transacted have been fully published in the third volume of our Journal of Proceedings.

Five meetings of Council, and numerous meetings of Special Committees, have been held, and the attendance at all of these has been distinctly satisfactory.

SUMMER EXCURSION.

In August, the Institute had as its guests the American Institute of Mining Engineers and in conjunction, and with the hearty co-operation of the officers and members of the Mining Society of Nova Scotia, we were enabled to carry out a most elaborate, interesting and highly enjoyable series of excursions through the most important mining and industrial sections of Eastern Canada and Newfoundland.

As the particulars of these excursions, meetings and entertainments will be fully described in the next volume of the Journal of the Institute, it will only be necessary to say that the chief points visited were Sherbrooke, Theford Mines, Quebec, Sydney, Louisburg, the Bras D'Or Lakes, New Glasgow, Westville, Stellarton, Halifax, Waverley, Old Sydney Mines, St. John's, and the Bell Island red hematite mines in Newfoundland, and that at every point touched by the excursion the members and their guests were welcomed and entertained upon the most lavish scale.

The heavy costs of transportation involved in an excursion covering so vast a territory were met by a Grant of \$2,000 from the Dominion Government, \$500 contributed by the Mining Society of Nova Scotia (being half of an amount given to that organization by the Government of Nova Scotia) and \$250 from the Quebec Government. We were also indebted to the Intercolonial Railway, the Dominion Coal Co., and Mr. R. G. Reid of the Newfoundland Railway for special concessions.

Owing, however, to the impossibility of securing rolling stock in Canada, at that busy season of the year, we were compelled to bring the sleepers, dining car, and equipment comprising the Institute's special train from distant points in the United States, involving an expenditure for mileage which was not provided for in our estimates, and creating a small deficit which the Treasurer has been compelled to charge against the ordinary income of the Institute during the year.

The publication of a handsomely illustrated Souvenir Volume describing the mineral industries of the territory covered by the

excursion was greatly appreciated by our guests, and although a large number of copies were printed in excess of the requirements of the party, the demand for copies of it has been so great that we could easily have disposed of twice the quantity.

LEGISLATION.

On 9th April, the Hon. Mr. Davis, Commissioner of Crown Lands, introduced in the Legislature of Ontario "An Act to Amend the Mines Act." Section 7 of this bill provided:—

"Every person carrying on the business of mining for any of the said ores in this Province shall pay a tax upon the gross quantity of the ores or minerals mined, raised or won during the preceding year from any mine worked by him to be paid to the Treasurer of the Province for the use of the Province at the following rates, or such less rates as may be substituted by proclamation of the Lieutenant Governor, namely:—

- (a) For ores of iron, fifty cents per ton;
- (b) For ores of zinc, \$5 per ton, or \$15 per ton of metal contents if partly treated or reduced;
- (c) For ores of copper, \$2 per ton, or \$25 per ton of metal contents if partly treated or reduced;
- (d) For ores of nickel, \$10 per ton, or \$60 per ton, of metal contents if partly treated or reduced;
- (e) For ores of copper and nickel, \$7 per ton, or \$20 and \$50 respectively per ton of metal contents of copper and nickel if partly treated or reduced;
- (f) For all other ores or minerals, such rate as may be from time to time imposed by Order-in-Council, but so as not to exceed five per cent. of the selling prices thereof in a free market."

The unwisdom of this proposed legislation will be readily appreciated by members of the Institute conversant with the conditions affecting mining undertakings; it imposed taxes absolutely ruinous and prohibitive; the very menace of them, if embodied in a statute, would be sufficient to destroy confidence and prevent investment.

Its unconstitutionality will be understood when it is stated that Section III of the 'Mines Act' of the Province had very distinctly repealed and exempted mineral lands patented prior to 4th May, 1891, from "all royalties, taxes or duties." In other words it was identical to the historic Mercier Mining Act which sought to confiscate mineral property in Quebec which had been alienated from the Crown unconditionally. Other provisions of the Bill were equally obnoxious.

The unexpected character of this proposed legislation, (it had passed its first reading in the Legislature before we became acquainted with its provisions), rendered immediate action imperative. There was no time to call the Council together, but in response to the urgent appeal of many of our members, whose interests were vitally affected by the Bill, I went to Toronto and co-operated with a large body of Ontario mining men, in the effort to have the Bill withdrawn or modified. After many meetings and interviews, much lobbying, and a considerable expenditure of time, we were so far successful in having the Bill pass the Legislature greatly modified in its original provisions.

The special tax of 50 cents per ton on iron, \$5.00 per ton (or \$15.00 per ton of metal contents if partly treated or reduced) on zinc ores; \$2.00 per ton (or \$25.00 per ton of metal contents if partly treated or reduced) on copper ores; and the general tax on "all ores or minerals" at a rate to be fixed from time to time by Order-in-Council, not exceeding 5 per cent of the selling price were struck out: but the Legislature still reserves the right to impose a "license fee" of \$10.00 per ton or (or \$60.00 per ton if partly treated or reduced) of nickel; and \$7.00 per ton (or \$50.00 per ton if partly treated or reduced) on ores of copper and nickel.

The Act as adopted by the Legislature is still open to most grave objection on constitutional grounds and, if ever enforced, its legality will be tested in the Courts.

At a meeting of the Council held in Montreal on 9th July, my action in this matter was unanimously endorsed and the expenditure involved in connection with the work was approved.

LIBRARY AND READING ROOM.

The collection of works on mining and metallurgical practice, books of reference, exchanges from kindred societies, magazines and papers, maps, plans and photographs in the Library and Reading Room has been considerably extended during the year and an additional book-case provided for their accommodation.

It has been suggested that in view of the comparatively limited accommodation provided for this collection in the Windsor Hotel, an endeavor should be made to secure larger premises elsewhere and there has been some correspondence with the Canadian Society of Civil Engineers with the object of ascertaining upon what terms the Institute might be given the use of a portion of their new building on Dorchester Street.

OTHER BUSINESS.

During the year the Secretary has replied to many enquiries asking for information concerning the mining industries of different sections of the Dominion.

MINING PROGRESS IN 1900.

Supplementing these notes on the work of the Institute it may not be inappropriate to refer to some of the salient features of mining enterprise and to the progress and prosperity of the mining industries of the Dominion during the past year. At this early date it is, of course, quite impossible to do more than make an approximate estimate, but from returns courteously furnished me by the managers and secretaries of our mining companies, by the officers of our Provincial Mining Bureaus and other official sources, it is quite certain that we can congratulate ourselves upon the most successful year in the history of mining in Canada. A conservative estimate indicates that the value of our mineral output during the year 1900, when returns are finally completed, will be not less than \$67,000,000 as compared with \$47,275,512 in the year 1899.

Roughly speaking we may distribute the production as follows.

Yukon, N. W. Territories and Manitoba . . .	\$28,000,000
British Columbia	16,000,000
Ontario	9,288,424
Quebec	3,000,000
Nova Scotia and New Brunswick	11,000,000

Or in round figures \$67,288,424

[NOTE.—Since this report was presented, the Mines Section of the Geological Survey has issued a preliminary statement, subject to revision, estimating the mineral production of the year at \$63,775,090, but, as quite a number of items, such as coal, iron and steel, nickel, asbestos, and mica, are manifestly under-estimated, I see no reason to alter my estimate.]

BRITISH COLUMBIA.

The statistics for the year are not quite complete but are sufficiently advanced to enable a very fair idea to be formed of the progress made last year which may be briefly summarized as follows:—

Tonnage ore mined	90%	increase.
Gold Production	20%	"
Silver: "	35%	"
Copper	20%	"
Lead	20%	"
Output of Lode mines, values	50 to 60%	"

The statistics of coal have not yet been handed in and can only be estimated. The Vancouver Island Collieries are expected to have at least held their own, while the output from the Crow's Nest Pass has

risen from about 69,000 tons in 1899 to over 230,000 tons in 1900 and this increase of 161,000 tons will about represent the increase in the total production.

For the following notes, I am indebted to the courtesy of Mr. W. F. Robertson, M.E., the Provincial Mineralogist:—

PLACER MINING.—Placer Mining proper has this year decreased very considerably. Atlin, our chief producer of last year, has been skimmed of the cream as far as the placers are concerned and is at present in the transition stage of shifting over to Hydraulics. Several hydraulic plants have been installed this past year but as yet, as might be expected, have not made any considerable output.

The ground in Atlin is, on the average, too deep for placer mining but is in many ways ideal for hydraulics and, with the values known to exist, should prove very profitable. The question of water will, however, be serious as there is not a sufficient supply to go round and consequently only a portion of the many leases can be worked at one time. The placer returns from the north central part of the Province are this year smaller than usual, owing to high water in the spring and the great demand for labour caused by the building of the telegraph line to Dawson.

HYDRAULICS.—The Cariboo District is showing that the diminished output of placer gold in recent years has not been due to the absence of that metal, simply to the fact that it lies too deep for placer work. It is now beginning to be recovered by the big hydraulic companies operating there, notably the Consolidated Cariboo Hydraulic Mining Co. which is further advanced in its work than any of the other companies. The output of gold from this district in 1900 will reach a point not touched for 14 years, certainly an encouraging sign. On the Coast a number of hydraulic leases have been taken out of beach deposits of black sand and the operations so far have yielded well, more than covering the costs of installation of plants and promising well for the future.

DREDGING—The dredging problem has not yet been solved in British Columbia. The river bottoms have been proved to carry gold in quantity much greater than has been successfully worked in New Zealand and elsewhere, but the "conditions," viz: boulders and swift water, combined with the fineness of the gold, have yet to be successfully overcome: here is a tempting field for invention.

LODE MINING.—We have had our troubles of one sort and another, but 1900 will show a total production from the lode mines this year that will represent an increase of between 50 and 60 per cent. over 1899, while the tonnage of ore mined has increased over 90 per cent. showing that the lower grade propositions are beginning to be more generally worked, thanks to the gradually increasing transportation facilities.

LEAD.—The feature of the year is the increased lead production, which is over 200 per cent. higher than that of '99, and the fact that East Kootenay has this year carried off from the Slocan the banner as the chief lead mining district, producing nearly 60 per cent. of the total output of that metal.

SILVER.—An increase in the production of silver has naturally followed that of lead, as the two are so closely associated in British Columbia. This increase will be nearly 70 per cent. over '99, not as great as lead shows, for the reason that the silver contents of the East Kootenay galenas is not as high as those of the Slocan, which district has heretofore been our chief producer.

COPPER.—Copper will show an increase of nearly 20 per cent. over last year, due to the Boundary District becoming a producer. The production of this District would have further increased our percentage of gain had it not been offset by a falling off of the production of the Nelson District and the materially lower copper assay value of the Rossland Ores.

LODE GOLD.—The production of lode gold will show an increase

of some 20 per cent. over 1899, due largely to the output of the Nelson District, which has been doubled this year, an increase in the tonnage in the Rossland Camp and the production of the Boundary District.

YUKON TERRITORY.

The output of gold from the Yukon during the year was not less than \$25,000,000, as follows:—

Received Dust and Bullion, Government Assay Office Seattle.....	\$16,946,437 08
Purchased by U. S. Mint and Selby Smelting Co., San Francisco during eleven months 1st Jan to Nov. 30th.	5,395,000 00
Add dust not reported and dust used in the territory, as a medium of exchange: say.....	3,000,000 00

The figures for previous years are: 1897 \$2,500,000.00; 1898 \$10,000,000.00 and in 1899 \$17,500,000.00. The total sum collected by the Dominion Government up to 1st July, 1900 for Royalty on the gross output of placer claims, after deducting the exemption allowed by the regulations was \$1,596,277.38. Of this amount the sum of \$733,041.04 was collected during the fiscal year ended 30th June last, as follows:—

Dawson	\$204,369 79
Grand Forks.....	24,462 49
Gold Run.....	49,036 95
Hunker Creek.....	40,113 90
Dominion Creek	94,749 06
Sulphur Creek.....	20,308 85
Total.....	\$733,041 04

So far gold in payable quantities has been found in the bottoms of the valleys, or on terraces along the sides of these valleys. No rich quartz veins have been found, but it is in the highest degree probable that, where gold is found scattered in such abundance through the alluvial deposits, the veins or stringers from which it has been derived will be discovered, and that some of these veins or stringers, or aggregations of them, will be sufficiently rich to pay a profit over working expenses for extracting the gold.

COAL.—While the existence of the deposits of lignite in the Yukon Territory is well known, many of our members may not be aware that an effort has begun to exploit them commercially. As a matter of fact last season several thousand tons were mined and transported to Dawson, and 531 tons were exported, in September, to United States Territory.

One of the mines is operated by the Alaska Exploration Company on Rock Creek about seven miles from the point where it joins the Klondike river, and about twenty miles from Dawson. The seam averages from four to eight feet, being about six feet thick at a depth of 175 feet and is opened by a series of tunnels penetrating the seam for 400 feet in a direct line. Although but twenty-five miles from the centre of the mining district of Bonanza and Eldorado, and within ten miles of Hunker Creek, the cost of transportation to these points and to Dawson has varied all the way from fifteen to twenty-five dollars per ton. With the opening up of the country these costs of course will be very greatly reduced.

The other working mine is operated by the North American Trading and Transportation Company, on Cliff Creek, which enters the Yukon sixty miles below Dawson, and ten miles below Forty Mile Creek. It is situated a mile and a half up the Creek and is connected with the Yukon by a tram line over which the coal is delivered into the bunkers on the company's wharf and then loaded into river steamers for delivery at points on the Yukon river. The seam is reported to be eight feet thick and is opened by four tunnels, the shortest of which is 200 feet and the longest 450 feet. Last season the mine produced 3,000 tons, the whole of which found a ready market.

DREDGING IN THE YUKON AND NORTH WEST TERRITORIES.

During the fiscal year ended 30th June last, leases have been granted by the Dominion Government to dredge for minerals in the Yukon Territory covering 1,313 miles and for the same purpose in the North West Territories covering 961.75 miles. Gold dredging on the North Saskatchewan River is still in an experimental stage.

During the past season the large dredge of the Saskatchewan Gold and Platinum Proprietary Limited has only been in partial operation—owing to the necessity of making certain necessary changes in the machinery. When, after many delays, due to the late arrival of the machinery from England, the dredge was put into commission, it is understood, though not yet officially announced, that the result was highly satisfactory showing a saving of from 25 cents to 30 cents per cubic yard.

The Saskatchewan Gold and Platinum Proprietary and the Alberta Gold Dredging Co. Ltd., have each a dredge approaching completion so that there will be three ladder bucket dredges at work on the river during the coming season. The dredges of the Loveland Co., the Evans Co., and one or two other concerns worked profitably during the year, but have only a limited capacity and are merely "dipper" dredges. As these are private enterprises they do not issue statements of results. The Star Gold Dredging Co., Ltd., contemplates building a large dredge of the New Zealand type.

To those of our members who are engaged in this industry, the following figures showing the profits realized last year from gold dredging operations in New Zealand will be of interest:—

"During the month of October ten dredges in Otago paid in dividends the sum of £8,135 while the dividends declared and paid by twenty-seven working Otago dredges for nine months, from January 1st to September 30th, 1900, are £76,118 on a capital of £195,652 which gives a return equal to 39 per cent. for nine months only. From January 1st to November 20th, 1900 there has been gained 56,533 oz. S dwt. 3 gr., which, at 77 s. per oz., is equal (roughly) to £217,625. For forty-six weeks the average number of working dredges has been thirty-four. The working expenses of each one, at £50 per week, are equal to £1,700. The weekly profit so far has equalled £3,031 (approx.). There were, at the end of October, thirteen dredges with a capital of £97,500, working, which so far this year (1900) have not paid any dividends. The amount invested in working dredges equals: Paying dividends £195,652, not paying dividends £97,500; total, £293,152. Taking declared dividends £76,118 to capital of all working dredges, £293,152 the return for nine months only is equal to 26 per cent."

ALBERTA.

The output of coal in the territories during the year was: Bituminous coal 304,000 tons; Anthracite coal 17,500. There was a slight falling off in production at Lethbridge the output of the Alberta Railway and Coal Company being 181,501 tons as compared with 192,889 tons in 1899. The H. W. McNeill Company also report a decline in the output of their collieries the production for the year being. Canmore Colliery 80,000 tons; Anthracite Colliery 18,000 tons.

It is not unlikely that before another year has passed the railway from Lethbridge to Great Falls will be made to standard gauge, in which case it is probable a large export trade of this Anthracite coal will be built up with Montana, Northern Idaho and Eastern Washington. The formation of a number of new companies indicates a probability of a very considerable development in the near future of the coal fields of Alberta along or near the line of the Crow's Nest Pass Railway.

ASSINIBOIA.

The production of Lignite at Roche Percee and Coal Fields will show an increase over previous years. As the workings extend the quality of the coal is found to improve and its sale is rapidly extending among the settlers of this Province and in South Western Manitoba.

MANITOBA.

A large number of mining claims have been recorded during the year in the district lying adjacent to the western boundary of the Province of Ontario, and several gold mining properties are being opened up. The gypsum deposits situated in the district lying north of Lake St. Martin in Townships 32 and 33, Ranges 8 and 9 West, are being rapidly staked out. The Manitoba Union Mining Company, composed of Canadian and American capitalists, have staked out a large area of land valuable for this commodity and purpose developing the claims at an early date. It is their present intention to place a reduction mill at Portage Bay on Lake Manitoba and to construct a tramway from that place to the mines.

COAL MARKETS IN MANITOBA AND NORTH WEST TERRITORIES.

The Crown timber agent at Winnipeg has furnished the following statement of the consumption of coal at points in Manitoba and as far west as Regina, which can be taken as approximately correct:—

American Anthracite.....	32,700 tons.
Canadian "	11,000 "
American soft.....	3,500 "
Canadian Galt.....	9,500 "
Souris Lignite.....	34,000 "

The following prices were obtained during the years 1899 and 1900, as shown hereunder:—

	1899 Per ton.	1900 Per ton.
American Anthracite, f. o. b. at Winnipeg...	\$7 75	\$9 50
Canadian " " " "	6 75	9 00
American soft, f. o. b. at Winnipeg.....	6 00	7 00
Canadian Galt, " " " "	.....	7 50
" Souris, " " Souris	3 75	3 75
Souris Lignite, " " Brandon.....	3 20	3 20
" " " Regina.....	3 20	3 30
" " " Melita.....	2 75	2 60
" " " Moosejaw.....	3 00	3 10

ONTARIO.

Gratifying progress marked the year's operations in Ontario the total value of the mineral production being estimated at \$9,288,424 as compared with \$8,789,901 in 1899.

COPPER AND NICKEL.—The feature of the year was unquestionably the notable expansion of the copper and nickel mining and smelting industries which have now assumed a leading position among the metalliferous mining enterprises of the Dominion.

Fifteen years ago when the members of the Canadian Copper Company pluckily invested their capital and commenced their pioneer work of development in the region, Sudbury was a barren and inhospitable region. To-day, owing to mining, and entirely dependent on it, it has grown to be a prosperous community, having a population in excess of 6,000 people, well housed, having excellent churches and schools, a good electric lighting system, a well managed hospital and a water works and drainage system equal to the demands of the people. 1,500 persons, miners, mechanics, furnace men, labourers, teamsters, etc. find employment at the mines. One company has spent in the district no less a sum than \$2,774,000 in wages and over \$4,000,000 in machinery, tools and supplies purchased in Canada and freights over Canadian railways. Add to these the very large sums expended during the year past by the Mond Nickel Company, the Canada Mining & Metallurgical Company, and other operators in this region and one realizes the vast importance of this great industry not only to the Province of Ontario but to the whole Dominion.

It has been stated by those interested parties who, to benefit themselves and their schemes, have been clamouring for the imposition of export duties, and other foolish taxation on these ores, that at present Canada is receiving less than 28% of the market value of the metal contents of this production. What are the facts? During the year 1900 there were produced from the mines at Sudbury 21,518 tons of copper nickel matte, in the production of which \$1,050,000 were expended on Canadian labour and supplies, or an amount equivalent to 72 per cent. of the selling price of these metals. It may be further stated that large concentrating works are now nearing completion at Copper Cliff, whereby the percentage of values of the metals remaining in Canada will be further increased to 85 per cent. or 90 per cent. of their market value. These works are expected to be in operation by the 1st of May this year.

Among the year's additions to the list of active producers in this industry may be mentioned the extensive new works of the Mond Nickel Company at Whitefish, the operations of the Canada Mining and Metallurgical Company at Massey, the Bruce Copper Mines of Ontario, Ltd., re-opening and erecting an important concentrating plant at Bruce Mines, on the north shore of Lake Huron, and the Rock Lake Mining Company, in the same vicinity. Nor must we overlook the opening up of the Gertrude Nickel property in the township of Creighton by Mr. F. H. Clergue and his associates, for it is from this mine that they propose to draw the supplies of nickel for the manufacture of ferro-nickel and nickel steel at their large establishment now under construction at Sault Ste. Marie. The Frasch process for refining nickel and other metals, about which certain Hamilton promoters were so enthusiastic a year ago does not appear to have materialized, beyond the stage of laboratory experiment.

IRON.—The magnetite mines of Eastern Ontario have been pumped out and overhauled, and a number of them have been producing and shipping ore, some of which went to the blast furnaces at Hamilton and the remainder to smelters south of the line. The production of Iron Ore in Ontario was 16,911 tons, a very large increase over the previous year, mainly due to the opening up of the Helen hematite mine in Michipicoton by The Lake Superior Power Company.

The body of ore in the Helen mine is a very large one, doubtless containing many millions of tons, and the quality is good, though non-bessemer, running pretty uniformly about 55 or 57 per cent. of metallic iron. The bulk of the output for 1900 was carried by steamer to the new blast furnace built by the Canada Iron Furnace Company at Midland, and blown in December last. A sample cargo was sent to Ashtabula, and Mr. Clergue is credited with the intention of entering into competition with the mines of the Messabi and Vermillion ranges in supplying the furnaces of Cleveland and Pittsburg, in spite of the duty of 40 cents per ton. The Helen mine was discovered in 1897 and but little work done on it until after it passed into Mr. Clergue's hands in 1898. Since that time a railway twelve miles long has been built, ore docks constructed, steamers brought from England to carry the ore, and next season will probably see half a million tons taken from the mine. The Midland Furnace makes the third in operation in the Province, the other two being at Hamilton and Deseronto. At both Hamilton and Deseronto, the ores used have been chiefly from the American side of Lake Superior but since an abundant supply of equally good ore has been uncovered at Michipicoton, it is quite probable the wants of the furnaces will be supplied from our own Province. New Blast Furnaces are being projected at Collingwood and Kingston.

I am indebted to the Director of the Bureau of Mines for the following statistics:—

	1900	1899	1898
Ore Smelted..... tons	100,692	110,036	77,023
Scale and mill cinder. "	13,092	10,004	8,614
Limestone for flux.... "	.....	25,301	13,799
Coke for fuel..... "	59,345	74,403	50,407
Pig Iron Product..... "	62,386	64,749	48,253
Value of Product. \$	936,066	808,157	530,789
Wages for Labor..... "	97,915	79,869	61,476
Average workmen.... No.	419	200	130

GOLD MINING.—The past year has witnessed a complete collapse in the production of gold in the north western section of the Province and most of the mines in the Lake of the Woods and Rainy River districts from which, a year or two ago, so much was expected, are shut down. It can be safely said that this failure is due neither to lack of good properties nor to lack of capital to exploit them. Over capitalization, ten cent stock manipulations, the greediness of promoters, unskilful labour, and, perhaps more than any other, grossly incompetent management are prominent factors which have brought about this unfortunate and deplorable depression.

In contrast to the falling off in production in the North-Western sections of the Province it is gratifying to note the activity in the development of gold mining enterprise in Eastern Ontario.

