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SEVENTEENTH YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

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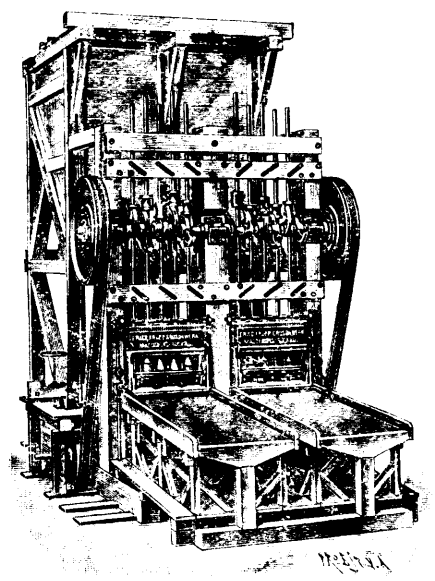

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Under the provisions of chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one 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

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17th YEAR OF PUBLICATION.

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Established 1882

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VOL. XVIII., No. 12. | DECEMBER, 1899. | VOL. XVIII., No. 12.

The Ontario Mineral Industry in 1899.

The mineral industry of Ontario has made substantial progress during the year 1899, as may be seen from the following table in which the output of the metalliferous mines and works for the nine months ending 30th September last is compared with the output for the years 1893 and 1896:

	1899 (9 months)	1896	1893
Silver.....Oz.	98,000	*nil*	.....
" Value.....$	58,800	"	2,500
Gold.....Oz.	20,210	7,154	5,560
" Value.....$	318,312	121,848	32,960
Nickel.....Lbs.	4,608,000	3,897,000	3,284,000
" Value.....$	556,633*	357,000	454,702
Copper.....Lbs.	4,642,000	3,736,000	2,862,000
" Value.....$	.....	130,660	115,200
Pig iron.....Net tons	48,216	28,302	*nil*
" Value.....$	693,455	353,780	"
Total Value.....	$1,627,100	$963,288	$605,362

* Including copper.

The Government receipts for the sale and lease of mining lands for the nine months of 1899 were $147,666, while for 1893 and 1896 they were $26,168 and $40,588 respectively.

Assuming that the figures for the last three months of the year when received will show a proportionate output, the total metalliferous product for 1899 will be somewhat as follows:

	Quantity.	Value.
Silver.....Oz.	130,666	$78,400
Gold..... "	26,946	424,282
Nickel.....Lbs.	6,144,000	742,177
Copper..... "	6,189,333	
Pig iron.....Net tons	64,288	924,606
Total.....		$2,169,465

The silver was almost entirely the product of the West End mine, near Port Arthur, the only one of the group of mines in that locality which has resumed operations since the heavy fall in the price of this metal. The yield in 1898 was 86,600 oz., worth $51,960.

Gold.

It is probable that the total yield of gold for the full year will be somewhat less than is estimated above, for the reason that several of the producing mines are either closed down or, from one cause or other, are doing comparatively little at the present moment. The Sultana has stamped scarcely any ore since the English company took it over last summer, the Regina is temporarily idle, and crushing at the Olive has been interrupted by the work of installing fifteen additional stamps, making twenty-five in all. The Mikado heads the list for quantity and value of output during the year, and this mine and the Golden Star are the only two in western Ontario which have run continuously throughout the year. In eastern Ontario, the Cordova Company's mine in Belmont township, where there is talk of increasing the number of stamps to forty, is probably first. The Deloro mispickel mine has also been doing well, and a new mine owned by the Boerth Mining Company and situated in Clarendon township has been added to the number of producers during the year.

In 1898 the yield of gold was 16,261 ounces, worth $275,078, so that in comparison the yield for 1899 has increased in quantity and value about 50 per cent.

Looking forward, there is little doubt that 1900 will show an equally large or greater gain over 1899. The Sultana will be again in operation with thirty stamps, and the Olive with twenty-five, while the other mines producing bullion in 1899 will have the same or a larger number of stamps at work. It is known that the Mikado directors are contemplating an enlargement of their output by adding a sorting plant. The forty-stamp mill of the Hammond Reef Company will also have begun operations on their huge low-grade dyke, which if found equal to expectations will afford work for many years. At the Gold Hill, an old location, the mill is being again fitted up for a campaign of longer or shorter duration, and other mines are preparing to pass from the prospecting to the producing stage. Among these is the Ophir in Galbraith township, where a syndicate is doing development work preparatory to starting up the mill next spring.

Prospecting has been going on actively during the year, and very many new locations have been taken up. Excellent results have followed development work on properties near the Mikado on Shoal Lake where the Sirdar, Tycoon, Bullion, Crown Point and other locations have been tested; and a new section near Sturgeon Lake, east of Regina Bay, Lake of the Woods, is holding out rich promise. In the lower and upper Seine River regions, Lake Manitou, Lake Minnietakie, the Michipicoton district and elsewhere, much exploring and developing has been done, which there is not space enough here to particularise. The placer gravels of the Onaping River have also received some attention.