The Deloro mines, in Marmorata township, Hastings County, operated by the Canadian Gold Fields Limited, have made sound progress both in the establishment of a successful plant for gold extraction and in under-ground development. It is worthy of remark that about 40 tons per month of White Arsenic, quite equal to the best English and German grades, is being produced by this company as a by-product. 125 persons are employed. Extensive mining and milling operations are also being conducted by the Cordova Exploration Company, Limited, another English Company, at the Belmont mine, in Peterborough County. This company employs 130 men. The Atlas Arsenic Company, the Sophia, and other properties, are also being worked in this section.

GRAPHITE.—This mineral is being mined profitably, and on a fairly large scale, in the township of Brougham, Renfrew County, by the Ontario Graphite Company, the output realizing a good price from consumers in the United States.

OTHER MINERALS.—The output of zinc, mica, petroleum, natural gas, silver, pyrites and structural materials also contributed to what has been on the whole, a year of substantial progress in mineral production in Ontario.

STATISTICS.—Mr. T. W. Gibson, Director of Mines for Ontario has courteously furnished the following official statement of the mineral production of the Province during the year:—

The total value of the mineral output of Ontario for 1900 was \$9,288,424; the number of workmen employed in the industry 11,109 and the amount of wages paid \$3,364,400. Following are some of the principal items:—

	Quantity.	Value.
Building stone.....	.....	\$ 650,342
Cement.....barrels.	432,154	698,015
Line.....bushels.	3,893,000	544,000
Drain Tile.....No.	19,544,000	209,738
Brick & Terra Cotta...No.	254,701,600	1,520,959
Petroleum.....Gallons.	23,381,783	1,869,045*
Natural Gas.....	.....	392,823
Salt..... tons.	66,588	324,477
Mica..... "	69	81,550
Iron Ore..... "	90,302	111,805
Pig Iron..... "	62,386	936,066
Steel (open hearth)... "	2,819	46,380
Nickel..... "	3,540	756,626
Copper..... "	3,364	319,681
Gold.....ounces.	18,767	297,861
Silver..... "	160,612	96,367

* Value of Products, viz., illuminating oil, lubricating oil, etc., not value of Crude.

PROVINCE OF QUEBEC.

ASBESTOS.—Mining in this Province was chiefly remarkable for the flourishing condition of the Asbestos industry. A strong market and a considerable advance in prices for all grades of fibre created an activity at the mines in the Eastern Townships unprecedented in the history of Asbestos production in Canada. Properties which had been shut down for years were reopened, large expenditures were made in

re-equipment, expensive modern milling plants were installed, or are under construction, and, notwithstanding an advance of 25 per cent. in wages the labour market was, and is still, inadequate to the requirements of the industry.

From returns furnished by the mines and railway companies the shipments from Thetford, Black Lake, East Broughton, Ottawa County and Danville, during 1900, will approximate in round figures 23,251 tons of all grades of asbestos, and nearly 7,000 tons of asbestic, estimated on the most conservative basis, to be of a value at the mines of not less than \$1,000,000. The shipments over the Quebec Central Railway increased from 13,898 $\frac{1}{2}$ tons in 1899 to 19,970 $\frac{2}{3}$ last year, as follows:—

From Thetford Mines.....	31,254,700 lbs.
“ Black Lake.....	6,896,565 lbs.
“ East Broughton.....	1,789,000 lbs.

Total shipments via Quebec Central Ry. 39,940,265 lbs.

During the year 1899, if we may believe the returns published by the Mines Section of the Geological Survey, the production was valued at \$483,299.

IRON.—The iron industry will also, we believe, show increased values over previous years. Charcoal pig iron of superior quality was manufactured by the Canada Iron Furnace Company, at Radnor Forges, and by the Grantham Iron Works, at Drummondville. The figures of the Canada Iron Furnace Company were:—

Pig Iron made.....	4,677 $\frac{1}{2}$ tons.
Ore charged.....	13,019 “
Charcoal used.....	660,000 bushels.
Limestone.....	1,550 tons.

The returns from the MacDougall Plant are not available. 2175 tons of magnetite were shipped to the United States from the township of Hull. It is not unlikely that the Bristol Iron Mines, in Pontiac County, will be reopened again this year, and there is a movement in progress to exploit the large deposits of the magnetic sands on the North shore of the St. Lawrence.

MICA.—During the first six months of the year mica mining was actively prosecuted principally in Ottawa County, in the districts of Templeton, Wakefield, Hull and Buckingham and record prices ruled for all sizes and grades. Towards the end of the year, however, a reaction set in, the market weakened and production fell off considerably.

Hitherto the bulk of Canadian Mica has found a ready market in the United States where it is greatly favored for electric insulation, and while this is the most natural outlet for our production, there seems to be no reason why a very much larger trade should not be built up with the United Kingdom and the continent where, hitherto, Indian Ruby Mica, from Madras and Bengal, have practically had a monopoly of these markets.

A glance at the statistics given in the following table, courteously furnished by Mr. Harrison Watson, Curator of the Canadian Section of the Imperial Institute will be useful in this connection.

	Quantities.	Value.	Quantities.	Value.	Quantities.	Value.
	Cwts.	£	Cwts.	£	Cwts.	£
Norway.....	.....	.....	.....	.....	.....	.....
Germany.....	184	1,104	541	1,572	60	538
Holland.....	4	67	58	77	32	302
Belgium.....	249	2,395	456	666	95	625
French Possnins	.....	.....	.....	.....	.....	.....
India.....	.....	.....	.....	.....	.....	.....
China.....	.....	.....	.....	.....	.....	.....
United States....	3,442	4,745	10,028	7,550	2353	2916
Brazil.....	40	544	102	397	417	2455
Uruguay.....	.....	.....	.....	.....	43	250
Argentine Repub.	69	245	62	491	.....	.....
Bombay.....	14	120	79	602	70	615
Madras.....	4086	31364	4,750	33,497	16,136	93,773
Bengal.....	6171	37796	12,301	69,589	17,156	81,130
Burmah.....	.....	.....	4	45	.....	.....
Ceylon.....	748	1094	132	932	237	1,440
Hong Kong.....	.....	.....	.....	.....	20	25
South Australia...	18	115	.....	.....	.....	.....
Victoria.....	12	95	.....	.....	.....	.....
Canada.....	103	790	200	845	962	4,199
Newfoundland....	.....	.....	71	220	.....	.....

The late Dr. George Dawson having sent over to London average samples of Canadian Mica with the object of determining their commercial quality and the likelihood of an extension of trade in the United Kingdom, Prof. Wyndham Dunstan, M.A., F.R.S., Director of the Scientific and Technical Department of the Imperial Institute reports as follows:—

“General physical and chemical examination showed that the samples were uniform in character, pliable and softer than much of the mica which appears in the English market.

In order to ascertain its commercial value, and especially its fitness for electrical purposes, the samples were submitted to one of the largest electrical manufacturers in London, and also to one of the largest mica brokers in the City.

The electrical manufacturers report that the mica is suitable for a variety of electrical purposes. On the general question of the uses and comparative value of the Canadian Amber Mica, the brokers remark that this variety of mica is of no other value than for electrical purposes, its special value being principally due to its softness and easy lamination. They are of opinion that Canadian amber mica is of greater value for electrical work than most of the Indian mica that comes to this country. They remark, however, that there are two or three varieties of Indian Mica, such as White Bengal, Cochin, from the west coast of Madras and Ceylon Amber Mica which compare very favourably with the Canadian product, whilst the selling prices of these Indian varieties are often from one third to one half those asked for the Canadian Mica. They confirm the opinions expressed in Dr. Dawson's letters of February 16th and April 4th of this year, that Canadian miners obtain a better price in the United States than in the London market chiefly from the circumstance that American electricians prefer the Canadian product which is close at hand and can be depended upon for uniformity of quality and regularity of supply.

Although circumstances point to the United States as being the natural outlet for Canadian mica, nevertheless it would be worth while to take steps to make it better known in the British market since there are several factors operating against the Indian product, especially in the matters of tariff and regularity of supply.”

It may also be of interest to those of our members who are engaged in this industry to learn that during the year ended 30th March, 1900, 22,599 cwt. of mica was exported from India, of which the United Kingdom took 18,569 cwt.; France 33 cwt.; Germany 250 cwt.; United States 3,666 cwt.; Ceylon 30 cwt.; and Japan 51 cwt.

Returns for the United States are not yet available for last year, but we may quote those published by the Director of the Division of Mineral Statistics at Washington for the year 1899 in the hope that they may be useful for reference:—

	1899.	Quantity.	Value.
Unmanufactured.....	1,709,839		233,446
Cut or trimmed.....	67,293		42,538
Total.....	1,777,132		275,984

CHROMITE.—Returns from the Quebec Central Railway show that the shipments of this mineral were: From Black Lake 4,117,840 lbs. and from Coleraine 555,860 lbs. or a total of 2,336 $\frac{1}{2}$ tons. The output for the previous year, as reported by the Geological Survey was 1,950 tons of a value \$23,760.

It is worthy of remark that a portion of the output was shipped to the Electrical Reduction Works at Buckingham, Que. for the manufacture of ferro-chrome.

COPPER PYRITES.—Production, as in former years, was confined to the old established and extensively worked mines of the Eustis Mining Company at Eustis, and the Nichols Chemical Company at Capelton. Some prospecting was also done in the neighborhood of Sherbrooke.

GOLD MINING.—Attention has been again directed towards the exploitation of the Beauce Gold Fields and some exploration work is being carried on by the Beauce Syndicate Limited, an English Company, over the property of the McArthur estate.

LEAD.—During the year, the old Wright mine, at Lake Temiscamingue, was acquired by the Anglo-Canadian Lead Syndicate Limited, an English Company, having an authorized capital of £21,500, of which £13,437 10s. is paid up. The mine has been reopened and is being re-equipped with new machinery, including a concentrating plant brought out from South Wales. Several hundred tons of ore and concentrates were shipped to England during the year, one cargo assaying :—

Bullion Lead in concentrates..... 63.5 per cent.
Silver per ton of concentrates..... 14.87 ounces.

OTHER MINERALS.—Barytes, ochre and structural materials constituted other features of the mineral production in this Province. It is greatly to be regretted that a highly successful year should be marred by the inevitable and long looked for collapse of the so-called Gaspé Oil Fields, and the consequent liquidation of the Canada Petroleum Company. While it is possible an effort will be made to reconstruct and consolidate the various companies which have spent with a lavish hand so much British Capital in the exploration of this territory, the outlook does not warrant any expectation of success.

VALUE OF TOTAL OUTPUT.—From these facts I should say that the value of the mineral production of the Province of Quebec will not be less than \$3,000,000, as compared with a valuation of \$2,000,000 in the previous year.

NEW BRUNSWICK.

The production of Manganese and Gypsum constituted the most important features of the somewhat limited mining enterprise in this Province.

The Mineral Products Company, at Hillsboro, we believe, are now figuring on the construction of a ferro-manganese plant in the Province.

Coal Mining, in Albert and Queen's County, it is reported, will be exploited on an important scale during the ensuing year.

NOVA SCOTIA.

Entering, as they unquestionably are, upon an era of great activity, the coal, iron, and steel industries of Nova Scotia occupy a foremost position in the mineral expansion of the year.

The returns published by the Government are made up for the fiscal year which ends on the 30th September.

COAL.—The output of coal during this period was the largest in the history of this industry, amounting to 3,238,245 tons as compared with 2,642,333 tons in the previous year, and the sales 2,997,546 tons compared with 2,419,137 tons in 1899. The most notable shipments were 624,273 tons to the United States, the greatest on record to this market, the largest previous shipments being 465,194 tons to 1865.

New collieries were opened out and are being equipped at Port Morien, by the Gowrie and Block House Collieries, Ltd., at Port Hood, by the Port Hood Coal Co., and, at Broad Cove, by the Inverness and Richmond Collieries and Railway Co., Ltd. In addition to these important additions to the list of producers, the Dominion Coal Company has three new collieries under development which will materially add to their output during 1901.

A feature of the year was the passing away of the historic General Mining Association, Limited, the pioneer of mineral development in

Nova Scotia, which sold the remainder of its once vast mineral holdings to the Nova Scotia Steel Company. The new owners are building an up-to-date coking plant at Old Sydney Mines to supply their furnace plant at Ferrona, in Pictou County, and as a feature of their contemplated large steel works.

The following table shows the output and sales by companies during the fiscal year :—

COMPANIES.	Output.	Sales.	Colliery Consumption & Workingmen.
	TONS.	TONS.	TONS.
Acadia Coal Co.....	291,884	258,378	37,581
Canada Coals and Ry. Co. ...	67,290	55,456	8,621
Cape Breton Coal Co.....	12,126	9,891	2,535
Cumberland Ry. & Coal Co. ...	128,904	403,170	25,723
Dominion Coal Co.....	1,930,425	1,808,694	85,041
Gowrie & Blockhouse.....	Being	opened.	.....
Intercolonial Coal.....	244,000	226,535	17,484
Inverness & Richmond.....	56	Being	opened.
Jubilee Colliery.....	85	58	27
Mabou Colliery.....	195	65	.....
Nova Scotia Steel Co.....	249,910	225,932	28,033
Port Hood Coal Co.....	2,323	1,770	522
Scotia Colliery.....	525	417	58
Sydney Coal Co.....	7,222	7,180	457
Total.....	3,238,245	2,997,546	209,682

IRON AND STEEL.—The vast undertakings of the Dominion Iron and Steel Company are well known to all of you. The furnaces and coking plant have practically been completed, and the steel works are rapidly being constructed. The operation of this great establishment means a greatly extended consumption of coal during the present year, and we trust for many years to come. During 1900 the Company imported from their mine at Bell Island, Newfoundland, about 100,000 tons of hematite.

The Nova Scotia Steel Company mined about 1,600 tons from their Bridgeville areas. The operations of this progressive company will be readily understood from the following figures :—

Nova Scotia Ore used at Ferrona.....	19,000 tons
Wabana hematite (Newfoundland).....	33,000 "
Other foreign ore consumed.....	2,000 "
Limestone quarried.....	27,500 "
Coke made.....	29,000 "
Pig iron made.....	29,260 "
Steel made.....	22,000 "

Considerable activity was also manifested in the prospecting and exploration of iron areas at Torbrook, in Annapolis County, at Arisaig, in Antigonish County, and at Whycocomagh, in Inverness County, which it is hoped may ultimately lead to the discovery of workable deposits.

GOLD MINING.—The output of gold was slightly in advance of previous years, the returns for the fiscal year (ended 30th September), showing a yield of 31,110 ounces compared with 27,772 ounces in 1899.

The crushings amounted to 65,000 tons so that the average yield was about half an ounce to the ton. The Brookfield Mining Company, Blue Nose Gold Mining Co., and Richardson Gold Mining Co., were, as usual, the most profitably worked undertakings.

At Harrigan Cove 1813 tons yielded 3,403 ounces.

COPPER.—A copper reduction plant was completed at Pictou by the Copper Crown Mining Company, and several hundred tons mined at their properties in Colchester and Cumberland. Deposits at Polson's Lake and Lochaber, in Antigonish County, were also prospected.

GYPSUM.—Gypsum returns so far show that the year's production was slightly behind last season's, due largely to the non-working of the quarries in the Baddeck District. It is expected that these quarries will resume work next year, and that the production will rise from 122,281 tons to its normal figure of about 150,000 tons. In addition to the shipments of this mineral, considerable quantities are manu-

factured for local use, ground for house work, and used in the manufacture of fertilizers.

OTHER MINERALS.—783 tons of Barytes were produced from Cap Rouge, Inverness County.

TRIPOLI AND SILICA.—Incomplete returns show that about 1,150 tons were treated, chiefly by the St. Ann's and by the Bass River Silica Companies.

In addition to the usual quantities used locally, the Nova Scotia Steel Co. quarried 24,300 tons of limestone, and the Dominion Iron and Steel Company used a large quantity for concrete work taken from their Georges River Quarry, probably about 75,000 tons. In addition large quantities are being quarried at that place and at Marble Mountain, West Bay, for the company's furnaces.

BOUNTIES PAID IN 1900.

The Auditor General's Report for the year ended 30th June last shows the following bounties paid on pig iron, puddled bars, steel ingots, and silver:—

Bounty on Pig Iron.

CANADA IRON FURNACE CO. (\$18,234.92).—	
Production during 12 months ended June 30th, 1900—	
6052.78 tons from Canada ore @ \$3.00.....	\$18,158.34
38.29 tons from foreign ore @ \$2.....	76.58
DESERONTO IRON CO. (\$27,026).—	
Production during 12 months ended April 30th, 1900—	
462 tons from Canada ore @ \$3.....	1,386.00
12,820 tons from foreign ore @ \$2.....	25,640.00
HAMILTON BLAST CO., LTD. (\$107,009.69).—	
Production during 12 months ended May 31st, 1900—	
11,929.19 tons from Canada ore @ \$3.....	35,787.57
35,611.06 tons from foreign ore @ \$2.....	71,222.12
JOHN MCDUGALL & CO. (\$5,485.07).—	
(Grantham Iron Works).	
Production during 10 months ended April 30th, 1900—	
1,828.37 tons from Canada ore @ \$3.....	5,485.07
NOVA SCOTIA STEEL CO. (\$73,162.22).—	
Production during 12 months ended May 31st, 1900—	
11,886,225 tons from Canada ore @ \$3.....	35,658.67
18,751.77 tons from foreign ore @ \$1.....	37,503.55
MINERAL PRODUCTS CO., PICTOU (\$7,378.24).—	
Production during 5 months ended Nov. 30th, 1900—	
2,459,415 tons from Canada ore @ \$3.....	7,378.24
	<u>\$238,296.14</u>

Bounty on Puddled Iron Bars.

ONTARIO ROLLING MILLS CO.—	
Production during June, 1899, from pig iron made in Canada—	
400,165 tons @ \$3.....	1,200.50
HAMILTON STEEL & IRON CO., LTD.—	
Production during 11 months ended May 31st, 1900, from pig iron made in Canada—	
2,973.54 tons @ \$3.....	8,920.60
	<u>\$10,121.10</u>

Bounty on Steel Ingots.

NOVA SCOTIA STEEL CO.—	
Production during 12 months ended May 31st, 1900, from pig iron not less than 50 per cent of which was made in Canada—	
21,453.43 tons @ \$3.....	64,360.29

Bounty on Silver.

HALL MINES CO. (\$17,482.07).—	
Mined in 1898-9, 31,190 tons (proportion of \$30,000, less \$71.91, cost of inspection).....	10,442.09
Portion of unexpended bounty of 1895-6 distributed under O. C.....	6,699.95
Short paid on output of years 1895 to 1898, inclusive, as shown by inspection.....	340.03
BRITISH COLUMBIA SMELTING & REFINING CO.—	
Portion of unexpended bounty of 1895-6 distributed under O. C., \$648.81, less overpaid on output of years 1895 to 1898, \$193.40 and cost of inspection \$49.19.....	6,246.22
CANADIAN SMELTING WORKS—	
Mined in 1898-9, 57,805 tons (proportion of \$30,000 less cost of inspection, \$29.35).....	\$19,456.65

TRADE IN MINING MACHINERY.

Coincident with this great expansion in mineral development there has naturally been a correspondingly heavy trade in supplying our mines, mills, and smelters with mining machinery and supplies, a business in which it is gratifying to observe our Canadian manufacturers have more than held their own. The manufacture of many lines of high-class mining machinery has grown rapidly during the last few years, and today we have throughout the Dominion a number of large establishments which in point of engineering skill, equipment, and capacity to turn out good work, will compare favourably with the large works of our enterprising neighbours across the line. Naturally, we are not yet able to fill all the varied requirements of our mines and smelters, and a very large trade is done with the United States and other countries, as a reference to the following official statistics of the imports during the year ended 30th June last, will show.—During this period there were imported under the free list, mining and smelting machinery of a value of \$724,187, compared with \$299,800 imported in 1899, \$207,737 imported in 1898, and \$128,780 brought in 1897. Of the free entries the United States supplied \$680,250, compared with \$283,481 in 1898; Great Britain \$43,720 as compared with \$16,380 in 1899. The distribution of this machinery was as follows:—

	1900.	1899.
Nova Scotia.....	\$320,038	\$ 24,243
British Columbia.....	182,087	88,911
Ontario.....	145,040	142,216
Quebec.....	30,661	26,621
New Brunswick.....	10,246	212
Manitoba.....	1,600	1,080
N. W. Territory.....	674	10,926
Yukon.....	33,841	5,591
	<u>\$724,187</u>	<u>\$299,800</u>

These figures, however, convey but an approximate idea of the great importance of our mining industry in its relation to the trade and commerce of the country, for we find scattered throughout the Trade and Navigation Returns, numerous entries not included in my comparative statement. Here are a few culled at random:—

Diamond Drills (not including motor power, which is dutiable)

	1900.	1899.
For Province of Ontario.....	\$17,940	.....
" Nova Scotia.....	2,111	.....
" British Columbia..	4,201	.....
	<u>\$24,252</u>	<u>\$9,692</u>

(Great Britain \$1,030 ; United States \$23,222.)

Stamp Mills, Ore and Rock Crushers, Cornish and Belted Rolls, Rock Drills, Air Compressors, Cranes, Derricks, and Percussion Coal Cutters:—

	1900.	1899.
Ontario.....	\$20,683	.....
Quebec.....	1,548	.....
Nova Scotia.....	6,738	.....
Manitoba.....	4,123	.....
British Columbia.....	2,653	.....

Total..... \$35,745 \$33,780
(Great Britain \$365 ; United States \$35,380.)

Wire Rope:—

	1900.	1899.
Ontario.....	\$8,773	.....
Quebec.....	13,364	.....
Nova Scotia.....	16,271	.....
New Brunswick.....	3,230	.....
Manitoba.....	500	.....
British Columbia.....	33,367	.....
N. W. Territories.....	814	.....
Yukon.....	2,582	.....

Total..... \$78,901 \$416,158
(From Great Britain \$32,852, United States \$46,037.)

These notes, hurriedly compiled, are presented in the hope that they may, perhaps, be of some service to the members.

B. T. A. BELL, Secretary.

Notes on the Iron Ore Deposits of Bilbao, Northern Spain.

By FRANK D. ADAMS, M.Sc., Ph. D., F.G.S.

The Iberian peninsula, while producing comparatively little iron, is known to contain many large deposits of iron ore some of which have been worked from very early times. Iron ore occurs throughout the whole length of the Cantabrian Mountains on the northern coast of Spain, in Navarre, through the Basque Provinces, Santander and Asturias to North Portugal. Other large deposits are known in eastern and southern Spain, in the Provinces of Murcia, Almeria, Seville and Malaga. It has however, owing to difficulties of transport, been up to the present time worked only near the coast, but many great ore bodies which exist inland—in Leon, Old Castile, Aragon, Andalusia and Murcia—are now being opened up. †

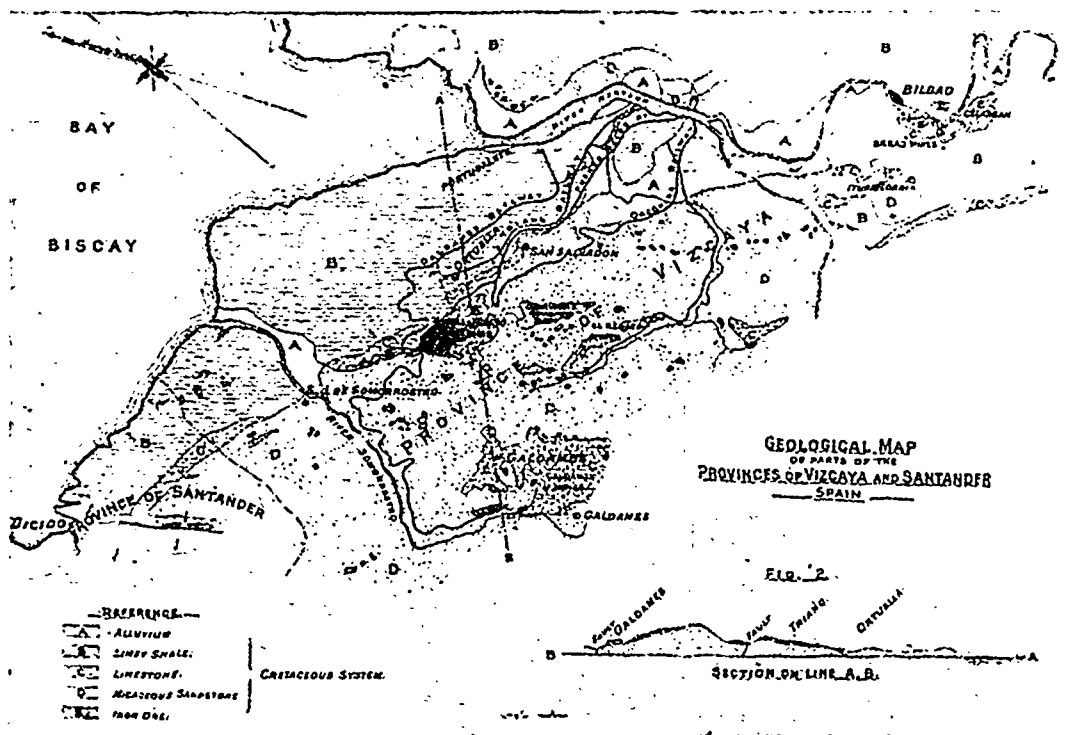
The most important deposits, or at least those which up to the present time have been worked far more extensively than any others, are those which are situated in the district of Vizcaya, in the Basque

peck," and in *Hamlet* a situation described as "worse than the mutines in the bilboes."

These Bilbao deposits however were first worked on a very large scale when the great demand for ores of this particular class was created by the introduction of the Bessemer process, and there are now (1899) in the Bilbao District, no less than 204 iron mines. The following figures will show the rapid increase in the production of iron ore in the District of Vizcaya:—

1861	54,000 tons.
1870	268,500 "
1880	2,345,000 "
1890	4,272,918 "
1899	6,146,542 "

Almost the entire amount in 1899 was exported, only 621,165 tons, or 6.7 p.c. of the total amount mined, being smelted in Spain. The ore is shipped chiefly to England, although a considerable amount is sent also to Germany. In 1899 the shipments to Great Britain, Germany and the United States of America were as follows:—



Provinces, and which, lying near Bilbao from which point the output is shipped, are known as the Bilbao Iron Deposits. These deposits are situated on the northern slope of the Cantabrian Mountains. The ground is for the most part hilly or mountainous, with very little flat land even along the sea shore. The ore lies chiefly at altitudes of between 600 and 1,100 feet. The most important of these Bilbao Iron Ores are those of Somorrostro and Orcanera, the former of which has been worked continuously for several hundred years, and it is believed that it is these deposits which are referred to by the Elder Pliny in the first century of our era when, in his Natural History, he says: "In the part of the Cantabrian coast which is washed by the ocean, there rises a high and steep mountain, which marvellous to relate is composed entirely of iron."

It was from these ores that the metal for the celebrated Toledo blades was obtained, and in fact in the time of Shakespeare these deposits were so renowned that the term *Bilbo* was employed to designate various objects of iron and steel, as sword blades, fetters, etc., and so we find Falstaff (in the *Merry Wives of Windsor*) speaking of himself as "compassed like a good bilbo in the circumference of a

Great Britain.....	3,955,000 tons.
Germany	550,000 "
United States of America.....	75,000 "

The small shipments to the United States are due to great fluctuations in freight rates between Spain and North America. It is important to note that 87½ p.c. of the iron ore imported into Great Britain comes from Spain and chiefly from these Bilbao deposits.

Bilbao, which is the chief port of north-eastern Spain, is situated on the River Nervion, 6 miles from the sea; the name Bilbao being derived from the Basque word *Bulibao*, which means "Town on the Plain." In addition to being an excellent port it has abundant railway communication with the surrounding country. The river all the way down from Bilbao to the sea presents a busy scene, being filled with ships flying the flags of all nations, loading iron ore and other products at the almost continuous succession of wharves and landing stages which occupy the bank of the river. The bulk of the Bilbao ore as shown in the accompanying map is in the Somorrostro District, about Triano and Orcanera, some 6 or 7 miles west of the city of Bilbao on a high ridge immediately south of the railway. It is reached by taking the train to Ortuella from which place good roads lead to the mines. Great ore dumps are seen by the side of the railway all

† Zeit. fur. Prak. Geol., Nov., 1900.

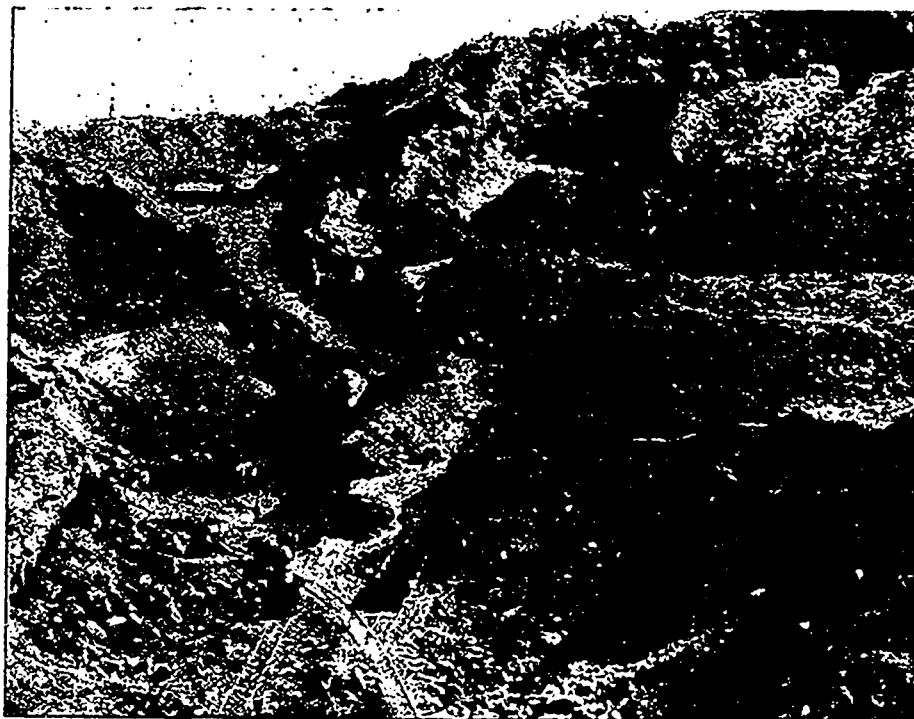
PLATE I.



ESPERANZA MINE.

Shows general character of the surface of the district and open cut from which Campanil is obtained.

PLATE II.



Workings near the Esperanza Mine.
Afford Campanil.

PLATE III.



"CHIRTA"

Residual mantle of ferruginous clay with nodules of limonite scattered through it. The underlying limestone is seen protruding through the "Chirta," in the background. The method of working the deposit and preparing the limonite for shipment is also shown.

PLATE IV.



"CHIRTA."

Showing the peculiar pinnacled surface of the underlying limestone. The material is being shovelled into ox carts, in order that it may be taken to the mill to be washed.

along the base of the Somorrostro ridge, the ore being carried down from the mines by all sorts of conveyances, from the picturesque but slow moving Basque cart drawn by a pair of oxen, (See Plate 6), to great systems of overhead wire rope tramways of modern construction.

The most extensive occurrence (Triano, Ventura, etc.) is irregular in shape, about two miles long and at Mt. Triano five-eighths of a mile wide, with a maximum thickness according to Kendall § of 220 feet.

The country rock is Upper Cretaceous in age and has the form of a saddle, corresponding in direction with the shore, and the ore deposits are found on both sides of this. The Cretaceous shows the following succession:—

1. Light grey shale, very calcareous.
2. Grey limestone, (about 250 feet thick).
3. Dark micaceous sandstone, calcareous.

The strata where the bulk of the iron deposits occur have a general northeast dip which shows however many variations and disturbances. Their present attitude is the result of the upheaval of the Cantabrian Mountains in Tertiary times.

The ore occurs exclusively in connection with the limestone and is thus limited in depth at any point by the lower surface of that rock. This is very important, showing, as it does, that the deposits are essentially superficial in character and extent. The erroneous notion that in the case of the Bilbao deposits we have to do with "mountains of ore," arises mainly from the fact that the slopes of the hills coincide in some places with the dip of the limestone, and this rock having been replaced by ore, the whole hill or mountain seems to the casual observer to be a mass of iron ore, while, as a matter of fact, the ore is present merely as a superficial crust or coating.

The various ore bodies have an irregular elongated form, their longer axes coinciding with one another and with the strike of the strata. The relations of the sandstone, limestone and shale to one another and to the iron ore are well seen in accompanying sections. In one of the Triano sections (Figure 1) the overlying covering of shale is still preserved at the northern end. The other Triano section (Figure 2) shows the limestone entirely removed and replaced by ore in the flat portion of the area about the Concha and Adela Mines, the ore resting directly upon the underlying sandstones. In almost every part of the area the ore appears with a denuded surface, and is either actually exposed to view or concealed by a thin superficial covering. Where the limestone has been completely removed it lies directly on the surface of the sandstone. The ore deposits being thus essentially superficial in character, there are no *mines*, properly speaking, in the Bilbao District.

The ores are of five classes, and are designated locally as follows:—

1. *Vena*.—Red Hematite; compact, soft or sometimes powdery. Generally the purest of the ores, holding about 64 p.c. of iron. It was the only ore used in former times to supply the Catalan forges. Very little of it now remains.
2. *Campanil*.—Red Hematite; compact and crystalline, with numerous little drusy cavities lined with calcite. Said to derive its name from the ringing or bell-like sound which it gives out when struck with a hammer. It is the best of the ores, with the exception of *Vena*, and is one of the chief ores in the Triano Mines. It strongly resembles the hematites of Whitehaven and Furness. It may be said to carry about 55 to 58 p.c. of iron with 4 to 8 p.c. of lime.

3. *Rubio*.—Limonite, carrying about 55 p.c. of iron, but usually more or less siliceous.
4. *Chirta*.—A ferruginous clay, with limonite nodules scattered thickly through it.
5. *Carbonato*.—Siderite, carrying about 44 p.c. of iron. Found almost exclusively at or near the base of the hematite or limonite deposits, and can be seen to pass into them. It was undoubtedly the primary ore and has by its alteration given rise to the *Vena*, *Campanil* and *Rubio*.

These ores are all very low in phosphorus. The Carbonato often contains a small amount of sulphur, but as it is roasted before exportation, this impurity is for the most part driven off.

The following are analyses of samples of the several varieties:—

	Vena.	Campanil or conera.	Rubio.	Carbonato
Ferric oxide	90.70	84.00	79.96	5.31
Ferrous oxide.....	...	...	...	50.18
Manganous oxide.....	1.30	1.90	.70	1.00
Alumina .....	.15	...	1.44	...
Lime	1.00	4.60	1.00	.57
Magnesia .....	.02	...	.55	3.21
Silica.....	1.05	3.20	8.10	3.60
Carbonic acid .....	...	...	...	...
Sulphuric acid.....	...	...	.10	...
Sulphur.....	.03	...	...	trace
Phosphoric acid.....	...	trace	.03	...
Water and carbonic acid.....	5.40	6.00	...	36.28
Water.....	...	...	8.25	...
	99.65	99.70	100.13	100.45
Metallic iron.....	63.49	58.80	54.62	43.96

The workings are practically all open cuts with a few short tunnels. The accompanying photographs* show some of the principal occurrences in the Triano District. The first of these (Plate 1) shows the Esperanza "mine." An open cut in Campanil mixed with streaks of yellow ferruginous clay and limonite. The ore contains the little drusy cavities lined with calcite, mentioned in describing the ore, in great abundance, one or more being present in every hand specimen.

Another similar occurrence of Campanil, worked by a great open cut and tunnels, near the Esperanza, is shown in Plate 2.

The next workings which were visited presented a deposit of a different character, the so-called Chirta. It is a yellow ferruginous clay with nodules of limestone scattered abundantly through it. It lay upon the limestone, mantling it deeply, the bed rock however protruding in places, as seen in the background of the picture. The face of the clay bank was being torn down by workmen with picks, the material being then thoroughly disintegrated by means of implements resembling forked mattocks, and then screened. The several processes are shown in the photograph (Plate 3). In this way the limonite nodules are separated from the clay and the ore prepared for shipment.

In other workings near by, the limonite-bearing clay was mixed with water and passed through an inclined revolving cylinder, the inner surface of which was studded with spikes. As the material passed out of the lower end of the cylinder and down a gently inclined shallow trough, any large unbroken clay masses were picked out by a number of men and boys, and were thrown aside to be crushed and once more passed through the cylinder. The finer washed stuff consisted of the limonite nodules and the water carried away the clay. A rather clumsy process, entailing much labour, the wages of a man, however, being only two pesedas a day.

* For those photographs I am indebted to Professor Rils of Cornell University, in whose company I had the pleasure last summer of visiting the deposits described in the present paper.

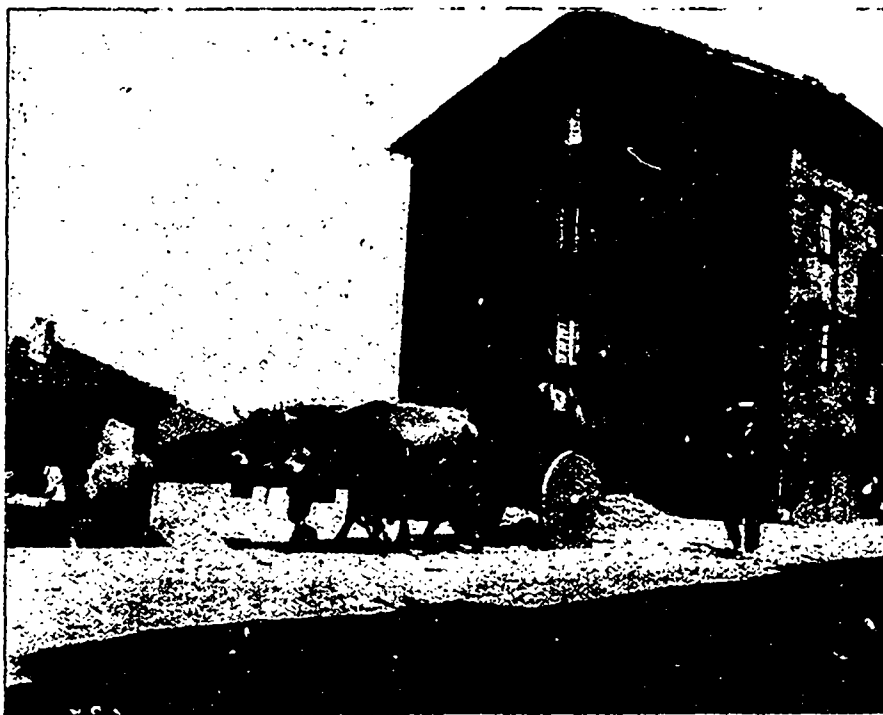
§ The Iron Ores of Spain. Trans. of the Fed. Inst. Mining Eng Vol. III, 1891-92, p 607.

PLATE V.



SAN BENITO PROPERTY.
Yields Rubio and Carbonato.

PLATE VI.



SCENE ON ROAD BETWEEN ORTUELLA AND TRIANO.
Basque ox cart employed to carry ore.

The origin of this Chirta is well seen in some of the neighbouring occurrences. (Plate 4). The underlying limestone where it is exposed on the higher ground or where it is laid bare by the removal of the Chirta by the pick of the workmen, is seen to have been dissolved away giving rise to that peculiar surface form, seen often in the bare limestone districts of the Upper Alps and known as Karren structure. The edges of the limestone beds stand up like sharply pointed slabs, a form evidently produced by the solvent action of the rain or percolating waters upon the surface of the limestone, while the Chirta which represents the insoluble residue, which has gradually accumulated from the solution of a very considerable body of limestone, remains as a mantle upon the surface of solution and in pockets between the Karren. Much of the iron oxide has gathered itself together by concretionary processes into the limonite nodules which constitute the ore.

In another immense open cut or quarry, worked in benches and known as the San Benito property, the Rubio and Carbonato were seen. A photograph of this is shown in Plate 5. The Carbonato or Siderite has a banded appearance and seems, in places at least, to be interbedded with limestone. It is seen only in the lower levels of the cut, being covered by the porous limonite known as Rubio, which is the superficial alteration product of the Carbonato and can be seen to pass into it, working downward along joint planes and fissures in the siderite and often enclosing blocks of the latter not yet entirely altered. At the time of our visit, the white Carbonato and dark Rubio were being worked together along a face in the cutting where they occurred intimately associated, one passing into the other.

The Carbonato is calcined before being shipped, in furnaces situated on the lower slopes of the cut.

The origin of the ores seems to be as follows:—

The limestones themselves and especially the overlying calcareous shales contained, as these rocks so frequently do, a certain amount of iron disseminated through them in the form of various ferruginous compounds. The country during later Tertiary and Quaternary times was subjected to long continued denudation. The calcareous strata under these circumstances were dissolved and the iron passing downward in solution was, in the lower portion of the limestones, converted into carbonate of iron, which may therefore be considered as the primary ore, being the first ore concentrated in bodies of considerable size.

As the denudation proceeded, the calcareous shales and the limestones, being thoroughly leached out, left their insoluble residues as a mantle of residual clay, and under the oxidizing influence of the air and oxygenated waters, much of the iron instead of being removed by the waters was left behind in the form of insoluble oxides,—Limonite or Hematite, "Chirta" or "Campanil"—mixed with ferruginous clays. As the surface of the country became lowered, the deeper bodies of Carbonato also became oxidized to Rubio—and hence the deposits in their present form. The concentration is undoubtedly going forward at the present time.

Farther to the east along the same line of folding, in the Pyrenees, as for instance at the well known Rancie Mines near Vicdessos, there are also iron ore deposits in the form of bedded veins of limonite, occurring in limestone and passing over in depth into siderite. The strata however here being highly tilted, the deposits follow the limestones down to great depths and are not confined to the surface as in the case of the Bilbao ores.

The Bilbao ores in their relations and mode of occurrence bear a strong resemblance to the limonite deposits of the great limestone valleys of central and eastern Pennsylvania, which have been worked for the production of iron ever since the rise of this industry in America. These have been made the subject of a recent paper by Mr. T. C.

Hopkins,† who shows that they occur chiefly in the residual clays formed by the solution or disintegration of the Ordovician and Cambrian limestones and slates underlying these portions of Pennsylvania, the original source of the iron being the strata by whose decay the clays in question were formed, and through which strata it was originally disseminated chiefly in the form of carbonate.

It is stated that the Bilbao ores are steadily degenerating in quality,‡ and also that the deposits are rapidly approaching exhaustion. Lying altogether in the limestones and being thus essentially superficial deposits, exposed and worked over the whole surface simultaneously, it would seem that they have seen their best days.

"We are continually hearing that the deposits are almost exhausted," said a Spanish ore shipper, "but year by year we have a larger output." This very fact, however, is hastening on the end. But while these deposits may be and probably are approaching exhaustion, many new deposits, as has been mentioned, are being opened up farther inland, so that the supply of Spanish ore will probably continue without serious diminution for at least some years to come.

Concentration of Argentiferous Galena as carried on at Helena Frisco Consolidated Company's Mills, Gem, Idaho, U.S.A.

By W. MUIR EDWARDS, Montreal.

The subject of my paper this afternoon is the Concentration of Argentiferous Galena as carried on at the Helena Frisco Consolidated Company's Mills, in which I worked as vanner man about four months last summer. The mine, the treatment of whose ore this paper deals with, is situated in the Coeur d'Alene district—a district justly celebrated for its lead and silver mining. The country is very mountainous and although at first the prospects were opened up and worked by shafts sunk on the outcrop, now most of the mines are worked by a tunnel driven into the hill to cut the vein, and a vertical shaft sunk on the vein. The Helena Frisco mine is worked by a tunnel about $\frac{1}{4}$ mile long, driven in to cut the vein at the 600 ft. level, and a vertical shaft sunk at this point, which last summer had reached the 2,200 ft. level. Levels are driven every 200 ft., and the mine is operated by a system of over-hand stoping. The stopes are permanently timbered, and everything taken out of them is put through the mill.

MATERIAL TREATED.

The material to be treated consists of an Argentiferous Galena, a considerable amount of zinc sulphide and a dark colored country rock with a hardness of about $4\frac{1}{2}$ and a specific gravity much less than that of either the lead or zinc sulphides, in fact the difference in the specific gravity of the lead and zinc is so small as compared with that of the Galena and the country rock that the latter is never seen at the point of concentration, the separation being entirely between the lead and zinc sulphides.

The Galena is of two varieties, one a very fine grained, and the other a coarse grained having a good cubical cleavage.

The silver is carried largely by the cryptocrystalline variety, and its percentage varies slightly in different parts of the mine. It is usually quoted in the mill concentrates as running 22 oz. to the ton.

The zinc occurs both in the powdery form distributed through the Galena, and also in the massive form. The presence of zinc how-

† Cambro-Silurian Limonite Ores of Pennsylvania. Bull. of the Geol. Soc. of America, vol. 11, 1900.

‡ See Paper by Kayser, in Stahl and Eisen, vol. xviii, p. 373.

ever, in large quantities is not universal throughout the Coeur d'Alene district. Some mines, the Hecla for instance, have no zinc at all, while others have not as high a percentage as the Frisco which with the Tiger Poorman are about the worst in this respect. The process of separation is, of course, much simpler where there is no zinc sulphide in the material. The large specimen on the table marked A gives a very good idea of the material to be treated in the Frisco. In it can be seen the waste rock, both varieties of the Galena, and also, the powdery form of the zinc; the massive zinc also showing.

GENERAL DESCRIPTION OF MILL.

The plant for separating these different constituents is contained in a 750 ton mill situated at the mouth of the mine tunnel. It is a five storey structure built up the side of the mountain, narrow at the top where the crushers are placed and broadening out for the jig and vanner rooms below. On the fifth floor are the crushers. Between the fifth and fourth floors, but in an extension by themselves, are the Pelton water wheels, four in number, which drive the coarse mill, the fine mill, the slime mill and the dynamo which supplies light to the mill and mine. Each of these is separated and may be speeded up, slowed down or shut off independently. On the fourth floor are all the rolls which are used in the mill—the dry rolls set immediately in front of the bin into which the crusher feeds; the Allis rolls which receive the middlings from the coarse jigs, and three fine rolls which crush the middlings from the fine jigs. On the third floor are the arrangements for classifying the feed for the different concentrating machines below. These consist of a separation by two sets of trommels, followed by an hydraulic classification as the feed passes down a launder over the jigs, followed by a settling out of the coarser slimes as the overflow from the jig launder flows through a tank above the tables, and a final settling out of the finer slimes as the round tables' overflow passes down a long tank behind the vanners. The second floor is the concentrating floor on which are the jigs, round tables and vanners. On the first or ground floor are the ore-bins, slime concentrate bins, apparatus for weighing and loading the ore, settling tank for mill overflow and also a lower vanner room.

DETAILED PROCESS.

As the mine and the general arrangement of the mill have been described, we might now consider somewhat in detail the treatment of the ore. The process is as follows—the ore is run out of the tunnel in a string of cars pulled out by a horse. The cars which are then on a landing a storey above the crusher floor are weighed, run over and dumped into a bin having a capacity of about 60 cars, which is behind and above the crushers. From this bin the ore slides over a grizzly down which it is raked by the crusher man to the crusher. The fine material passes through the grizzly and under the crusher, thus saving a needless waste of power. While being raked over the grizzly the feed is also cleaned of the wood, spikes, broken hammers, candle hooks, etc., which necessarily are mixed with it.

The crushing apparatus consists of two Blake crushers, one a 10 x 20 in., and the other a small emergency crusher 10 x 15 in. placed alongside in case the big one should have to be shut down for repairs. The capacity of the larger crusher is such that it can put through more than the jigs can handle. The jaw plates are set from 1 in. to $1\frac{1}{4}$ in. apart, the size of aperture varying slightly as owing to the fact that everything is put through the mill, the character of the feed varies a good deal. The crushed material falls into a bin from which it is fed by a shaker to the coarse or dry rolls. This feeder is a long shallow box shaken lengthwise by a cam and spring attachment, which is adjustable so that any desired feed may be given to the coarse rolls.

The rolls are 30 in. diameter, and 15 in. across the face. They

are set $\frac{3}{4}$ in. apart and run at the rate of 34 R.P.M. From these rolls the feed slides by gravity to the trommels.

The trommels consist of two sets. The first set comprises two exactly similar trommels 6 ft. long x 3 ft. in diameter, each having two divisions with 10 m.m. and 15 m.m. holes respectively. They are set side by side, the left hand trommel handling the direct feed from the coarse rolls, while the similar trommel alongside handles the recrushed coarse-jig-middling from the Allis rolls.

The second set consists also, of two similar parallel trommels, 8 ft. long by 3 ft. in diameter, having three equal divisions with 3, 5 and 7 m.m. holes respectively. Each of these trommels handles half of the mixed feed passing through the 10 m. m. holes of the first set. All of the trommels are revolved by gear wheels at the rate of 20 R.P.M. and run wet, being watered by a row of spouts running along above them.

The feed is thus divided according to size, with 6 separate portions—the oversize of the 1st set, material between 10 and 15 m. m., the oversize of the 2nd set, material between 3 and 5 m. m., and material finer than 3 m. m. The last two portions pass on to be further classified for the feed of the fine jigs, tables and vanners. The other four portions comprise the feed of the coarse jigs. As it would be tedious to enter into a detailed description of the throw, R.P.M. size of sieve and other particulars in regard to both the coarse and fine jigs, I submit information drawn up in tabular form giving the feed, the R.P.M., the number of compartments in which concentrate is made, both Hutch and Top, and similar information of the middlings, the size of sieve used in the different compartments and finally whether tailings are made or not.

All of these jigs, with the exception of the Bull jig, which is a three compartment single jig, are four compartment ones, arranged in sets of twos placed back to back, each set handling one portion of the classified feed. The plunger is worked directly by an eccentric on a shaft run from an overhead pulley. The throw in the different compartments is not given in the tabulated statement because it varies a good deal, the variation depending not only on the feed treated but also on the fit of the plunger. It can only be stated that the Bull jig has an eccentric throw of from $2\frac{1}{2}$ to 2 in., and that the rest of the coarse jigs have a throw varying between $1\frac{1}{2}$ to 1 in. The throw in the fine jigs decreases from $\frac{7}{8}$ down to $\frac{1}{8}$ in. as the feed gets finer, but there is no uniform decrease, the lack of uniformity being not so noticeable as in the coarse jigs.

The coarse jig room contains the Bull jig and four sets of jigs, the extra set being provided to handle half of the feed from the 15 m.m. holes of the first trommel.

The concentrates from these coarse jigs are led down by pipes to the ore-bin below. The middlings are led down to an unwatering tank on the lower floor and are then raised by a bucket and belt elevator up to the roll floor, where they are put through a pair 36 by 14 in. Allis rolls. They then pass into the left hand trommel of the first set and so start through the mill again. The tailings go direct to the tail race.

This finishes the concentration carried on in the coarse mill as it is called, which comprises the crushers, the dry and Allis rolls, the two sets of trommels, No. 1 elevator and nine jigs. This mill is run by a separate Pelton water wheel and may be shut off independently of the rest of the mill. This is an important consideration especially as regards the slime mill which may be kept running even if the coarse, or fine mill for that matter, has to be shut down to repair the elevator, or on account of choked rolls an event which happens frequently.

We have now to consider the concentration carried on in the fine and slime mills. It will be remembered that the feed smaller than 5 m. m. passes on to be further classified. This is first done by a Calumet classifier running along above the "direct" fine jigs. This classifier

consists of a launder with boxes on the side opening into the main launder and having rising currents of water of varying intensity in them. The heaviest particles naturally settle out in the upper boxes and a separation according to the heaviness of the pieces is thus made. The feed thus classified and the different portions led to suitable fine jigs below the overflow passes on to the round table tank. The particulars of these jigs are given in the tabulated statement and need not be described here. The concentrates from these jigs are led to the ore-bin below. The middlings from these fine jigs are run to an unwatering box on the lower floor in front of No. 2 elevator. The settled material in the box is run into the elevator through a gate at the bottom of the box. The overflow passes to a long tank from the bottom of which the settled material is tapped by spigots and this is also run into the elevator. The overflow of the tank passes to the main settling tank of the mill. The elevator takes the middlings up to the roll floor, where they are run into an inclined launder behind the pair of fine rolls to which it is fed by gates.

These rolls are Allis wet rolls 30 in. in diameter and 14 in. width of face and run at the rate of 88 R.P.M. The feed is divided equally between the rolls from which it passes into a small trommel. This trommel is 8 ft. long, 36 in. in diameter, has a mesh of 3 m.m., and runs at the rate of 20 R.P.M. The oversize of this trommel passes into a small elevator which raises it to the roll floor again and passes it into the third pair of fine rolls. These are 24 by 14 in. rolls and run at the rate of 52 R.P.M. From these rolls the recrushed product passes again into the middling trommel. The feed passing through the mesh of this trommel is equally divided between two similar Calumet classifiers exactly similar and parallel to that on the direct feed side. In the fine jig room, and also in the vanner room, the recrushed middlings are treated, one, the left hand side, (travelling with the feed) and the direct feed on the right, an equal number of machines being provided for each.

The middling jigs are exactly similar in construction to the direct feed ones, but in practice no tailings are made unless the feed is very heavy, overflow water only being allowed to go into the tail race. This it will be seen throws a very heavy zinc feed on the middling vanners.

The middlings from these jigs are piped down to an unwatering box in front of No. 2 elevator and are elevated and recrushed. The concentrates of course pass to the ore bin below.

Bedding is used on all the fine jigs. It collects gradually itself on the direct feed side and is skimmed off and taken over to the middling jigs with a shovel. This has to be attended to frequently. The size of the bedding is shown in the samples.

The fine jig room contains in all eight sets of jigs, four on the direct feed side and four on the middling feed side. They comprise what is known as the fine mill and are run by a separate Pelton water wheel.

The overflow from the three Calumet Classifiers passes over screens through which it falls into a tank above and behind the round table. This tank is 54 feet long and of a cross section as shown in the diagram submitted. The side of the tank near the bottom is pierced with a number of holes filled with big spigots which again have small holes in them plugged with small plugs about $\frac{3}{8}$ inch in diameter. There are about ten of these holes behind each table. Half of these feed three at a time on the top table and the other five feed a similar tank below which in turn feeds the second row of tables. There are three tiers of tables, three in each tier, the middlings from the upper two comprising the feed of the lower table. The tables are 18 feet in diameter and have a speed of one revolution in 75 seconds. The concentrates from all three tables go direct to the

slime concentrate bin while the tailings go direct to the tail race. The middlings from the lower table run down and into an elevator (No. 4) by which they are elevated to a settling tank behind the middling vanners. Samples of the round table concentrates, middlings and tailings are shown in bottles 22, 23 and 24.

The overflow from the round table tank runs into a long tank behind the direct feed vanners.

The feed, by a system of launders especially on the middlings side is made fairly uniform.

The upper Vanner Room contains ten vanners, five on the direct side and five on the middling side. They are the ordinary 6 ft. Frue vanners and run at from 205 to 210 R.P.M. The feed is from spigots in the bottom of the settling tank, there being five spigots about $\frac{1}{4}$ inch in diameter opening into a launder supplying each vanner. Two of these are kept running, the plugs behind the vanners being changed every half hour. This insures a more uniform feed and also places the feed on the vanners much thicker. There are two very good devices which are not met with on all Frue vanners. One consists of a small extra roller held tightly against the out side of the belt just below and behind the large front roller as shown in the diagram. This cleans the belt very thoroughly and causes all the concentrates to fall into the box doing away with the heavy hoeing which is one of the hardest parts of a vannerman's work. The other device consists of a hole in the bottom of the concentrate box connected by a short pipe with a launder running into the slime concentrate bin.

A constant stream of water is fed into the concentrate box and this washes the concentrate into the launder and so carries it to the slime concentrate bin where it settles, thus doing away with all shovelling and transporting of the concentrate. The overflow from the vanner tank passes into a long covered tank outside the mill where the settled material is again drawn off by spigots and this feeds into the settling tank behind the lower vanners. The overflow from this last settling tank outside the mill passes to the tail race. The tailings of the upper vanner which runs about 2 per cent. lead run down to the settling tank behind the lower vanners.

In the lower vanner room there are four 6 feet and one 4 feet Frue Vanners. The feed from the outside overflow tank feeds in at the end and the tailings from the upper vanners feed in a different point along the tank and are therefore principally handled by some separate vanner.

The overflow from the feed tank runs into the tailing launder and helps to flush it out. The lower vanner concentrates are wheeled out by wheel-barrow and dumped in a pile preparatory to loading. The tailings which are expected to be kept $1\frac{1}{2}$ per cent. go direct to the river.

Samples of vanner concentrates which should be between 50 and 60 per cent. lead, and of the direct and middling tailings are shown in bottles 25, 26 and 27.

The slime mill is run by a separate turbine and the speed of the vanners may be varied to suit the feed. Although the tables are also run with this turbine, the speed is altogether regulated to suit the vanners. The speed varies between 200 and 210 R.P.M., the speed depending in the percentage of zinc, a very heavy zinc load necessitating a high speed.

The concentrates from the mill are run into bins and allowed to settle, the overflow water passing into the mill settling tank. There are two ore bins and two slime concentrate bins, the feed being turned into one of each pair while the other is being cleaned out. The ore is wheeled out, weighed, run and dumped into freight cars in which it is transported to the smelter.

The mill is exceptional in not having the fine jig middlings ground

in a Huntington mill. Most of the mills in the canyon have one or more Huntingtons. The need of one was felt however when a heavy feed was put on the mill, as the feed on the round tables was much too coarse causing a large loss in the tailings, the tailings running sometimes as high as 12 to 14 per cent. This also had the effect of throwing a heavy coarse feed on the middling vanners which was hard to handle since the latter had to be run at the same speed as was required to handle the direct feed which would not be appreciably affected. As the middling feed was the richer, however, when the tables get loaded, which they did sometimes to the depth of 2 inches, everything of course being then washed into the middlings, the vanners were speeded up to 220 to 230 and a very fair separation was made under these circumstances. The plans for installing three Huntingtons were in process of completion just before I left. Experiments with the Halet table were also to be made, looking to a substitution of these for the round tables. Most of the other mills use Wilfley tables for treating a size between that treated by the round tables and the vanners. Wilfley tables had been used in the Frisco mill but had been discarded in favor of an additional number of vanners.

The motive power is obtained by tapping the creek which runs past the mill about a mile and a half up the canyon and leading the water by a flume to a point above the mill. From the penstock the water is led down by a 6 inch pipe to the Pelton water wheels, the feed pipes being connected although the turbines are separate. The mill may also be connected to an engine driven by steam when the water is too low in the creek. It is usually necessary to use this engine from September to March.

The mill comprising a 10 x 20 inch crusher, 5 rolls, 9 coarse jigs, 16 fine jigs, 12 round tables and 15 vanners is designed to handle 750 tons every 24 hours. In practice however, good results are not obtainable with a larger feed than 600 tons. With this amount of feed per 24 hours the mill can separate the valuable material from the waste with only a loss of $\frac{3}{8}$ per cent. in the mill tailings. A staff of seven regular mill men, comprising a crusher man, a roll floor man, two jig men, one vanner man and shift boss is employed to operate the mill.

I might just briefly compare the above practice with the German practice in similar ores as carried on at Clusthal in the Hartz for the description of which I am indebted to a report by Mr. C. Van Petersdorff in the Report of the California State Mineralogist for 1890. The chief differences are:—

FIRST.—That in the German practice there is an elaborate preliminary hand-picking which with our high priced and non-interested workmen is not done extensively on this side of the Atlantic. At Clusthal for instance seven separate products were made by hand picking and each of them had a separate treatment. At the Frisco everything was put through the mill except when, as sometimes occurred, they were able to ship crude ore.

Again separation by sizing is carried on on much smaller material at Clusthal than at the Frisco. At the former establishment after an hydraulic separation, getting rid of the slimes, the coarse product was sized down as low as 1 m. m. while everything below 5 m. m. was sorted hydraulically at the Frisco. There is also a difference in the treatment of the middlings. Those at Clusthal are recrushed by stamps, while at the Frisco, at least I suppose this is true by now, the middlings are recrushed by Huntington mills. The superiority of the American practice in this respect is however being recognized on the other side, I believe, and Scrantz mills, which are very nearly equivalent to Huntingtons are being installed instead of the stamp batteries. Finally in the general arrangement of the mill it is also noticeable that

while at the Frisco the machines of the same kind are grouped together on one floor, viz., the rolls on the roll floor, the jigs on the jig floor, etc., the practice at Clusthal is to have the group of machines for any one operation on the same floor, i. e. coarse crusher, screens and jigs on one floor, the fine crusher, screens and jigs on the next floor, etc., this latter arrangement does away with the elevation of the middlings but is very wasteful of "drip."

In conclusion permit me to say, gentlemen, that any opinion I have offered and any statements I have made in the course of this paper are based only on personal observations as a student workman in the mill, and while visiting other mills in the canyon, and on opinions gleaned in conversation with other mill men, therefore if I have made mistakes which are apparent to gentlemen present who have doubtless a more intimate acquaintance with the district or with the particular concentrating propositions presented, I trust you will pardon me.

The Determination of Lead in Ores by Fire Assay.

By W. LAY, A.R.S.M., Kimberley, B.C.

The fire assay, dependent as it is upon many variables, is at best, an approximation only to the ultimate lead contents of the ore, and is strictly speaking applicable only to pure ores of medium or high grade. But since upon it smelting charges are based, and consequently ores bought and sold, in the great generality of cases admittedly inexact as it is, the method has been widely adopted.

In many institutions for the instruction of assaying, it is customary to start the beginner with dry lead assays, the prevalent idea apparently being that it is a somewhat elementary task, whereas all practice tends to point to the fact that the successful conduct of that operation requires considerable experience, and that it is in reality one of the most difficult of the fire assays. Moreover, text books on the subject of assaying seem to be singularly reticent regarding the difficulties likely to be encountered, and of the manner in which to cope with them. In view of these facts, the following inquiry into the sources of error in the fire assay, being the outcome of a somewhat wide practical experience with many and varying grades of lead ores, may be of interest.

In the first place errors may arise from:—

1. *Loss of lead* owing to
 - (a) Volatilization.
 - (b) Lead passing into the slag in chemical combination.
 - (c) Spiriting causing mechanical loss.
2. *The Presence of certain elements in the ore*, which under the conditions of the assay are also reducible, and pass into the button of lead simulating that metal.

The first source of error—loss of lead from the three causes mentioned, may be guarded against, and may be reduced to a minimum, by taking due and necessary precautions, but should elements be present to any extent in the ore, which like lead are reducible, the fire determination, upon the face of it, breaks down altogether, and wet analysis must be resorted to. Zinc, copper, tin, antimony and bismuth, are susceptible of reduction in a similar manner to lead, but of these only zinc, copper and antimony are likely to be met with in lead ores, as a rule, and copper and antimony only will be of material effect (unless the amount of zinc present is excessive), and inasmuch as copper will be readily detected prior to assay, antimony will be likely to cause most trouble, and should the resulting lead button show the slightest signs of brittleness upon assay of an ore, a wet determination of the lead contents should be made. The following assays show that antimony when present even in small quantities is not

volatilized to any extent, but passes mainly into the lead button, and to a lesser extent into the slag, since the conditions, which favour accurate estimation of the lead, also promote the more or less complete reduction of the antimony.

The fusions were made in a muffle, in a reducing atmosphere. Charges thus:—

Ore—10 grams, Flux—30 grams, Salt cover and 2 iron nails.	}	Flux composed thus:— Bicarb. soda—16 parts, Carb. potash— 16 parts, Borax—8 parts, Flour— 5 parts.
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DURATION OF FUSIONS 1 1/4 HOURS.

Per cent. Antimony in Ore.	Per cent. Lead in Ore wet analysis.	Per cent. Lead in Ore fire assay.	Condition of button resulting from fire assay.
0.63	54.2	53.6	No evidence of brittleness. Slightly brittle.
0.90	55.7	54.7	
1.35	55.3	54.9	Buttons crack under the hammer.
1.80	54.8	54.8	
2.70	50.3	51.0	
3.60	47.7	48.5	

Since then it is impossible to guard against this latter source of error, it would seem that attention should centre upon the loss of lead from the various causes mentioned, and upon the conditions affecting that loss.

First as regards loss of lead:—

Loss by volatilization.—While lead and its compounds are sensibly volatile at comparatively low temperatures when exposed to the air, yet it must be borne in mind that, in process of assay, the reduced lead, and that still undergoing reduction, are covered with slag and so protected, while the temperature during the greater part of the operation is low, hence it would seem improbable that a material amount of lead would be volatilized provided the proper conditions prevailed.

Loss in the Slag.—Whatever properties the flux used may possess, a certain chemical loss of lead is bound to occur in the slag, since complete reduction, under the most favourable conditions, cannot be effected. The analysis of slags from a number of very carefully conducted assays showed a mean percentage of 0.62 per cent. lead. Further investigation showed that this chemical loss largely increases with the temperature, and that in cases of improper firing, it may amount to almost double this last figure.

The following assays will illustrate the loss in the slags as compared with that by volatilization. The assays were made in precisely the same manner, as regards amount and proportion of the charges of ore and flux, and duration of fusion as those above quoted:—

Per cent. Lead in Ore wet analysis.	Per cent. Lead in Ore fire assay.	Difference between wet and fire assays in units of Lead.	Per cent. Lead in slag wet analysis.	Weight of slag from fire assay (approximate)	Units of Lead accounted for in slag.
50.9	49.2	1.7	0.62	28 grams.	1.7
52.2	50.7	1.5	0.53	28 "	1.5
52.7	51.1	1.6	0.47	29 "	1.4
62.6	61.0	1.6	0.53	28 "	1.5

It would seem from these analysis that the greater part of the missing lead can be accounted for in the slag, taking the difference between the wet and fire determinations as representing the ultimate loss. The loss by volatilization in these instances must therefore of necessity have been not appreciable.

Loss from Spirling.—This mechanical loss of lead caused by too high initial temperature is probably the greatest source of error—a conclusion justified by the evidence afforded both by observation and experiment.

The following are typical of the loss which may be occasioned by this cause:—

Charges of ore and flux same as before:

Per cent. Lead in Ore. Time of fusion 1 1/4 hours.	Per cent. Lead in Ore. Time of fusion 3/4 hour.	Per cent. Lead in Slag by wet analysis.
53.6	51.0	Slags average 0.74 per cent. Pb.
54.5	52.9	
51.0	50.1	
49.4	47.1	
61.2	59.3	
53.0	51.0	

Second as regards the conditions which affect the loss of lead.

The loss of lead from the various causes considered, may be said to depend essentially upon, and to be governed by the following factors:—

- (1). The temperature and duration of the fusion.
- (2). The atmosphere, neutral reducing or oxidizing in which the fusion is conducted.
- (3). The nature and properties of the flux employed.

Temperature.—The great secret is to start the assays at a low temperature. For the first 45 or 50 minutes, it should not exceed that of incipient fusion of the charge—dull redness (say about 550° C.), and should then be gradually raised till at pouring it about equals that of a gold assay. The total time of the operation should be from 1—1 1/2 hours—certainly not less than 1 hour—carbonate ores not requiring so long for their reduction as sulphides.

While a low initial temperature is a *sine qua non* of success, as guarding against loss of lead by spiriting and a minor loss by volatilization, yet on the other hand the temperature during the earlier stages must not be too low, otherwise the necessary reactions will not have taken place, and the right conditions will not have been arrived at when the temperature is raised, and the results will be vitiated.

The atmosphere in which the operation is conducted should be reducing. In the case of a muffle furnace, this may be attained by placing a few pieces of charcoal in the front part of the muffle, and a more even temperature throughout the muffle is also thereby engendered. This measure ensures conditions which combat volatilization of lead. Protected by a layer of slag and surrounded by an envelope of reducing gas, loss from this cause is minimized. Arsenic, when present in any considerable quantity would seem to promote this loss.

The Flux.—The essential features of a good lead flux may be stated thus:—

- (1). It must be readily fusible to protect the lead from volatilization.
- (2). It must contain excess of carbon.
- (3). The amount of borax present must not be excessive, otherwise lead will tend to pass into the slag chemically combined as a borate.
- (4). It must act as a desulphurizer.

The following well known lead flux composed of:—

Bicarb. soda.....	16 parts.
Carb. potash.....	16 "
Borax glass.....	8 "
Flour.....	5 "

When used in the proportion of 3 of flux to 1 of ore, with a salt cover and a couple of iron nails in the charge, will be found to give satisfactory results in the case of oxidized and sulphide ore alike.

Upon an average, in the case of ores of medium and high grade, free from interfering elements, the wet assay exceeds the dry by about 1.7 per cent., though in some instances the dry assay can undoubtedly be made to more nearly approach the wet.

The writer desires rather to emphasize the fact that the conclusion that in a properly conducted fire assay the main loss of lead is occasioned not by volatilization but by chemical combination in the slag, is outborne by analysis, though he is well aware that it is somewhat at variance with the views of some, who lay great stress upon the volatility of lead, seeming to hold it up as the main source of error.

It may be said in favour of the fire assay that rapid determinations can be made which satisfy many technical requirements, but it must be acknowledged that rapidity in this case is quite incompatible with accuracy. At best the determination is unsatisfactory, inasmuch as while the errors involved may be reduced to a minimum, their total elimination is impossible. It would seem then that these facts argue strongly for the speedy and general adoption of the wet method (with a certain arbitrary deduction) as a basis for settlement in the case of the buying and selling of lead ores, as is the custom with copper ores to-day.

In conclusion, it may be said that the views expressed in the foregoing, have been arrived at by the writer, after making upwards of 10,000 lead determinations in almost every kind and grade of ore, pure and impure, and after he has been checked up by other chemists in the case of upwards of 1,000 samples.

Pioneer Work in The Crows Nest Coal Areas.

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

At the moment of commencing to write, news comes to hand of the sudden demise of Dr. G. M. Dawson, the respected head of the Geological Survey of Canada, and it is imperative that anyone professing to treat upon the subject of this paper should, under the sad circumstances, pay a tribute to the value of those splendid services, which he so faithfully rendered to the country; and especially is it fitting that I should do this because he was the first authority to recognize the value and possibilities of these coal areas. He passed through the country in 1881, and although there was only time for a cursory examination, his keen perception, and intuitive scientific genius enabled him to prepare a monograph, the accuracy of which has been fully established by subsequent detailed surveys; and for the geological data upon which this paper is based, I wish to acknowledge my indebtedness to Dr. Dawson's reports, which were of the greatest assistance to me, when first opening up the coal seams for active operation.

But whilst Dr. Dawson may be called a scientific pioneer of the Crows Nest Pass, and the first to realize its enormous importance and value, it is right here to tender a meed of praise to the men who first discovered the existence of coal and, especially, to the one man whose name is most intimately associated with this district. It was in the late seventies that Mr. William Fernie, in company with his brother, whilst prospecting near Martin Creek for gold first noticed coal float in the bed of the streams, and was led by this to make a more careful examination of the steep mountain sides, and finally to discover at an elevation of about 6,000 feet the outcrop of a 30 foot seam of coal. Although this was Mr. Fernie's first experience in dealing with anything but the precious minerals, he was shrewd enough to conclude that it might be a find of considerable importance, and from that date until 1896, when the Crows Nest Pass Coal Co. was formed, with Mr. Fernie as a Director, in season and out of season, through good and evil report, in the face of opposition—which at times threatened to swamp the undertaking—he never ceased to labor and scheme for the building of a railway and the development of mines; devoting all his time and pledging his last dollar, and it is only a fair tribute to his British pluck and energy to say, that but for the tenacity and ability

with which he clung to his pet scheme, there probably would not have been either a Crows Nest Railway or coal mine to-day. Mr. Fernie has had a remarkable career, of which this, possibly the most important coal project in the world, is a fitting climax. The son of an English country doctor, educated and trained to follow his father's profession, at twenty he ran away to sea, sailed nearly round the world, reached San Francisco in the early fifties, became a gold miner there and, subsequently, in British Columbia, being one of the earliest pioneers of the Fraser River placer mining, and afterwards going with the rush into the Cassiar and Caribou country. Attracting public attention he became Gold Commissioner and Government Agent, and for some years ruled the Indians and miners with a rod of iron in the Fort Steele division of East Kooteney, winding up his career in connection with the Crows Nest coal areas. To-day, at sixty five years of age he has retired to enjoy a well earned rest, and it is some satisfaction to know that the reward of his industry has furnished him with ample means to do so.

I have dwelt on personal matters to this extent because it is not always that the men who deserve credit in connection with onerous and difficult mining enterprises get it, and there is certainly no calling in which high qualities of character are more often demonstrated.

The coal areas referred to lie longitudinally upon the western side of the first range of the Rocky Mountains near the boundary, which separates British Columbia from Alberta. Coal seams are found in the Cretaceous formation, and are inter-stratified principally with sandstone and shales, super-imposed upon carboniferous limestone, and below this proceeding westerly we find the Cambrian rocks. The extent of the coal field is theoretically ninety miles long, running north from the south fork of the Elk River, but the actual limit of the coal basin, which is undisturbed, and can be counted upon to yield workable coal, extends only a distance of forty miles north of this point where the limestone comes to the surface, and the coal measures are so broken up and disturbed as practically to terminate at a point four or five miles north of Michel Creek. The exact southern limit is from four to five miles south of the North Kootenay Pass. The western limit of the basin is defined by the Elk River, all along the west bank of which the limestone outcrops and forms precipitous mountains. The eastern limit is determined by a line running north and south, at an average distance of nine to ten miles from the Elk River. Allowing for the limestone areas which have been eroded between the various mountain peaks in the creeks, it is probable that the nearest estimate obtainable of the area of workable coal is not less than 150 square miles, and Dr. Selwyn, the late head of the Geological Survey, computed the available coal to each square mile at 24,976,000 tons.

The coal measures lie in a long and narrow synclinal trough, the strike being due north and south. The western outcrops upon the mountain sides are at an elevation of from 1000 to 2000 feet, and upon the eastern side near Martin Creek, from 500 to 1000 feet above the level of the trail. As the creeks are traversed they gradually rise into the measures and the outcrops are exposed on the level of the trail which gives the easiest possible access. The question of the exact extent of this basin will be determined by the geological survey, which is now being conducted, but the limits here given are probably correct. It is possible that there may be areas of detached coal between the limestone ridges a considerable distance north of Michel Creek, but there can be no large area favourable for working outside the basin indicated. The southern boundary is easily determined by the character and pitch of the rocks, all of which are much disturbed, and are frequently flexed with over-turning folds to the east. Along the trail which crosses the North Kootenay Pass the Cretaceous rocks are found, dipping to the north at an angle of 30 degrees, and at this point there is also a large fault with a throw to the east of not less than 1,500 feet. Another large fault crosses the River Elk near the bridge, so that while

the coal seams have been found outcropping in the south fork or Wigwam River they cannot extend any considerable distance in that direction. Dr. Dawson estimated that the exposures in the Crows Nest Pass indicate a total thickness of 7,000 feet of Cretaceous measures and 9,610 feet of limestone, and it is worth noting that his estimate at the Crows Nest summit and the North Kootenay Pass is the same.

In connection with the geological formation of this coal field, there are two interesting problems, one of which has been solved, and the other is in a fair way to solution. The first only became a problem in 1893, when disregarding the opinion expressed by Dr. Dawson in his reports of 1882 and 1885, the theory was broached that this coal basin contained two distinct series, which were designated the Elk River series and the Martin Creek series. The former was declared to contain twelve seams, with a total thickness of 151 feet of coal, and the latter twenty seams with a total thickness of 132 feet. This has been proved to be an error: there is really only one series. The exact number of seams has not yet been ascertained, as the areas are not fully prospected, but the result will be to cut down the workable seams of bituminous coal to something like eight or ten, and to reduce the aggregate thickness to 120 feet. In the former computation a large number of seams of bituminous shale were included, under the head of "Cannel" coal, but no true "Cannel" has been discovered, and these can be eliminated. In this connection it is worth quoting the opinion of Dr. Dawson in his report of 1885, at page 76, B. where he says: "The horizon is probably identical, and the general effect of the section is that of a wide, low synclinal, there is also every reason to believe that the coal bearing horizon here met with is the same as that discovered east of the Crows Nest Lake, and though the exposures are few near the main or water-shed summit, it is not improbable that the same horizon may be found there occupying the trough of a synclinal mid-way between the upper summit and the crossing of the east branch of Michel Creek."

The second problem mentioned has reference to the possible extension of these coals on the eastern side of the Rockies, in the direction of what is known as the Gap. As the Cretaceous formation is found here great hopes have been expressed that the same class of coal would be discovered. These hopes have not yet been fulfilled, although excellent coals have been found. At Livingston a seam 6 feet 6 inches thick has been prospected by tunnelling to a depth of several hundred feet, and further south near to the Mormon settlement at Cardston, a number of sections have been taken up, which contain outcrops of valuable coal, on the banks of the St. Mary River. This coal shows an analysis 4.05 per cent. of ash, and 91.20 of volatile combustible matter and fixed carbon, and by fast coking yielded a firm, coherent coke. It is too soon yet to pronounce definitely upon how it will compare with the Fernie coals, but further exploration in this direction will be carefully watched.

The pioneer work in the Pass, with which the writer is more closely identified followed that dealt with above, and commenced in 1897. Called upon to open up these seams in a new country and amid conditions the most unfavourable, it was at the time no easy task. The location decided upon for first openings, Coal Creek, was then 105 miles from the nearest railway station, Fort Macleod, and forty miles from the Crows Nest summit. The country all along the valley of the Elk was heavily timbered with magnificent belts of tamarac, fir, spruce and cedar running as high as 300 feet, and with trunks six to nine feet in diameter. The under growth was dense and there was no clearing and no passage except the Indian trail. The difficulty of commencing mining operations was greatly increased by the fact that these could not be delayed until the railway was constructed, the company being under an obligation to furnish coal by a given date, in order to secure

their land grant, so it became a race between railway and coal mine. The railway construction was commenced at Fort Macleod in July, 1897, and the prairie road, as far as the summit, was available in March, 1898.

Meanwhile operations had been commenced in the coal measures at Coal Creek in November, by the gang of men who were taken in to assist in prospecting. The first miners employed arrived in December, 1897, and were Welsh-men, they pitched their tent and hung out a sign claiming to be the pioneer coal miners of the Pass. The railway did not reach Coal Creek until August, 1898, and meanwhile supplies of every kind had been hauled, at first from Fort Macleod and afterwards from the summit over a "tote" road, the like of which has probably never been seen in the west. Much of the material had to be "packed" in, and a "pack train" of ten to twenty horses was kept constantly at work, the cost, when roads were at their worst in the spring, running as high as five cents a pound from the summit to the mine. This was due largely to the execrable character of the road, which after leaving the summit, and especially along the low lying valley of the Elk River was a simple clearing over-soil consisting of five to six feet of alluvial mud. The character of the road can best be imagined from the experience of the writer, who, with a first-class team never made the journey from the summit to Coal Creek, a distance of thirty-three miles in less than two days, and often required three. In spite, however, of these drawbacks, when the railway reached the mine there was a stock of 10,000 tons of coal banked out, and more than 4,000 feet of heading had been driven. Plant and machinery of every kind had been so ordered as to reach the mine as soon as the railway was open, and 100 car loads of material was waiting at various points, between Winnipeg and Macleod to be pushed through when the road was ready. With a plentiful supply of timber near at hand it was possible to get all bridge and trestle work hewn and hauled into position, and within four months of the railway reaching Coal Creek everything was in running order, there was a daily output of 300 to 400 tons of coal and 50 coke ovens were producing coke.

As the coke industry was the "raison d'être" of the establishment of these works it is appropriate that I should refer to the quality of the coke although it is not necessary three years after it has been in the market to say anything in its praise.

I will simply remark that regarded in all respects there is no other coking coal in the world which is equal to it, even the celebrated Durham coal which furnishes the next best coke is inferior in purity.

I append the following comparative analysis of coke:—

	Carbon.	Ash.
Crows Nest, British Columbia.	91.97	8.03
Crested Butte, Colo.	89.00	11.00
Cardiff & Sunshine, Colo.	87.18	12.82
Belt Montana washed coal.	91.00	9.00
Connellsville, Pa.	86.88	11.54
Trinidad, Colo. washed coal.	85.00	15.00

Another analysis of a seam which has not yet been worked, but of which I took a sample, shows even better than this, viz., carbon 95.98, ash 4.02. An average analysis of the raw coal gives fixed carbon 73.04, volatile matter 21.13, water 2.75, ash 3.08, the yield of coke varies from 68 to 73. To make one other comparison let us take two of the most celebrated Welsh coking coals, the Park, which gives in coke as follows: Carbon 89.72, ash 8.50, and the Ogmores patent coke made in the Coppee ovens: carbon 92.26, ash 7.74. From this it will be seen that Crows Nest coke does not suffer by comparison with the very highest standards. The effect of putting such a coke as this upon the market is well known to most of you, in that it has entirely replaced Welsh and Connellsville coke, which had to be imported at enormous cost to help out the very inferior local coke, which was previously

CROWS NEST
COAL AREAS B.C.
1893.

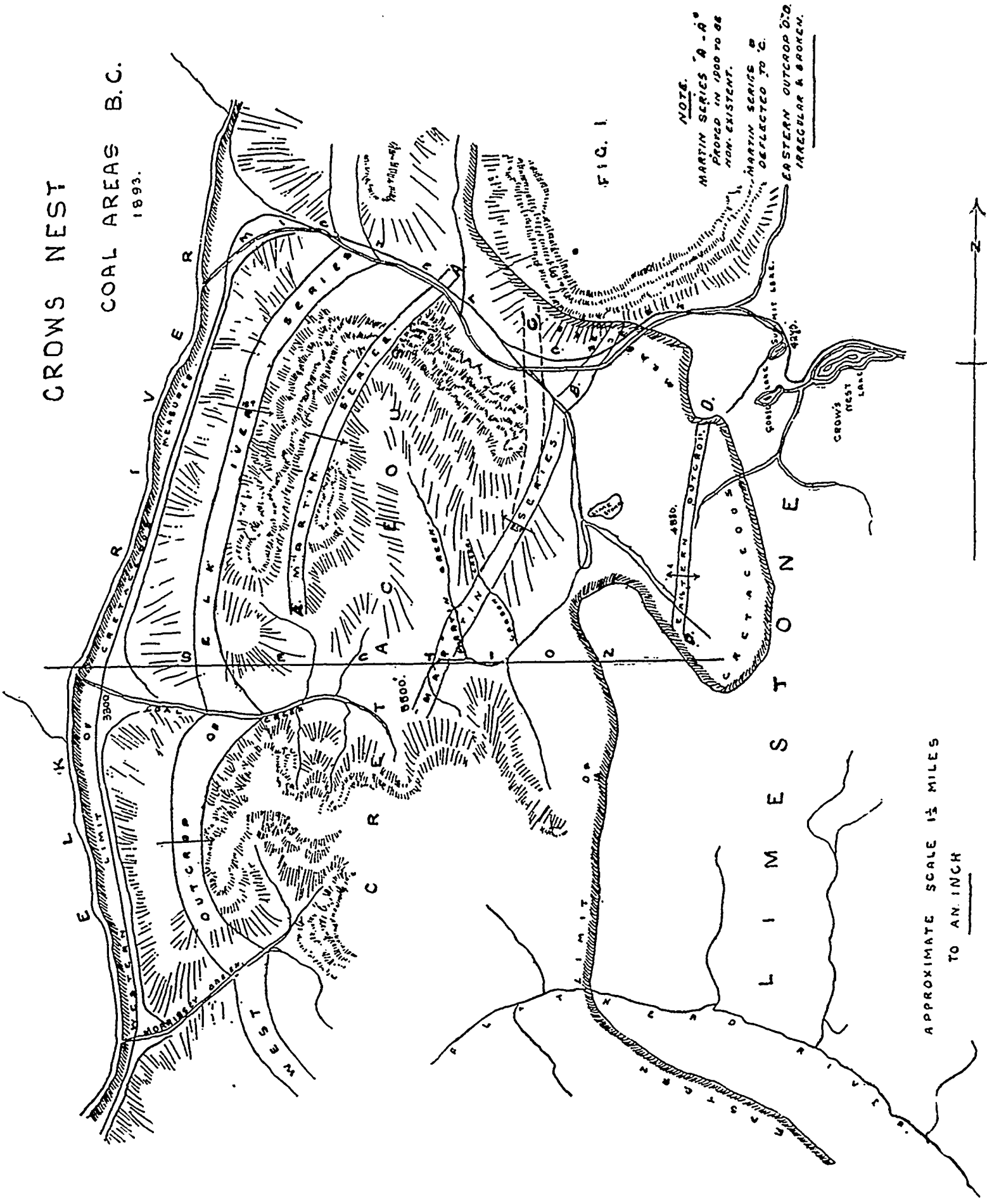


FIG. 1

NOTE.
MARTIN SERIES A-A'
PROVED IN 1900 TO BE
NON-EXISTENT.
MARTIN SERIES B
DEFLECTED TO C.
EASTERN OUTCROP D'D
IRREGULAR & BROKEN.

APPROXIMATE SCALE 1 1/2 MILES
TO AN INCH



obtainable. The cost of this imported coke ranged from \$15.00 to \$20.00 a ton, laid down at the smelters, whilst Crows Nest coke costs about \$7.00, and the reduction in smelter charges already effected has been largely due to this factor. The coal, whilst not an ideal one for domestic purposes, is still far better than any other obtainable in the West, and with a strong draught burns admirably in stoves, but is not satisfactory in open grates, as it cakes and becomes dead. For black-smithing purposes it is an ideal coal on account of its great heat and its comparative freedom from sulphur. For steam getting it has demonstrated its superiority to any other western coal. It is worth noting here that two years ago the British Admiralty took 500 tons at Victoria, for a test upon the Admiral's Flagship which was just then starting for England by way of the Horn. So satisfactory was the result that I received a cablegram from the first calling place, Matanzas, stating that the Admiral had found it to give much better results than anticipated, and was so enamoured of it that he had cabled to the Lords of the Admiralty requesting them to arrange for its use on the Pacific Coast. When development has proceeded further and a larger tonnage is available there is no doubt that the English and American Pacific squadrons will use this coal. The question of a general market need not be discussed, beyond saying that, with such an unlimited supply there should be no difficulty in meeting all requirements, and I am satisfied that the quality of the coal and coke is such, that it must dominate the western market entirely. It is as indispensable to our American cousins across the border as to Canadians, and I anticipate that in less than five years this coal field will supply the entire consumption of coke in British Columbia, Montana and Washington Territory, and probably 50 per cent. of the raw coal required. Allowing only for a moderate development this would mean a daily output of not less than 10,000 tons of coal, and possibly more.

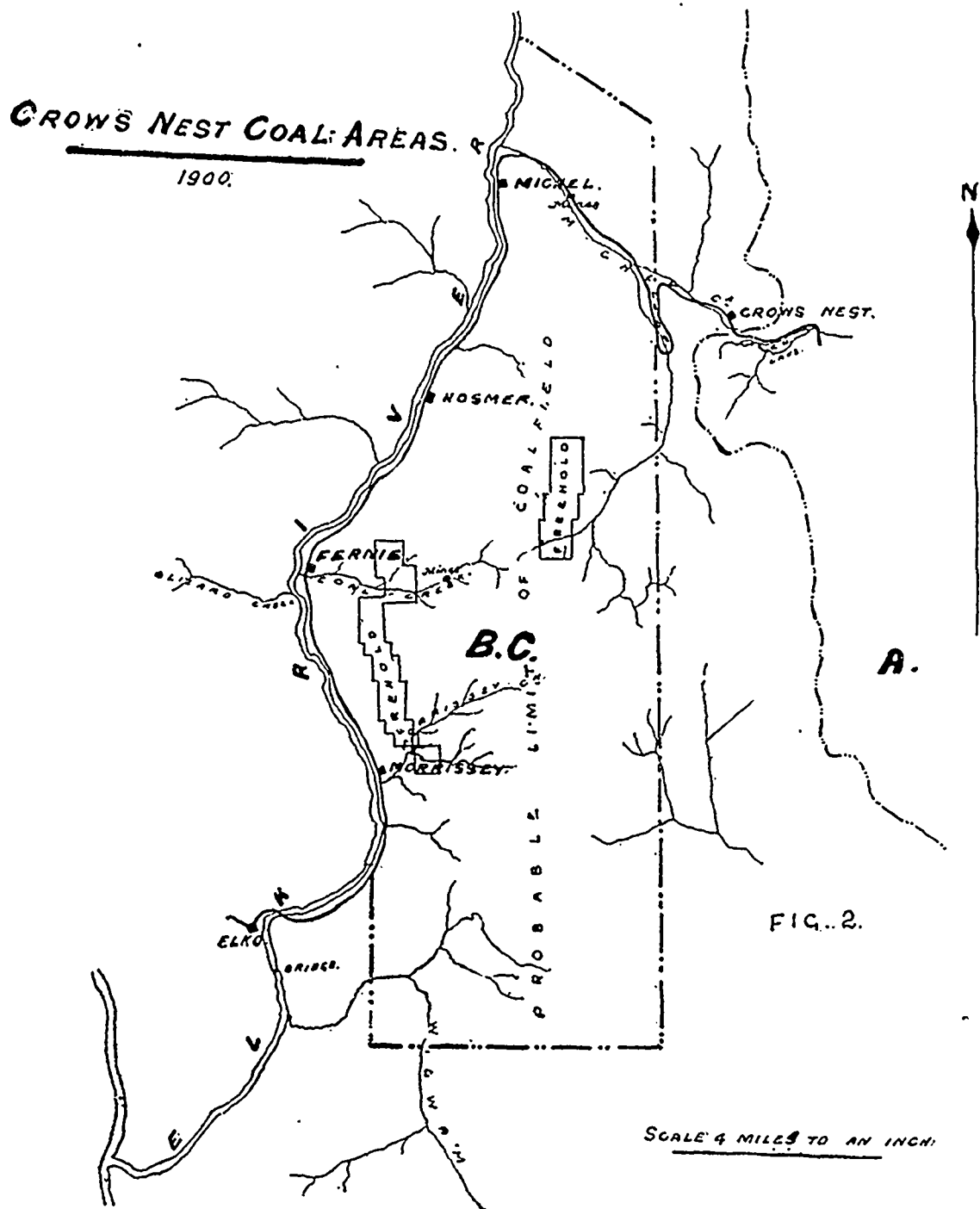
We must glance in passing at the conditions on which this coal-field is occupied, and the safeguards which the legislature has wisely enacted in the interests of the country. The local legislature of British Columbia and the Federal Parliament, by legislative enactment, have made over to the Crows Nest Pass Coal Co. by way of subsidy for the construction of the railway, 250,000 acres of coal lands, of which however, 50,000 have to be ceded to the Government to be disposed of as they see fit in the interests of the country, in order to secure an adequate supply of this coal to the public at a reasonable price. The protection thus sought to be given is a very necessary one, and the clause embodying it is carefully drawn, for it explicitly states that the 50,000 acres shall be of "equal value as coal lands with the residue of the coal lands." These words "of equal value" practically determine not only the question of quality in the coal but of location and access. The only practicable entry to the coal seams of the Crows Nest basin is in the creeks, because on the mountain sides the outcrops are too high and except in the creeks there is practically no flat-land at the base of the mountains upon which to erect the necessary works. All that is necessary, therefore, is that the Government shall see that this clause is complied with, and the selection judiciously made in accordance with the spirit of the provision.

I will conclude by briefly describing the appliances, plant and machinery installed at Coal Creek for the operation of the first mines opened there. I may state that the mines are five miles from the town of Fernie, the latter being situated on the banks of the river Elk. There is an electric power plant, which furnishes power for lighting the surface and mines, coal cutting, pumping and hauling. It is driven by a Polson horizontal engine, 16 x 16 inches, at a steam pressure of 100 lbs. The dynamo, is driven by a twelve inch belt, and runs 600 revolutions per minute. It is a direct current, constant, potential dynamo, 150 horse power, over-compounded 10 per cent. It supplies pressure on the line at 220 volts. The capacity of the dynamo is 250

volts or with no loading 400 amperes. There are two Polson locomotubular boilers, supplying steam at 100 lbs. pressure. The main haulage is conducted upon three systems, necessitated by the exceptional undulation of the floor, and I may here remark that this is one of the greatest difficulties to be contended with in mining these seams. It is not uncommon to start with a normal pitch of fifteen degrees, find this flattening out gradually until the coal becomes level, this pitching down again at twenty degrees. This actually occurred in the first main dip and of course disorganized the haulage. Upon the main level haulage is operated for 3,000 feet by a Jeffrey electric locomotive of seventy horse power. The weight of the locomotive is 2,000 lbs., there is an over-head wire and the haulage works on the trolley system. This installation has been thoroughly successful and has worked upon an even steeper grade than it was designed for. Upon a grade varying two to four degrees against the load it has hauled out 1,000 tons in twenty four hours. The secondary haulage is supplied by an electrically driven stationary hoist of twenty-five horse power. It is geared between the armature and the drum at a ratio of one in twenty-five, which gives the rope a speed of two miles an hour. This hoist hauls up a main dip of an angle of fifteen to twenty degrees against the load. It is stationed 1,500 feet inside the mine and works satisfactorily. From the working places to the mechanical haulage the coal is conveyed in cars drawn by horses. There is an installation of coal cutting machinery consisting of two electrically driven coal cutting machines, of the chain type, supplied by the Jeffrey Co. These have not been as successful as expected owing entirely to excessive grades and the irregularity of the pavement which makes it difficult to move them from stall to stall, but when in operation they have given the best results and upon easier grades have demonstrated their capacity. An installation of compressed air is now being made for the purpose of introducing percussion cutters which will probably be more suitable in such steep seams. The method of working adopted is the "pillar and stall," it being impossible to resort to longwall under such an enormous cover. It has been found necessary to leave very large pillars and in spite of this the crushing has been sufficient to close one section of workings. It must be remembered that this coal is exceedingly soft and friable and does not stand well, even where the pillars are left of exceptional size. It may yet be necessary to resort to square work, the system generally in use in the Old Country in thick seams.

At the present time the output at Coal Creek is from 1,200 to 1,400 tons a day, and is expected to be largely increased this year. It may be worth noting that the output in 1898 was about 60,000 tons; in 1899 100,000 tons; in 1900 240,000 tons.

The ventilation is produced by two of Murphy's reversible fans, yielding respectively thirteen, and seventy thousand cubic feet of air per minute. These however, were only installed temporarily for development work. There is a large Chandler fan, fifteen feet in diameter, capable of producing 300,000 cubic feet of air per minute, with a water gauge of three inches, and other installations of ventilating machinery will shortly be made in consequence of the large quantity of gas yielded by the workings. In this connection it should be noted that the altitude of the mine, about 4,000 feet, gives very low barometer readings, varying from 24 to 25 inches; and during atmospheric depressions the pressure per square inch does not exceed twelve pounds. Add to this the fact that a large quantity of coal dust is produced, and it will be seen that great care has to be exercised in connection with the ventilation. A thorough system of watering has been introduced with excellent results. Very little pumping is required in the mines at present and the only machine in use is a Tripley pump, electrically driven. It has a three horse power motor, 220 volts, 400 amperes, and is geared direct to the crank shaft, at a ratio of twenty to one. The diameter of the pump rams is three inches, length of stroke



three and a half inches, number of strokes sixty, capacity seventeen gallons per minute.

Upon the surface in addition to the power plant, already referred to, there is a large and costly trestle, which had to be built from one side of the creek to the other, 1,000 feet, in order to give access from the workings to the screen house; it has an elevation of thirty feet, with four parallel tracks, and the locomotive runs right up to the dump. There is a large screen house containing a modern equipment of shaking screens, twenty feet long by five feet wide, with a working speed of 100 strokes per minute by six inch stroke. The inclination of the shaker is seventeen degrees dip towards the discharge. The large coal passes over this screen to a travelling picking belt, sixty feet long and five feet wide, which moves at the rate of forty feet per minute and discharges all the large coal into the cars. Nuts pass through the first screen and fine through a second screen, so that there are three divisions of coal; all the fine is taken to the coke ovens. The tippler, which plays an important part in dealing with the whole of this output is a Mitchell. It is capable of dealing with 2,000 tons in ten hours, and is so arranged that the falling cars release the wheel grips of the empty car; after it has

been emptied they run forward down a five per cent. grade for a distance of fifty feet then back on another track, falling five per cent. for the same distance to the side of the tippler. Having reached this point by gravity it is taken hold of by a "creeper chain," which lifts it up a fifteen degrees incline to a sufficient height to permit it again to run forward by gravity to the empty track, ready for attaching to the locomotive. The whole of this plant which is operated by an engine 12 x 12, the motive power being conveyed by chains and sprocket wheels, was manufactured by I. Matheson & Co., of New Glasgow.

The surface tracks are arranged in the "gridiron" fashion" being parallel and connected both at the extreme elevation and at the lowest point with the branch line. When a train of empty cars is brought in it is pushed above the top switch and left there; the cars are then allowed to fall by gravity, as required, and are diverted by the switch to whichever track is necessary. Afterwards they fall by gravity also below the screen house to the siding where the out-going train is made up, in this way no mechanical power whatever is required on the surface. The grade of the siding is .75 degrees.

The coke ovens are erected five miles from the mine, at Fernie,

upon a large plateau. At present there are 312 in operation. There is a special arrangement of tracks and bins to ensure the most economical handling, and as a matter of fact from the moment the coal is loaded into the cars at the working places in the mine until it is raked out of the ovens in the form of coke it is never touched by hand. It falls automatically from the tippler to the screen, is separated and passes into the railway cars, falls by gravity from the screen to the out-going siding, is hauled by a locomotive to the side of the coke ovens, where it is discharged through bottom door hoppers into a large bin, with a storage capacity of 5,000 tons. From the under side of this bin a low level track passes, with a slight falling grade to the top of the coke ovens and an electrically driven lorry carries the coal the full length of the ovens and discharges through a side chute into the holes. The ovens are of the ordinary bee-hive shape, twelve feet in diameter. They are placed in double rows, and the railway track runs between each set of ovens at a distance of about thirty feet from the doors. The average charge of coal is 6.5 tons (of 2,000 lbs.); the production of coke per charge averages 4.50 percentage, in coke 68 per cent. Time of burning seventy-two hours, average output for each oven per day 1.5. The

population of nearly 2,000 people, with a water works system, electric lighting for the streets and houses, good side-walks and a prosperous community.

This sketch is only intended to give a general idea of the opening up of a new concern in what has been called the "Wild and Woolly West," but which from my experience I would be disposed to call the "Wild and Woody West." The Crow's Nest Pass coal areas have had a start, and they will well repay for watching. I consider that they will furnish the key to the success of western mining and settlement. They certainly contain one of the most valuable, if not the most valuable, of our mining deposits, and long after those who were engaged in the pioneer work of the section have been called to another sphere, western Canada will be enjoying the fruits of their labours.

A Powerful Hydraulic Dredge.

There is at the present time being built at the Polson Iron Works, Toronto, Ont., the most powerful and complete dredging machine in the Dominion. It is a self propelling hydraulic dredge, which has been ordered by the Government, for the improvement of the Fraser River, and the Pacific Coast ports of British Columbia.

The rapid advancement of this Province has made it necessary to deepen the harbors and channels so that ships of large capacity can navigate with safety, and after long and careful study of the question it was decided to build a powerful dredge of the special type referred to, which although primarily intended for the Fraser River, can steam itself to any point and do a great variety of work.

The dredge has a capacity of 1,000 tons per hour, dredged and delivered at a distance of 4,000 feet. This is accomplished by an immense centrifugal pump about 11 feet in diameter, having a steel suction pipe which can be lowered to a depth of 40 feet. At the end of the suction pipe is a powerful rotary excavator of steel, which can cut or disintegrate any material short of rock or large boulders. This material is then sucked up by the pump with sufficient water to carry it along at the rate of 13 feet per second, and discharged through a pipe. The dredge is arranged so that it can discharge in any desired way, either into scows, or over an embankment, or to a long distance through a flexibly connected floating pipe.

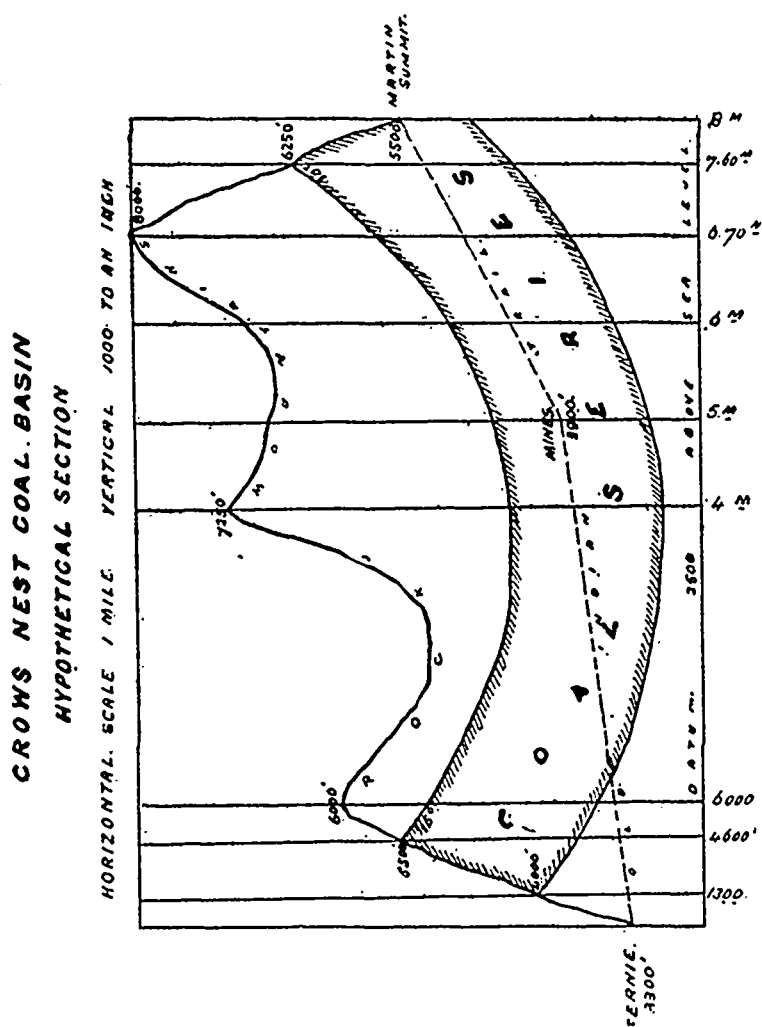
The boilers and engines on the dredge are of 1,000 H. P. The engines are of the triple expansion surface condensing type, with water tube boilers capable of carrying 225 lbs. working pressure.

The dredge is fully equipped for either fresh or salt water service with complete appliances of the latest pattern and fully up-to-date. The hull has a steel frame throughout, and will be shipped from Toronto in sections, and put together in British Columbia, where it will be sheathed with wood.

The main deck of the dredge is entirely devoted to machinery while the upper deck contains accommodation for the officers and crew. Here are several staterooms, separate mess rooms for the officers and crew, kitchen, pantry, bath room, etc. The dredge is fitted with electric light, and has a complete machine shop for making ordinary repairs while in remote places. The dredge is also a complete self-propelling steamboat, with pilot house and steering gear, so that when her work is completed at one locality (which will not take long owing to her large capacity) she can pick up her anchorage and go to another.

The designer of the dredge is Mr. A. W. Robinson, M. Am. Soc. C. E., a Canadian Mechanical engineer, whose work in this line is well known in the United States, and abroad.

It is a matter of congratulation that this dredge is entirely a Canadian production, and that we possess sufficient enterprise, and have the manufacturing facilities to execute the entire work in one



ovens are built of sandstone, which is quarried in the Pass, and are lined with fire-bricks, which have to be imported either from Scotland or Pennsylvania. The cost of these bricks laid down reached the enormous figure of \$70.00 per thousand, and it is to be hoped that a suitable fire-clay may yet be discovered in the Province.

Although not directly a branch of mining it is necessary to say that in such a country, as I found at the Crow's Nest Pass in 1897, mining operations were not the only ones which had to be conducted. A townsite had to be selected, cleared, divided into lots, sold, and built upon. Many of you have been there; to those who have not I may say that in one year from the time that operations commenced the town of Fernie was one of the most prosperous in British Columbia, with a

establishment. The Polson Iron Works not only build the hull, but also the main pump, triple expansion engines, propelling engines, auxiliary engines, and water tube boilers, and in fact the complete dredge, set up and delivered under steam at its destination, ready for work.

The construction of this dredge marks a new era in the method of carrying on our public works in which dredging is required. The modern demands of increased capacity and economy have developed high powered dredges capable of doing from six to ten times the work of the old fashioned machines of a few years ago, and at a fraction of the cost.

Mr. Robinson has also designed a still larger dredge for the St. Lawrence Ship-channel. This dredge is also being built by the Polson Iron works, and will be one of the most powerful in the world. The hull is entirely of steel 160 feet long, 42 feet beam and 12 feet 6 inches deep.

It has a 36 inches floating discharge pipe 2,000 feet long, carried by cylindrical pontoons wholly of steel, which will weigh 400 tons.

Mr. Robinson has been commissioned to examine the seaport channels of Nova Scotia and New Brunswick, with a view to designing a large self-propelling dredge, which will be suitable to the conditions there existing.

Mr. Robinson has designed and built over one hundred dredges of all kinds, and his experience has enabled him to bring them to a high state of perfection. Mr. Robinson is now engaged as consulting engineer on a contract for deepening the Ship-channel of New York harbor, and has just completed a dredge for that work having a capacity of 40,000 cubic yards per day.

MINING IN QUEBEC.

The mill of the North American Graphite Company, near Buckingham, will make an experimental run on a tonnage of graphite shipped from the mine of the Ontario Graphite Company, near Perth, Ontario. The agreement with the Cameron Syndicate having terminated the North American Graphite Company will resume work on its mines.

Mr. Obalski, Inspector of mines estimates the production of Asbestos in Quebec during the year ended 1st January, 1901 to have been:—

1st class crude.....	1,755 tons worth.....	\$210,250
2nd class crude.....	3,490 " "	182,640
Fibre	16,368 " "	326,526
Total Asbestos.....		21,613 \$719,416
" Asbestic.....		7,935 15,948

Commenting upon the industry he says:—

"During the past year, this industry assumed a development which equalled that of the best periods of its history and prices rose proportionately high. First class crude, which was selling last year at \$100 to \$110 reached \$180 to \$200; the second class \$80 to \$100; the fibre \$30 to \$40 and the other qualities in proportion. The demand also greatly increased and necessitated the taking on of a larger number of hands, night work in some cases, and an increase of the capacity of the mills, etc. In addition, mines that had been unworked for some years were re-opened. This prosperity applies to the districts of Thetford, Black Lake and Danville and the best illustration that can be given of it is supplied by the fact that the mining companies voluntarily raised their rate of wages 25 per cent.

The Capelton copper mines were regularly worked and yielded 33,742 long tons of low grade ore worth \$150,152 at the mine, about one half of which was shipped to the United States and the remainder utilized on the spot. The Eastis and Nichols mines were worked during the whole year, employing 270 men, 185 of them underground and the others on the surface, the wages paid footing up to about \$70,000. The Nichols Chemical Company has built a wing to its works for the manufacture of muriatic acid. It also prospected the old Sherbrooke mine, located on lot VII, 12 of Ascot, where ten men have been employed since July. A shaft, dipping 45° to the South East, has been sunk on a 6 feet vein running North East. About 175 tons of ore had been taken out at the time of my visit in October. A small 10 inch vein has also been noted to the South East of the first.

Important deposits of manganese are being opened on the Madelaine Group of Islands, Gulf of St. Lawrence. The development of these deposits is being carried on by Mr. W. G. Tait, of Picton, N.S., who owns the mining rights.

Of the Mica industry Mr. Obalski says:—

The reports received from the companies working in this province give the following summary:

1 1/3" thumb-trimmed....	338,200 lbs. worth....	\$31,860
2 1/3" " "	92,359 " "	18,534
2 1/4" " "	71,332 " "	24,953
3 1/5" " "	25,637 " "	15,706
4 1/6" " "	11,762 " "	11,451
5 1/8" " "	1,995 " "	2,696

Total..... 541,285 \$105,200

Say 270 1/2 tons.

To this figure must be added a certain quantity of mica prepared but not sold, still remaining in the hands of the producers and representing 64 1/2 tons of thumb-trimmed mica of various dimensions but generally large-sized, worth \$33,400 at the average market prices of the year, making a grand total of 335 tons, worth \$138,600, besides about 150 tons of rough culled mica estimated to be worth \$25,000. The prices of thumb-trimmed mica sold by the barrel have varied very much from the beginning to the end of the year, having fluctuated between the following limits:—

	cts.	cts.
1 1/3"	7 to	15
2 1/3"	18 to	35
2 1/4"	30 to	40
3 1/5"	45 to	60
4 1/6"	75 to	1.00
5 1/8" and over from \$1.25 upwards.		

It will be observed that during the year the demand for small sized mica was greater than that for the large sized.

Mr. John J. Penhale, for many years Superintendent for the United Asbestos Company, at Black Lake, and who for the past year or two has been gold mining in Oregon, has returned to the Eastern townships. It is reported that the United Asbestos Company has leased its property to an American Syndicate, the Manhattan Asbestos Mining Company, and that Mr. Penhale will be the manager of the new company.

Important additions are being made to the mining and milling plant at the Union Mines, Black Lake, formerly worked by the Wertheims.

A new company to be known as the Standard Asbestos Company, is being organized to acquire and work the property formerly operated by the Anglo-Canadian Asbestos Company. The Canadian Asbestos Company operates the mines and plant of the Glasgow & Montclair Asbestos Company, under the management of Mr. J. F. Phair, formerly mine manager for the Asbestos and Asbestic Company, at Danville.

At the fourteenth annual meeting of the Asbestos Club held on 25th ultimo, the following officers were elected for the ensuing year: President, R. T. Hopper; first vice-president, R. Stather; second vice-president, R. D. Whitney; secretary-treasurer, D. Wilson; assistant-secretary, W. A. Clearihue.

Great activity in asbestos production goes on at Thetford Mines where the Bell's Asbestos Company, under the energetic management of Mr. George R. Smith, M.L.A., King Bros., under Mr. B. Bennet, and the Johnson's Company are all working on an extensive scale. Large as the value of the output was last year, 1901 promises to be the banner year in the production of Canadian Asbestos.

LAKE OF THE WOODS.

Sultana Mine.—A recent run of ten days at the Sultana produced a brick of 180 oz. worth about 3,000. Connections have been made at the fourth level between the old workings and the new workings on the Crown Reef. Some very high grade ore was encountered during this development. Assays as high as \$160 per ton were obtained but it is expected that the ore will mill about \$10 on the plates. The mill is still working 3/4 time but will shortly be running night and day.

Mikado.—This mine is producing its regular quota of gold bricks monthly. The incline is now over 900 feet down. Work is proceeding satisfactorily on No. 2 vein and a large amount of payable ore is being blocked out. The manager N. McMillan has gone to England on business connected with the company.

Homestake.—A large body of ore has been encountered in the north crosscut. At this writing the ore body has been penetrated for ten feet. The ore is a well mineralized dark blueish quartz and looks promising. A hoist and pump have been ordered and will shortly be installed when sinking will be proceeded with.

Regina.—The new manager of the Regina Mine, Mr. Peterson, is expected next week. A large amount of capital has been secured and active development will be proceeded with at once. It is to be hoped that the new management will develop the water power at Whitefish Rapids which is distant only four miles from the mine. There could be developed a constant power of at least 500 horse at a very moderate expense by the erection of a dam 20 feet high at this point. This dam would at the same time be a boon to the properties on Whitefish and Sturgeon Lakes as it would drown out Dogpaw Rapids and afford uninterrupted steamboat communication from Whitefish to the upper end of Sturgeon Lake.

Golden Horn.—A party has left for this property to unwater the shaft and resume development work.

Champion.—This property will be equipped with a new hoist and compressor plant, and mill at an early date. This property from a shaft two hundred feet deep and one hundred and twenty feet of level, has produced over \$15,000 worth of bullion, and when equipped with an adequate plant will be a steady producer.

Triumph.—This mine owned by Alpena, Mich. people will be re-opened in June.

Pine Portage.—Arrangements are being made to resume operations on this property which was one of the first producers in the Lake of the Woods. This promising property affords another striking instance of tender foot methods in mining. Shaft in the worst possible place for convenience, a ten-stamp mill with a water supply from a creek that is bone dry for nine months in the year, and an antiquated man-killer of a horse whim for hoisting. There was no crusher and as a substitute the ore was dumped three or four times between the shaft and the mill. The management ran out of money before the mill was completed and it must have been an amusing sight to see the stamp stems playing up through the temporary roof. The character of the milling may be judged from the fact that one can pan quick by the spoonful from the tailings. Your correspondent has thoroughly examined this property and there is no doubt in his mind that Pine Portage will under decent management form a paying proposition.

Whitefish and Sturgeon Lake Districts.

Nish-Shish-an.—Work has been commenced on this prospect, which is situated on Sturgeon Lake, by the Michigan and Ontario Mining Company. Contracts for 100 feet of sinking have been let.

Thist Lake.—N. Higbee is working with a gang of men on a new discovery on Thist Lake from which great things are promised.

Gold Panner.—Operations on this property will be resumed at once.

Gold Winner.—This property is under option to an English Syndicate which will proceed to development in a few days.

Nine.—This property which has developed one of the best showings in the District will be shortly equipped with modern machinery. A magnificent water power at Cariboo Falls situated a mile and a half from the mine will be developed to supply the power for the mine. A minimum H. P. of 500 can be depended upon all winter or during the direct seasons in summer.

Virginia.—The deal on the Virginia still hangs fire but it is to be hoped that this property will be taken hold of by some one who will give it the chance it deserves. Another instance—\$40,000 expended—\$10,000 of work done.

Wabigoon District.

Salsese.—This mine has resumed shipping to the mill at Keewatin. A washout on the branch from Dymont interrupted shipments for several weeks.

Big Master.—A suspension of operations has been ordered and one drill only is running on the mine. A freeze out game is on and to an outsider it is evident that such a frost is necessary to check the reckless extravagance of the present management.

Grassy Bay.—The N. C. Westerfield Co. of St. Paul has begun operations on the McRae properties on Grassy Bay.

Twentieth Century Co.—This Co. is at last actively mining with compressor and steam hoist on its properties on the Upper Mamont. This company has already paid a dividend, a very creditable performance since said dividend was paid before a tap of work was done on any of its properties.

Cross Lake Mining Co.—This company, one of the Westerfield Companies is actively sinking on its property on Cross Lake.

Rainy Camp.—This property operated by the Rainy Lake Power and Dev. Co. has shut down pending the installation of a more powerful mining plant.

Independence.—The erection of the ten-stamp mill which is on the ground will be proceeded with at once.

Wabigoon Iron Range.—An iron range of first class hematite ore has been located in the north part of Zealand townships and a company is cutting roads and shipping the deposits. This range comes within a mile of the C. P. R. at Barclay, and if development shows any considerable quantity of such ore as prospectors have on exhibition, iron mining will become a feature of the Wabigoon District. Excellent samples of hematite are shown from Turtle Lake twenty miles south of Tache and exploration will be active in the Lake during the summer.

Eagle Lake District.

Golden Eagle.—This property known as the "Higbee" on Eagle Lake is being steadily developed with satisfactory results. The vein varies from 3½ to 5 feet wide, carries good values. The shaft is down 73 feet and at the 60 foot level a drift is being driven out to the hill-side for drainage and ventilation.

Viking.—This property is now under examination by prospective purchasers. The vein varies from 4 to 5 feet in width and shows a good deal of visible gold.

Grace.—J. H. Carlor the owner of this property will begin development early in June. A mill run of surface ore of about ten tons made last summer gave an average of nearly two ounces per ton.

Baden Powell.—This property owned by J. A. Partington and associates of Rat Portage has within the last month produced the richest samples of "free" gold ever seen from the Eagle Lake District. Your correspondent saw a button of gold weighing 6 ounces that was panned out of surface rock by the prospector and his industrious wife.

El Dorado.—There is enough vein in sight with plenty of gold to make this property worthy of its name. There is a fine little two-stamp mill on the property with a boiler about half large enough to drive the engine, no crusher and a general air of ignorance pervading everything on the job. The same old story—good surface prospect—tenderfoot manager—must have a mill—gets it—don't develop—shuts down—general howl.

Sturgeon Lake District.

The excitement in this district still continues. It is estimated that a hundred canoes and three hundred men are exploring the shores of Sturgeon and other lakes in the vicinity. The government will cut a road to the mines from Ignace on the C. P. R. Peter King, the original discoverer and prospector says that by constructing a dam on English River, water power can be made available for all the mines in the neighborhood and at the same time back up the waters so that a tug can run from Ignace to Sturgeon Lake.

Seine River District.

Golden Star.—Capt. J. M. Jones, formerly of the Regina is engaged with a crew of 15 men unwatering and retimbering the shaft which was left in very bad shape by the former management.

Olive.—A meeting of the Olive directorate was held in Rat Portage last week and was adjourned to meet again in Toronto when the future policy of the company will be determined.

MINING IN NEW BRUNSWICK.

So much development of mining claims is going on in Nova Scotia and British Columbia, Ontario, etc., it seems almost unnecessary to say much as to mining matters in New Brunswick, nevertheless considerable money is being invested in one way and another at various points in the Province in hope of future paying results.

The difficulty, or one of the difficulties, is that while we have a Mining Law and a Mines Department at our Capital, Fredericton, we have no regularly trained Mining Director or head of a Department such as there should be, the mining business of the Province being merged with the duties of the Surveyor General and the mineral resources of the Province are practically unknown to the Officials of the Department. Those who are in charge, it can be said are obliging, painstaking and courteous, but there it ends.

With the possibilities of the Province in the mining line the government should have a capable Mining Engineer, and an assay office, so that the prospector could promptly and at reasonable rates get an idea of any values in mineral that might be met with.

New Brunswick possesses Coal, Iron, Copper, Antimony, Manganese, Shales, Asbestos, Nickel Ore or Pyrrhotite, Galena, Gypsum, Baryta, Salt Springs, Mineral Springs, Red and Black Granites, Tripoli, and at one or two points evidences of Tin and Cinnabar or quicksilver rock. In addition it is fairly evident that Oil and Natural Gas abound, and it is simply a matter of time and money to exploit these resources. At points in the Province evidences of gold are also to be met with but sufficient work has never been done in the way of prospecting or developing such indications as may have been met with.

That there is a firm idea that some of these minerals may yet come to the front, and on a paying basis, is evidenced by the fact of operations at a number of points which I will as briefly as possible enumerate.

In addition to the coal developments in the Grand Lake region of Queens County, prospecting is now going on at two points in Kent County. At one point called the Mount Carlyle Mine it has recently been reported that a 3½ ft. seam of coal has been discovered. This property is now bounded to some American Capitalists.

At Dunsinane, Kings County, a few miles east of Sussex, operations have been in force for some time past looking for coal and it is reported that 4 ft. of coal has been found. Rumours of a discovery of Anthracite between Hampton and Norton on the line of the I. C. Ry. have been rife, but it is not generally credited. One sample seen by the writer was a handsome specimen of Slickensided Shale from the Shale belt that extends from Dorchester to Hampton, on which at Hillsboro, Albert County, years ago the famous Albertite coal was mined and yielded enormous profits, but gave out; since then the material has not been found in quantity. It is stated a company has recently been organized, by a Capt. Colhoun of New York, in Montreal, to again work and develop this property, also the celebrated Baltimore Shales which have long been supposed to be valuable as an oil producer.

The New Brunswick Oil Company, a local concern, aided by, it is supposed, American capital, have already spent considerable money in boring for oil in the Memramcook Valley and are at present time conducting operations there. This company has secured very large concessions from the New Brunswick Government on lands at various points in the Province for oil and gas rights, and savours very much of a monopoly. The Government if oil is struck stands in to reap a handsome royalty while the local stockholders, owing to the political pull in which the company was organized will come in for fat dividends, or a ready sale for their stock.

At Dorchester for the past year or so quiet development has been going on on some copper areas now owned by an American concern with headquarters at Providence, Rhode Island. The concern has spent a large sum of money on prospecting and developing and have now almost ready a smelting plant, and at present time about 100 men are engaged in and around the works. It is known as the Intercolonial Copper Company and stock of same sells readily in the New England States. Later on I will try and give you a more detailed account of this somewhat important development, which it is confidently claimed bids fair to be a dividend paying concern.

Work of development at the Jordan Monoham Manganese Mine near Sussex, now controlled by some New York capitalists has been suspended

during the winter months. It is said work will again be resumed shortly. About 6,000 tons of ore is now on the dump waiting shipment.

Some work has been going on at Salt Springs, Kings County, N.B., the Government Diamond Drill being engaged in trying to locate the salt beds supposed to exist in the locality.

It is rumoured that the iron deposits of Upper Woodstock may be re-opened and that the D. S. & I. Co. of Sydney have their eyes on same. How correct this may be is uncertain but no doubt if the Woodstock ores could be mined and placed on seaboard anyway cheaply they would pay for operation as the iron is of an excellent quality.

The Pyrrhotite or Nickel ore mines near St. Stephen are as yet idle, but it is said some further work of development may go on this summer. Why this important body of ore, being right on the seaboard and possessing in point of transportation a vast advantage over the Sudbury products, does not interest capital is a mystery to me as well as many others. Time will however make this plain.

An important deposit of Antimony in York County, is now open for capital. It is intended to place matter in the hands of some London capitalists at an early day, so I understand. The copper proposition at Le Tete in Charlotte County await the advent of the capitalist. These are really well worth inspection and development. At Red Head, Charlotte County, is a huge deposit of iron and copper pyrites right on seaboard within 200 yards of deep water shipment the year through with vein 15 to 18 feet wide. The surface ore carries from 39 per cent. to 44 per cent. sulphur. Strong traces of copper and also carries a fair percentage of gold. Mining experts say that if developed to depth of 75 to 100 feet it will result in a first class copper producing belt. The property is open for capital on most liberal and easy terms. I must however not trespass on your space further and during the next few weeks will note what is going on and advise you.

PORT HOOD COAL.

The following is excerpted from the 1st annual report of this company:—

The work of developing and equipping the company's property has proceeded steadily, and with all practicable expedition during the past year. The slope was sunk to a depth of between 1,100 and 1,200 feet, at which point levels are now being opened out. The character of the seam and the quality of coal have sustained the most favorable expectations of the Directors; the seam at the depth reached exceeds seven feet in thickness and the coal has proved to be superior for steam producing and domestic purposes to most of the coals on the market.

The work of construction on the shipping pier was carried to a length of about 1,400 feet—giving a depth of about eighteen feet of water and will be further prosecuted during the winter and early spring with a view to its completion for the opening of navigation.

During the late autumn months several storms of almost unprecedented violence swept this part of the coast of Cape Breton, but no damage whatever was done to the company's property, an evidence your Directors think, that the pier has been well located and well constructed.

Machinery for the permanent equipment of the mine has been ordered, and all necessary materials for the overground construction work, bank-head, etc., are being assembled as rapidly as possible.

Mr. Bartholomew's engagement as Manager having expired on September 30th, your Directors did not consider it expedient to renew it. They subsequently engaged Mr. John Johnston, late assistant Manager of the Dominion Coal Company, as Manager, and he comes to the Company's service with the highest testimonials for varied experience and practical ability. Under his energetic administration your Directors look forward confidently to an early completion of all equipment work, and the placing of the mine among the large coal producing properties of the Province.

The outlook for the coal business continue to be very satisfactory, last year's prices are well maintained, and the production of our provincial collieries is unequal to the steadily increasing demand; there is every prospect that we shall be able to market our output advantageously to the company's interest.

BALANCE SHEET 31ST DECEMBER, 1900.

		LIABILITIES.	
Capital Stock.....		\$750,000 00	
Coupon Bonds.....		750,000 00	
			\$1,500,000 00
Accounts payable.....		3,730 61	
Coupons and accretions to date		13,979 00	
Equipment reservation account.....		1,823 74	
			19,533 45
			\$1,519,533 45
		ASSETS.	
Property.....			\$1,225,079 50
Mine development.....	\$ 26,800 62		
Less Coal Sold.....	4,873 99		
			21,926 63
Equipment of Mine.....			18,025 86
Pier.....			39,856 01
Reservoir.....			5,417 43
Bonds and Stock held as security.....	177,300 00		
Contingent account.....	5,280 00		
			182,580 00
Cash, current bank account.....	1,565 39		
Deposit receipts.....	25,000 00		
At Mines.....	52 63		
			26,618 02
			\$1,519,533 45

PAYNE CONSOLIDATED.

The following is excerpted from the Director's Report for the year ended 31st March last, submitted 14th instant:—

During the past year Mr. C. H. Hand has severed his connection with the Company as Manager. The Board, on recommendation of Mr. Hand, appointed Mr. W. E. Zwicky, manager, as his successor, Mr. Hand agreeing to pay occasional visits to the mine.

In March last your Directors deemed it advisable to suspend the payment of dividends, owing to the scarcity of ore in sight above No. 5 Level. This level has been a disappointment in that it has not produced anything like the quantity of ore as found in the level above, and as estimated by Mr. Bernard MacDonald, in his report, at about the time this Company took over the property.

No. 8 Tunnel has not yet reached the ore chute, progress having been very slow, owing to the many drawbacks, to which your Manager makes reference in his report.

Your Directors have under consideration the advisability of installing a compressor and concentrator, to be operated by water power, and one of your Directors, Mr. F. B. Mathys, has recently paid a visit to the mine to thoroughly investigate and report on same.

MANAGER'S REPORT.

I have practically stoped out all the large ore reserves that were blocked out above No. 5 level. I am still stoping out smaller streaks above this level with profitable results. There is a large block of ground above No. 5 level, between raise No. 2 and chute 35, which I am now prospecting, and from present indications I believe it will produce considerable ore. Have extended Nos. 4 and 5 levels to the main fault.

I have done very little prospecting to locate the vein on the east side of this fault, but as soon as I get the winze connected with No. 8 will endeavor to locate it.

No. 5 level shows ore in the bottom in several places, and one continuous chute, from six inches to two feet wide and about 200 feet long, which looks very encouraging for the future of the mine.

The stopes between Nos. 4 and 5 levels were not as good as there was reason to expect from indications shown in those levels. Have cut a station at chute No. 46, in No. 5 level, and started a winze to be connected with No. 8 winze is now down about 60 feet, and as soon as it is sunk to a depth of 125 feet will start level No. 6. This winze has two compartments and is permanently timbered, and large enough to handle all output, materials and supplies necessary for the working of the property below No. 5 level.

Since assuming the management of the mine I have driven No. 8 tunnel 630 feet, making a total of 930 feet as a crosscut; thinking I might cut the vein that crops on the Thursday Fraction claim.

As I did not find it I believe I passed through a broken section of it, caused by a large fault we encountered about 700 feet in. After stoping No. 8 tunnel as a crosscut I started a level about 30 feet from the face of tunnel, the course being about the same as the strike of vein, and I expect to cut the vein on the turn of the fault as it shows in No. 5 level. I had about 230 feet to drive from crosscut, if the fault continued down on the same dip as it shows above No. 5 level. I have driven about 175 feet in this direction and have 55 feet yet to drive.

When I cut the vein I will then have to drive on it about 100 feet in a northerly direction, so as to be able to start an upraise to connect with the winze I am now sinking in No. 5 level. Will have to sink and upraise 329 feet more before winze is completed. Progress in tunnel No. 8 was very slow for many unavoidable causes, principally the large flow of water encountered in driving, the hardness of the rock, compressed air line freezing and danger from snowslides, making it very difficult to secure and keep good men at work.

I am now driving No. 8 tunnel by hand, on contract, owing to our pipe line giving out. I did not think it advisable to try and repair it at present, on account of the deep snow and danger from slides.

From my knowledge of the property and the indications showing as development progressed, I have every confidence that we will find large bodies of as valuable ore as has been produced in the past.

We are now in a position where we must install some kind of power to operate below No. 5 level and it is very necessary to get it in as soon as possible. Owing to the rock becoming much harder below No. 4 level, we will have to change our method of mining from hand to mostly machine work to obtain better results and reduce our operating expenses. My experience during the past year proves this conclusively. I am confident I can reduce our expenses from 15 to 20 per cent. with a suitable plant. I have looked into the matter considerably and would recommend that we put in a water power plant of 250 horse power capacity, which will furnish ample power to operate a compressor that will supply air for 10 drills, run a 75 ton concentrator, operate the hoist in No. 5 level, and furnish power for an electric light plant suitable for our requirements.

From estimates made we have from 75,000 to 100,000 tons of fillings in the mine and on the dumps, which in my opinion will pay handsomely to have concentrated. Have had some of the fillings tested at Kaslo Sampling Works, but will make a further test of about 1,000 tons, and results from such test will approximately prove their worth and satisfy us whether it will justify us in putting in a concentrator at the present time or not.

FINANCIAL STATEMENT.

ASSETS.	
Mines, Mineral Claims and Assets.....	\$2,607,004 92
Permanent Equipment.....	16,044 14
Office Furniture.....	556 74
Mine Supplies and Stores on hand, as per inventory.....	2,082 51
Accounts receivable.....	14,459 28
Cash on hand and in Banks.....	116,867 41
	<u>\$2,757,015 00</u>

LIABILITIES.

Capital Stock.....	\$3,000,000 00	
Less in Treasury.....	400,000 00	
		\$2,600,000 00
Accounts payable.....		12,142 27
Profit and Loss.....		144,872 73
		\$2,757,015 00

PROFIT AND LOSS.

To Cost of Mining and developing.....	\$149,775 21	
" Freight and Treatment.....	209,225 05	
" Tools and Appliances, etc.....	2,102 54	
" General Expenses.....	3,817 52	
" Montreal Office Expenses.....	1,800 71	
" Ore tax.....	8,812 21	
" Written off Permanent Equipment.....	1,844 52	
" Repairs to buildings, Tramway, etc.....	1,159 53	
" Directors' Compensation.....	4,000 00	
	\$382,537 29	
" Dividends.....	234,000 00	
" Balance.....	144,872 73	
	\$761,410 02	
By Balance brought forward.....	\$ 34,762 10	
" Proceeds Ore Sales.....	717,056 07	
" Miscellaneous Receipts.....	9,591 85	
	\$761,410 02	

MOND NICKEL COMPANY, Ltd.

This company proposes to utilize the invention of Dr. Mond for refining nickel and copper ores. By his process a volatile compound is formed with carbonic oxide. He has protected the process by patents taken out in every country of industrial importance. An intimate knowledge of the details is required, it is said, for successful working, so that a practical protection is thereby afforded independently of patents. For the carrying out of the process, which is said to be an entirely new departure in metallurgy and likely to secure the command of the nickel trade, Dr. Mond has taken the precaution of securing some 22 mining locations, covering between four and five thousand acres, in the Sudbury District of Ontario, which at present produces nearly half the world's supply of nickel. On the locations a mine known as the Victoria Mine has been opened, and it is now in complete working order, and since February some 10,000 tons of ore have been raised, assaying 3½ per cent. of nickel and ¾ per cent. of copper. Plant of the most modern type for roasting, smelting and Bessemerizing this ore has been erected there, and is practically ready to start. The matte so produced, and containing some 40 per cent of nickel and 40 per cent. of copper, it is proposed to transport to Clydach, near Swansea, in Wales, where extensive works, having a frontage to the Swansea Valley Canal, are in course of construction. It is calculated to produce some 1,000 to 1,500 tons of nickel and 4,000 to 6,000 tons of copper sulphate per year. The present consumption of nickel is about 9,000 tons a year, and is increasing rapidly. It is used in ship building, especially for warships and armour plates, and for purposes where strength and comparative lightness are important, as in ordnance, rifle barrels, propeller shafts, locomotive axles, bicycles, etc. The process appears to have already been worked out in all details on a manufacturing scale and 50 tons of nickel manufactured and delivered to consumers. The sulphate of copper is obtained as a bye-product, and its use for the prevention of disease in the vine is considerable and increasing. It is estimated that the value of the sulphate of copper alone will cover the total expense of mining, smelting and refining the ore, leaving the value of the nickel as profit. If this is so, then substantial dividends should be shown, since nickel is quoted at £165 and sulphate of copper at £23 per ton. Dr. Mond, the vendor, takes a purchase price of £325,000. As to 50,000 in deferred shares, 99,165 in ordinary shares and the balance in cash. The amount is large, but seems reasonable, even moderate, since, with the exception of the £50,000 in deferred shares, it represents approximately the sum the vendor himself has expended in the business up to January 1st last. Since then he has expended a further £30,000, which the Company will refund to him. Of the 50,000 in deferred shares the vendor gives 10,000 to Dr. Carl Langer for his assistance in the past in working out the refining process. Dr. Langer becomes a director, and his services are secured for 10 years, together with all patents he may obtain in relation to the extraction of nickel. Dr. Mond, of Brunner, Mond and Co., becomes chairman of the directorate, which is undoubtedly a strong one, and ought to tell for success if any directorate should. Among its members we notice the name of Sir Andrew Noble, the chairman of Messrs. Armstrong, Whitworth and Co. After payment of the purchase price, £115,000 of the present issue of £472,496, part of a total nominal capital of £600,000, will be left to provide for the completion of the works, mining developments and working capital, and this sum is believed by the directorate to be amply sufficient. Those who can will secure an allotment in this Company.

Highlander.—This Ainsworth Camp property is being vigorously developed, the main tunnel being advanced at rate of 5 feet per day. The property has been thoroughly proven by diamond drill, with the result that three well defined galena ledges are known to exist, as well as a blind lead of chalcopyrite. The ore body first encountered averages 15 feet in width, with good values throughout. An upraise of about 1,000 feet will soon be started to connect main tunnel and surface.

NEW COMPANIES.

ONTARIO.

Massey Station Mining Co., Ltd.—Incorporated 24th April, 1901. Authorised capital, \$300,000 in shares of \$100.00 each. Head Office, Copper Cliff, Ont.

Algoma Steel Co., Ltd.—Incorporated 10th May, 1901. Authorised capital, \$20,000,000 in shares of \$100.00 each. Head Office, Sault Ste Marie, Ont.

BRITISH COLUMBIA.

Salmon River Gold Mining Co. of British Columbia.—Registered 25th April, 1901, as an Extra Provincial Co. Head Office for United States, Spokane, Washington. Head Office for British Columbia, John S. Clute, Jr., Barrister, Rossland, B.C. Authorised capital, \$1,500,000 in \$1 shares.

Rosland Proprietary & Mining Co., Ltd.—Registered under the laws of British Columbia, 25th April, 1901. Authorized capital, £10,000 in £1 shares. Head Office, Robert S. Lennie, Solicitor, Nelson, B.C.

St. Louis Mines, Ltd.—Incorporated 25th April, 1901. Authorised capital, \$1,500,000.

Leech River Goldfields Mining & Development Company, Ltd.—Incorporated 26th April, 1901. Authorised capital, \$12,000 in \$10.00 shares.

Lynn Creek Copper Gold Company, Ltd.—Incorporated 11th April, 1901. Authorised capital, \$30,000 in \$50.00 shares.

Minnesota Mining & Development Co., Ltd.—Incorporated 14th May, 1901. Authorised capital, \$1,000,000 in \$1 shares. Formed to acquire and operate mines in the Lardeau District of British Columbia.

NEW BRUNSWICK.

Canadian Coal and Manganese Co., Ltd.—Incorporated 20th May, 1901. Authorised capital, \$1,000,000 in shares of \$100.00 each. Head Office, Coal Branch, New Brunswick.

GREAT BRITAIN.

Williams Concessions, Limited.—Registered on April 16th, by Ernest Salaman, Fort & Co., 12 Union Court, London, E.C., with a capital of £5,000 in £1 shares (1,000 deferred). Object: To acquire and deal with mines, rights, land, milling, smelting, electrical, chemical and other works, etc., in Canada, British Columbia, or elsewhere, and to carry on the business of diamond, gold, silver, copper, coal, and general miners, smelters, metallurgists, engineers, contractors, etc. No initial public issue.

THE HELEN IRON MINE.

Dr. Robert Bell, Acting Director of the Geological Survey, gives some interesting particulars of the now famous Helen Iron Mine at Michipicoten being extensively worked by the Clergue Syndicate:—

The existence of iron ore at what is now the Helen Mine is said to have been known for two or three years to certain trappers and explorers, one of whom, Benjamin Boyer, brought it to the notice of Mr. H. F. Clergue in 1899. The latter purchased the location and immediately proceeded to develop it as a mine. The occurrence lies at the east end of a deep pond, about a quarter of a mile long, called Boyer Lake.

The ore is a hard but somewhat porous or spongy red hematite, with a specific gravity of about 5. The ore-body, from which a layer of muck or peaty moss has been removed, forms a point dividing the head of the lake into two small bays. It has a lumpy surface with a dark blueish gray color. Small quantities of brown hematite (limonite) and yellow ochre appear in joints and cavities, but they do not form any appreciable portion of the mass.

The horizontal dimensions of the exposed ore are about 500 feet in every direction and its greatest height above the lake is 100 feet. The ground rises steeply all around the head of the lake, so that the ore lies at the bottom of the amphitheatre, open to the west or lake side. A drift has been run at the level of the general surface of the ore, southward into the hill, and this penetrates similar hematite for 250 feet, thus giving a known breadth of 750 feet from north to south.* During the winter of 1899-1900, by taking advantage of the ice on the lake, a number of holes were bored in the bottom along a north and south line, which passed the extremity of the point of the ore at a distance of 250 feet to the westward. On this line and abreast of the point the lake had a depth of 100 feet, including ten feet of soft mud, and at 150 feet below the bottom, where the boring ceased, the drill was still in hematite like that on the dry land. A bore-hole from the surface of the exposed ore was sunk to a depth of 188 feet below the level of the lake without reaching the bottom of the hematite. The ore-mass has thus been proven to have a continuous depth of 300 feet, and as this follows the plane of the bedding, which is vertical, the probability is that the depth is very much greater. The general strike is parallel to the axis of the pond which is about east and west. The railway approaches the mine from the west along the foot of the hill on the south side of the lake.

The rocks rising steeply from the railway track a short distance west of the ore deposit and about in line with its southern side, consist of dark.

*Mr. E. V. Clergue informs me that the distance from the head of this drift to the extremity of the ore point is 975 feet.

greenish-gray diorite and a soft, light-gray arkose schist. On the north side the ore-mass is bounded by a considerable thickness of thin layers of hematite, like that of the main body, interstratified with others of quartz rock. These alternating beds are from half an inch to three or four inches in thickness, and the mass is similar to the "jasper belt" traceable some miles to the east-north-east in the general strike of these rocks.

The ground rises to a height of 440 feet, according to our barometer, at a distance of about 1,500 feet east of the mine. The hill is called Hematite Mountain, and the rock on its summit consists of light bluish-gray carbonate of iron (siderite), containing 36 per cent. of metallic iron, according to the analysis made in the laboratory of the Survey. Where it has been exposed to the surface influences it becomes encrusted with two or three inches of dark brown limonite, containing 52 per cent. of metallic iron. A light, yellowish-gray siderite, holding much finely divided silica, occurs near the northern side of the mine.

Boyer Lake is about 1,500 feet in length. On the south side of its outlet there is a purer variety of siderite of the same color as the last mentioned, which also passes into dark brown limonite on the surface. The lake discharges by an artificial trench cut through a narrow ridge of rock, along a bed or vein of impure, finely granular light yellow iron pyrites. A width of about six feet of the pyrites is exposed. Similar pyrites in larger quantities occurs on the south side of Sayer Lake, which is about 25 feet below the level of Boyer Lake. In a railway cutting on the north side of the former lake there is a good fresh section of the unaltered rocks of the iron belt, in a zone corresponding to that of the hematite and quartz rock on the north side of the Helen Mine. They consist of thin alternating beds of siderite and chert. The former is mostly of a light yellowish color, while the latter is of all shades of gray from nearly white to nearly black. The alterations to which both rocks are subject everywhere in the district may be seen at this locality, the siderite passing into limonite and hematite and the chert into a fine-grained soft freestone or 'sugarstone.' Sayer Lake discharges over a ridge of rock into Moon Lake, which is 78 feet lower. Along the railway, from the outlet of Sayer Lake to within 50 chains of Moon Lake station the laminated rocks of the iron belt are well exposed in the cuttings. Here they have been thoroughly broken up and brecciated. The contrast in color of the two components, as shown on the recently exposed surfaces of the breccia, is soon increased by exposure to the weather, the siderite rapidly deepening in shade, while the chert, which is mostly light, shows out strongly in spots on the yellow and brown surfaces of the siderite.

The great mass of hematite at the Helen Mine appears to have resulted from the alteration of an enlarged portion of the siderite band. Although the change occurred long after the upturning of the strata of which the siderite forms a part, it must have taken place at a somewhat remote period or long before the pre-glacial changes which produced the existing physical features of the region. The present surface of the ore-mass shows glacial striae running S. 2° E. Some detached masses of the ore, driven from the bottom of valley now filled by the lake, have been elevated by glacial action and deposited on the slope and top of the hill along the southern side of Boyer Lake. As already stated, the general attitude of the bedding in the vicinity of Helen Mine is vertical, and the strike east and west, but immediately around the ore-mass some disturbance of the strata has taken place, and this may have been connected with the alteration of the large body of siderite.

The boundaries of the ore-mass are not known with sufficient accuracy to enable us to make a correct estimate of the total quantity of ore which may be present at the Helen mine. But since any calculation may be better than none, the following can be given as a rough approximation, based on such facts as we have. The present exposed surface of ore measures, from north to south, about 500 feet, and the width is increased by 250 feet in the drift, or say 750 feet in all. From east to west the exposure of ore measures also about 500 feet and this length is increased by 250 feet westward from the extremity of the point by the record of the bore-holes, so that there is a known length of 750 feet. The report of the Ontario Bureau of Mines, dated 1901, gives the horizontal dimensions of the exposed surface of the ore-body as 650 by 850 feet. This would show a superficial area of 552,500 square feet, while the dimensions above stated would make it 562,500. The ascertained depth of the ore on the general plane of the bedding is 300 feet, namely 50 feet from the surface of the deposit to the level of the lake, 100 feet for the depth of the lake, and 150 feet in the bore-hole below the bottom. The breadth is as likely to expand as to contract in going down and we may safely assume that the walls descend about perpendicularly for the limited depth of 300 feet. If the deposit be supposed to be terminated by vertical planes at right angles to the strike, at the above distance apart, instead of allowing for its extension to a considerable length to the east and west, as would naturally occur in the case of an interstratified bed such as this, the content of the mass which may be considered as proved to exist, (after allowing for the portion within the above measurements occupied by the water of the lake), would amount to about 26,000,000 tons of ore. Until the actual dimensions of the deposits are more accurately ascertained, it will be impossible to say what proportions the above measurements bear to the whole mass of ore actually present. Possible irregularities in the walls of the section here given may somewhat diminish or increase the above estimated tonnage, but any variation on this account from the above figure will probably not be large.

Such a great mass of ore, having the form of this deposit, may naturally be expected to be continued in considerable force beyond the above stated limits, both as to depth and extension on the strike. It would not be surprising if the mine should produce more than double the above quantity of ore before it becomes exhausted. Three hundred feet, the depth to which it has been tested, is much less than we might reasonably expect a deposit of this magnitude and geological character to have, considering the fact that the strata are standing vertically. The occurrence of a considerable body of siderite on Hematite Mountain, about 1,500 feet east of the mine and another at the outlet of Boyer Lake about 1,500 feet west of it, with the mine itself on the line of strike between the two localities, indicates the extension of the Hematite mass into the hill to the east and under the lake to the west.

COMPANY NOTES.

Canada Consolidated.—This Company owns Lot 15, 5th Concession, Township of Jaffray, and Mining Locations K 157, S C 12, S C. 13 and S C 14, all in the Rainy River District, Ontario. Ample funds have been provided to ensure the steady and economical development of one or more of the properties. Satisfactory values have been obtained in past seasons, and the present management will proceed to thoroughly develop the veins known to exist.

Granite Gold.—This English Company, as noted in our issue of last month, is being liquidated, and is then to amalgamate with another English Company owning adjoining properties. At the shareholders' meeting May 6th it was explained that the Bank of Montreal and the Duncan Mines, Limited, had obtained judgments against the Company for £2,000 and £26,914, respectively. These judgments were obtained owing to threatened trouble with dissentient shareholders of the old Poor Man Company, whose property was acquired by the Granite Gold Mines, Limited. After liquidation and the proposed amalgamation have been accomplished, the properties will be worked to a larger extent than heretofore.

St. Keverne.—This Company has been reorganized with a capital of 100,000 \$t shares, assessable to 5c. each. Control is believed to be held in Montreal. Work will be resumed immediately. When the old Company ran out of funds it was understood that there was a very good showing of clean galena, and it is thought that now capital has now been found the Company will be a shipper before autumn.

Intercolonial Copper Company.—This Company informs us that it is now installing at its plant at Dorchester a battery of roasters built at the Phoenix Foundry and Locomotive Works of St. John, New Brunswick, under the Carmichael patents. These roasters are 15 in number, of a new type, and are expected to show a capacity of about 12 to 15 tons each every 24 hours. The power and sizing plant is complete, consisting of a Buchanan crusher, rolls, screens and elevators, furnished by the Geo. V. Cresson Company, of Philadelphia, and is all installed and ready for operation. This part of the plant will have a capacity of about 250 tons per day. The buildings, which will contain the leaching and electrolytic department of the mill, are complete, and the Holtzer-Cabot Company, of Brookline, Mass., is furnishing the dynamos, which will be delivered in six weeks according to contract. The Company hopes to have the entire mill ready for operation from July 1st to 15th.

Hall Mining and Smelting.—May 16. The limit of length of the first-class ore on the No. 6 level south is 45 feet, with an average width of 6 feet and an average assay value of 80 ounces per ton and 15 per cent. copper. —Office note. The manager is now raising and sinking on the vein to prove it in the levels above and below the No. 6 level.

Ymir Gold.—In enclosing the Warrant for the third Dividend of 1s. per share to the shareholders, the secretary adds:—I have much pleasure in informing you that the developments and the condition of the mine generally are extremely satisfactory, and good progress is being made with the long tunnel adit which has already reached a distance of 350 yards. This tunnel, it will be remembered, is being driven with the object of cutting the reef at the 1,000 feet level. At the recent meeting reference was made to the erection of a small plant for treating the tailings by means of cyanide. Information has just been received to the effect that very satisfactory results have been obtained, and although the complete figures could not then be given it is positively stated that the process is a financial success, and by this means, with an adequate plant in operation, the annual profits of the Company will therefore be largely increased.

Bosun Mines.—The Secretary reports to the shareholders, under date of 15th instant, having met with a rich ore chute in the lowest, or No. 1 Tunnel:—NEW DENVER, B.C., 25th April, 1901.—"No. 1 Tunnel.—You will be pleased to hear we have cut into some rich Ore on the footwall of the lode in this tunnel, at a point about 720 feet from the entrance. The lode has opened out suddenly, so that we have neither walls, but we are cross-cutting for the footwall, as we have found the ore in the bottom of the tunnel and it appears to lie on this wall and run up away from us rather flat. The pyrestreak seems to be 7 inches wide, and is solid Galena, of that lustrous, fine steely character, and assays from a rough sample not at all selected, Silver 112.5 ozs., and Lead 76.7 per cent. per ton. I am sure this will please you, as it does me, showing as it does that our plans are right, and that the ore chutes hold down and retain their values. I cannot tell you much about it for a few days, for we have floods of water and the cross-cutting must be done. We are still a few feet from the spot where we expected this ore, which I believe to be the first chute shown on the plan above No. 2 Tunnel." Also the following telegram dated New Denver, 14th instant:—"No. 1 Tunnel.—The lode in face of drive is well defined and of a promising nature, carrying ore 7 inches wide of good quality. We have had constant trouble with water. Mine looking up all round."

Tyee Copper Company.—By mail dated 11th April, the following information has been received and sent to the shareholders:—Main Shaft: This has been sunk to a depth of 100 feet from the surface, the progress of sinking being slower than was anticipated, on account of the hard material (diorite) through which the shaft is being sunk. North Cross-cut No. 1: This is being carried further north, and is going through the same kind of formation as in the adjoining claim (the "Lenora"), where a rich parallel vein has been struck to the north. N.B.—A cable has just been received from Mr. Livingston, stating that the parallel vein expected to be met in our Cross-cut No. 1 North has been struck, 3 feet wide, and contains high class ore, samples of which have been sent to London. West Drive: This is a new drive which has been started on the 200 feet level to extend our operations up to the western boundary. This is progressing well, and is being driven in ore. Assays from Upraise in Cross-cut No. 4 give copper 7.2 per cent., gold \$1.20, silver \$1.17. At 28 feet up an improvement took place in the ore in this upraise, an average sample assaying copper 14.6 per cent., gold \$6.40, and silver \$3.45. Consulting Engineer: Mr. W. Pellet-

Harvey, who was formerly Consulting Engineer to this Company has resigned his position, having accepted an appointment under the Canadian Government to take charge of the new Assay Office, which is being opened in Vancouver. Mr. Harvey continues to do the Company's assay work. Mr. William Thompson, 58 New Broad Street, London, who is acquainted with the property, has been appointed by the Board as Consulting Engineer to the Company, and is now on his way home after inspecting the property.

Queen Bess.—Cable from the mine: "Last month 200 tons mined; net value is estimated at \$4,900; estimated expenditure, \$4,175."

Rossland Great Western.—The following figures are reported:—"Returns from ore shipped during developments to date, namely, 3,461 tons, yielding 1,701 ozs. gold, 2,706 ozs. silver, 54 tons copper; value £11,138."

Le Roi No. 2.—The following figures are to hand:—"Returns from ore shipped during developments to 31st March, namely, 8,592 tons, yielding 4,390 ozs. gold, 15,778 ozs. silver, 206 tons copper; value £34,262. Return for month of April, 4,469 tons, yielding 1,798 ozs. gold, 6,389 ozs. silver, 98 tons copper; value £14,934."

Granite Gold—An extraordinary general meeting of the shareholders of the Granite Gold Mines, Limited, was held in London, this month, for the purpose of considering and, if thought fit, passing the following resolutions, namely:—1. "That it has been proved to the satisfaction of the company that the company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind up the same, and accordingly that the company be wound up voluntarily." 2. "That Mr. William McEwen, of Monument Square Chambers, London, E.C., chartered accountant, be, and is hereby appointed liquidator for the purposes of such winding up." Mr. Alex. McNab (Chairman of the company), who presided, moved the first resolution. Mr. Mitchell seconded the motion, which was carried unanimously, without discussion. Mr. I. Gluckstein said that he believed Mr. Roy Meldrum was willing to undertake the liquidation of the company. He, therefore, proposed: "That Mr. Roy Meldrum, of 5 and 6, Great Winchester Street, be and is hereby appointed liquidator for the purposes of such winding up." Captain Bax seconded the resolution, which was agreed to.

The Gold Gravels of the Stewart River.

The Stewart River bars were found to be auriferous as early as 1885, and in that and the two succeeding years it is estimated the yield amounted to about \$100,000. Prospecting has been carried on to some extent ever since, but the production has been small. Bars have been worked from the Mayo forks down almost to the mouth of the river. Steamboat bar, the richest bar discovered on the river, is situated about four miles below the McQuesten, and is reported to have yielded for some time at the rate of \$140 per day per man, as worked with a rocker. The gravels on this bar were auriferous to a depth of somewhat over two feet. In most of the other bars which were worked the auriferous deposits was less than a foot in thickness, and was confined to a small area near the head of each bar. The extreme shallowness of the gold-bearing gravels accounts for the rapid

exhaustion of the Stewart River diggings. During the past season no work of any kind was being done on the main stream below the Frazer falls. On the tributaries, some work was done on Scroggie Creek, on some creeks near the head of McQuesten, where some gold was taken out, and, late in the season, a strike was reported on Clear Creek.

The gold on the Stewart River bars is fine, and there is every reason to believe that it has been concentrated from the high gravel and sand banks described above as occurring along the valley from the Mayo down to the McQuesten. The gravels nearly everywhere contain scattered colors, and they are constantly being undermined and carried away by the river. During the past season a prospecting party under Mr. Morley Ogilvie examined the lower part of the river for dredging purposes, and the results are reported to be very favorable. The gold in the bed of the river proved to be coarser than on the bars, and was found in encouraging quantities. The conditions on the river are favorable for dredging, as the current, except in a few places, is not swift, and the gravel is comparatively small, with few large boulders.

LEGAL.

DEZIEL vs. BLACKBURN—JUDGMENT OF THE COURT OF KING'S BENCH.

D. was employed to work in a mica mine. While working in the lower level of the mine he was injured by a rock which fell from the wall of the upper level, bringing down with it a platform which was then being built. D's left leg was broken, and he was permanently injured, only being able to do light work while seated. He sued his employers for damages, on the ground that the accident was caused by the negligence and want of care of his employers and their foreman.

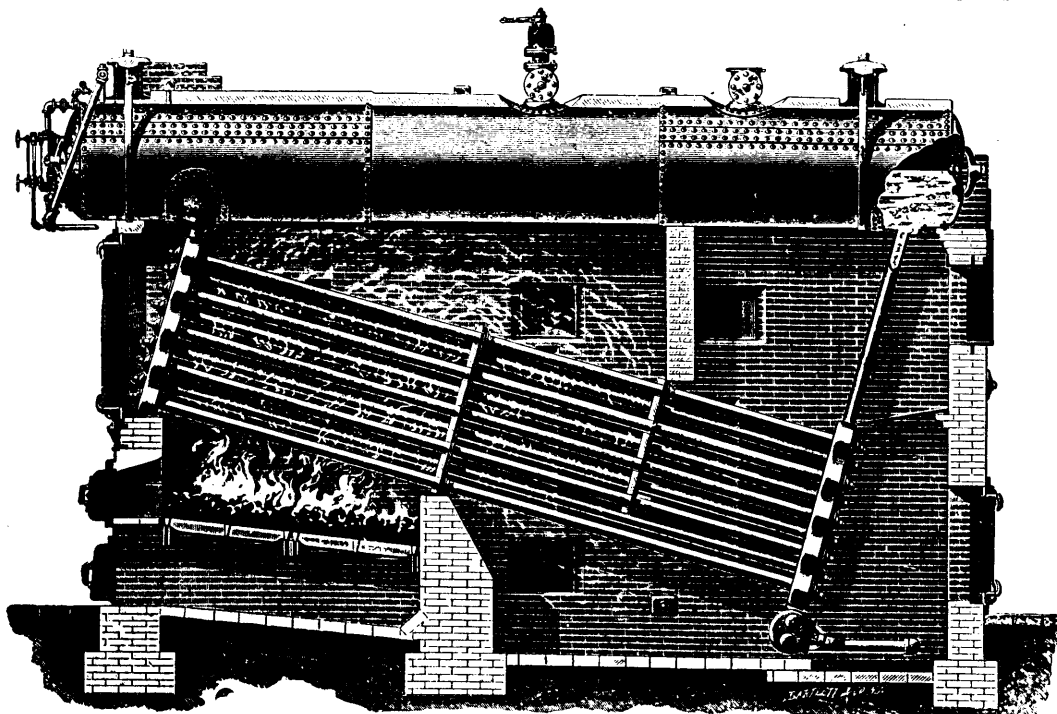
The evidence showed that stones and rocks had been falling from the roof to the danger of the men working on the lower levels; that a certain large rock was loose and threatened to fall, and that the foreman was notified of and admitted this danger; that after a considerable delay the foreman began to have a platform built to intercept this and other rocks, and that before it was finished the rock fell. It was also shown that on this very day D. had been directed to shovel some loose stones at a place immediately below the loose rock and the platform, and had been told that everything had been fixed and that there was then no danger.

The court decided that this evidence showed that the foreman had been very imprudent in thus telling D. to work, or even in allowing him to work at such a dangerous point, and that the employers were responsible to D. for the result of their foreman's negligence.

The employers also contended that the accident was one which was incident to the nature of the work in which D. was engaged, and that as he had voluntarily undertaken the work they were not liable for the injuries he had sustained. The court held, however, that that would only be so when the accident was one which could not have been foreseen, and when the employers had not been negligent, as they were in this case.

D. was given \$1,400 damages, and this judgment was confirmed by the higher court to which the employers appealed.

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MINING SAFETY LAMPS—At a recent meeting of the Institution of Electrical Engineers, Mr Walker, who read a paper on mining lamps, mentioned that the Su smann gas detecting apparatus is based on the occlusion of hydrogen by spongy platinum, but another means adopted is the diffusion of gasses. There are three well known means of securing lamps against interference: first, a set screw; second, a lead rivet, and third, the magnetic lock; but all of these could be tampered with, and if an ordinary lamp were opened, the consequences might be disastrous. The electric lamp puts a miner in the position of a man who has no matches in his pocket, and, therefore, cannot strike a light. As carbonic oxide is always present after an explosion caused by the igniting of the coal dust lying about a mine, it appears that a detecting apparatus showing the presence of this gas may be of immense use. If a miner can carry a battery strapped around his waist, the problem is solved, and an efficient lamp can be provided at once.

AN IMPROVED WINDING CAGE—In a buffered winding cage, designed by Theodore Bierhuse, of Kray, Essen-an-der-Ruhr, besides the usual fixed decks for receiving men or tubs, there is a special frame fitted to the under-sides of the floor, but capable of a slight travel in the direction of the lift, and having springs or some elastic substance intercalated between the floor and the frame. On the cage being set down on the keps, the frame takes the shock and is arrested, while, owing to the momentum, the cage continues to descend until the *vis viva* is absorbed.

PIG IRON PRODUCTION IN CANADA.—The statistics relating to the production of pig iron in the Dominion of Canada in 1900, as ascertained from the manufacturers by the American Iron and Steel Association, have just been issued. It appears that the total output for the year named was \$6,000 gross tons, as compared with 94,077 tons in 1899; 68,755 tons in 1898; 53,795 tons in 1897; 60,030 tons in 1896; 37,829 tons in 1895; and 44,791 tons in 1894; beyond which year the statistics of the Association do not go. Of the production of last year 70,349 tons were made with coke, and 15,741 tons with charcoal. The total output includes 3,781 tons of Bessemer pig iron. Neither spiegel nor ferro-manganese was made during the year under notice.

CORUNDUM, OR EMERY.—Corundum is one of the economic minerals to which the attention of the prospector and miner should be drawn, as the demand for it is increasing and is certain to continue. Mineralogically it is the oxide of the metal aluminium, and when pure contains 53 per cent. of the latter and is its richest known ore. It is generally a grey or bluish grey substance, but it is often coloured brown, black, yellow, or even red, with impurities. It may occur in granular massive form, but usually it is crystalline in structure, and the crystals when closely examined are six-sided prisms whose length is greater than their thickness. The main axis of the

crystal is also inclined with respect to the other two, giving rise to forms which are called rhombs. These crystals, and also any solid portion of a grainy mass, are very hard, and will easily scratch the face of a quartz crystal, and in fact almost any substance but the diamond. The weight is between that of zinc blende and metallic iron. When pure, corundum is really a gem. If of a distinctly blue tint it is the sapphire; when violet, the amethyst; when golden yellow, the topaz; when green, the emerald; when red, the ruby. These colours are due to a slight quantity of different metallic oxides. When the mineral is in fine grains, and of a dull brown or black colour, it is known as emery.

Extensive deposits exist in the Province of Ontario, Canada and are being opened and worked. Here the mineral occurs in the near vicinity of eruptive rocks, and it may be generally stated that although granite rocks of the gray and micaceous order seem to be the natural home of corundum, yet there is generally, if not always, in the vicinity of the deposits, dykes or overflows of trachytes, basalts or trap rocks.

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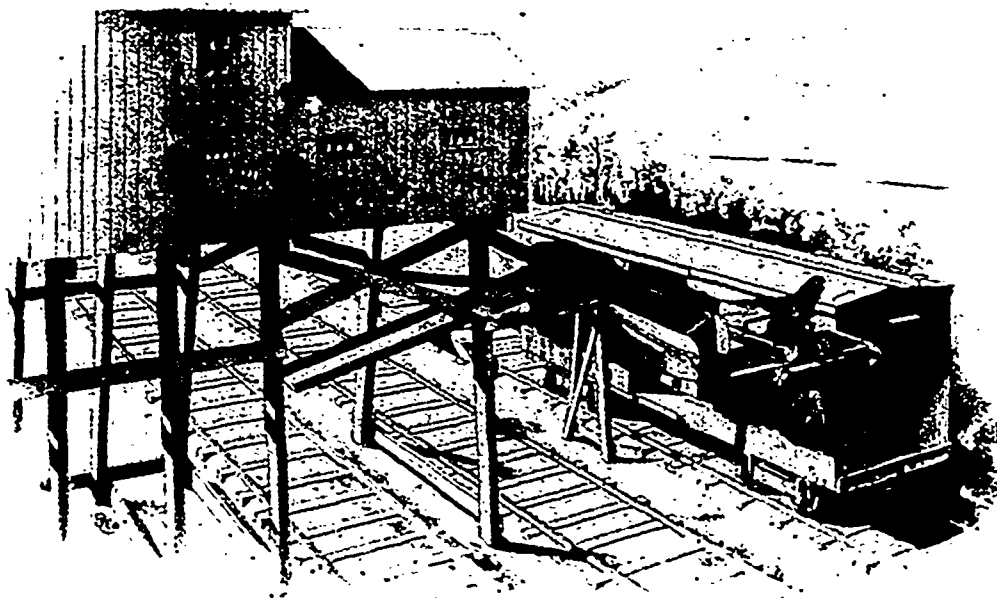
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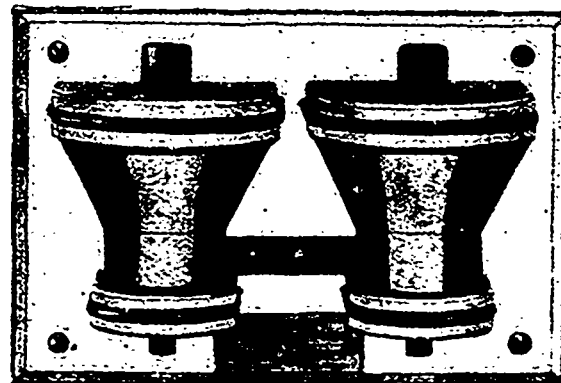
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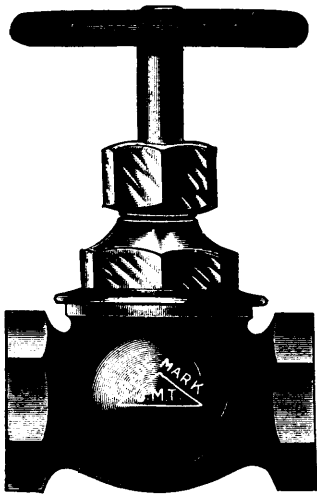
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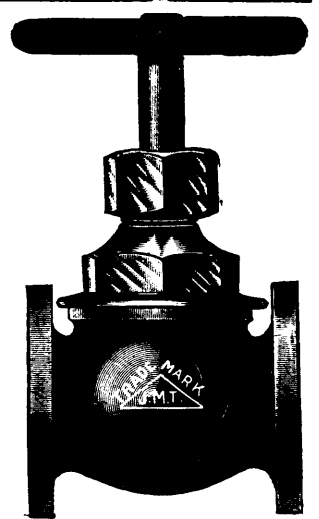
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Ontario's Mining Lands..

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 ; zincblende, 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,

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THOS. W. GIBSON,

Director Bureau of Mines,

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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

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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,
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Dr. C. M. PERCY,
Wigan, England.

With this valuable book my readers are well in touch, and I need only repeat here what I have more than once written in this Journal, that for interesting and valuable information on Canadian mineral industries and resources, it could hardly be excelled. No person can know Industrial Canada without it; any one may understand Industrial Canada with it.

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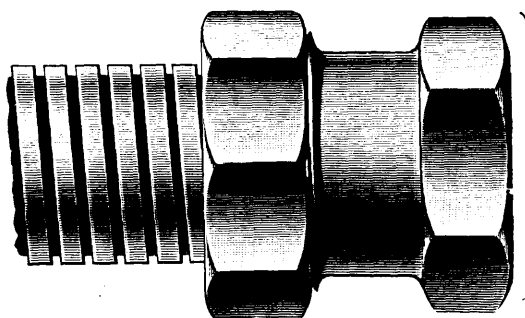
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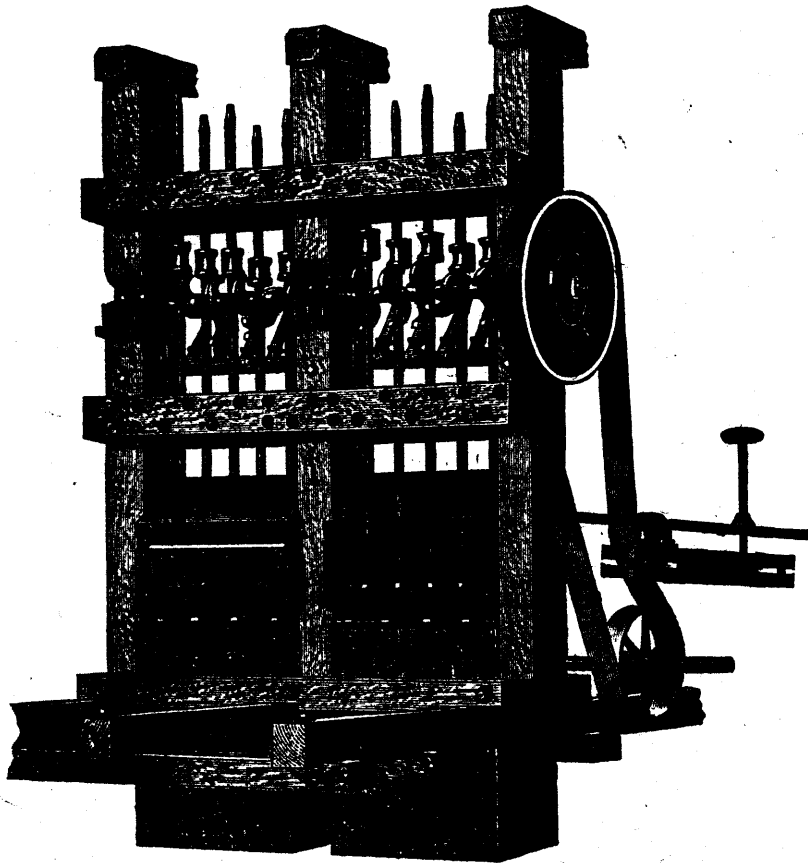
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