Nickel and Copper.

The yield of nickel during 1899 has no doubt been one of the largest in the history of Ontario mining, notwithstanding the fact that only one company, the Canadian Copper Company, has been producing matte. This large American enterprise has been continuously working

since 1886, and has now five furnaces in blast, smelting daily 400 to 500 tons of ore, the nickel contents of which average about 2.50 per cent., and the copper contents 3.40 per cent. The demand for refined nickel was good throughout the year, and has recently become brisk, carrying the price in New York from a range of 34 to 36 cents up to a range of 40 to 45 cents per lb. The increased demand for the metal and the invention of new methods of treating the ore has given an impetus to the industry and provided a market for good nickel properties. Dr. Ludwig Mond, of London, England, has invested largely in nickel lands in Denison and Garson townships. Dr. Mond has a process of his own for refining nickel which is regarded by experts as exceedingly promising. At Sault Ste. Marie, Mr. F. H. Clergue is constructing a plant for treating nickel ore which aims at saving the sulphur and iron and producing ferro-nickel direct, and the Great Lakes Copper Company of Boston are experimenting with an electric process which is claimed to be capable of separating the nickel and the copper from the ore in an operation occupying but a few hours. The output of nickel in 1898 was 4,567,500 lbs., worth (in the matte) $514,220.

The great bulk of the copper raised in Ontario is contained in the copper-nickel ores of the Sudbury mines, but some purely copper properties have been under exploration during 1899. One of these is the McGown mine near Parry Sound, where there is a considerable body of rich bornite and chalcocite, giving place in depth to the lower sulphides, and another is at Rock Lake in Aberdeen (late Coffin) township, Algoma district. The opening up of the McGown mine has greatly stimulated prospecting in the Parry Sound district, and many discoveries of copper, nickel and gold have been reported. The geological features in some parts of the district are quite similar to those of the Sudbury region where the bodies of copper-nickel ore occur. Some promising finds of copper ore have been made near old Bruce mines locations, where the Orford Copper Company has been acquiring lands and has a project for erecting a smelter. Operations were conducted on Michipicoton Island during last winter and spring by an American syndicate, said to be connected with the Standard Oil Company, but work was abruptly ceased and the properties condemned, it is alleged, without good cause.

In 1898 the copper production of Ontario was 8,373,500 lbs. with a matte value of $2,680.80.

A noteworthy change has been made by the Provincial Government in the conditions attached to the sale or lease of nickel and copper-bearing lands. By Order in Council dated 24th November last it was provided that nickel and copper ores on lands granted after that date should be refined in the Province, this provision being subject to modification in favor of Great Britain and other parts of the Empire. There has been some misapprehension regarding the change. It does not affect lands already granted, nor does it prevent the export of ore or matte from such lands. It is a development of the same policy which dictated the insertion of a clause in timber licenses providing that sawlogs cut on Crown lands should be manufactured into lumber in the Province; and whether the requirement in a coalless country is wise or mistaken, it is a direct outcome of the illiberal spirit which has so long been displayed towards Canada in commercial affairs by the United States. Into that country, where there are no nickel mines, nickel ore and matte enters free of duty, while there is a tariff of six cents per pound on the refined metal. The consequence of this arrangement is that the ore undergoes only the preliminary process of smelting into matte in Ontario, and is then exported to the States where the pure nickel and copper are separated by laborious and somewhat expensive processes, the outlay for labor on which is much more than on the smelting operations performed in Ontario.

Iron.

The iron mining business has been revived in consequence of the exceeding briskness of the iron market not only in Canada and the United States, but all over the world. The mines of eastern Ontario, in the county of Hastings and along the line of the Kingston and Pembroke Railway have been re-opened, and have found a ready sale for their product at the blast furnaces of Hamilton and Deseronto, especially the former. The latter, which makes charcoal pig, procures most of its ore from the United States. In fact, so far, the bulk of the iron made in Ontario has been the product of American ore. In 1898 the proportion of native ores used was only 27 per cent.; this year it has probably been larger.

Some large deposits of good hematite have been uncovered during the year in the Michipicoton district, and the Algoma Central Railway is now under construction from Gros Cap on Lake Superior to afford the ore an outlet. F. H. Clergue, of Sault Ste. Marie, is interested in the mines and railway, and it is said contracts have been made to supply the blast furnace now being built at Midland with ore in the spring. This furnace is an enterprise of the Canada Furnace Company, and will produce charcoal pig. The Ontario and Rainy River Railway, which is being built from a point on the Port Arthur, Duluth and Western westward, will tap the Atikokan and Mattawin iron ranges, and make the hematite and magnetic ores of that region accessible. The firm of Mackenzie & Mann, who are constructing the railway, are also interested in the iron mines, and it is proposed to erect a blast furnace at Fort William. The Hamilton furnace is being enlarged to a capacity of 250 tons daily.

The high prices which iron ore is being contracted for in the United States for next year's delivery, up to $5.25 per ton, should permit of the trade being resumed in exporting ore to the other side which flourished many years ago. That the opening exists is shown by the fact that Newfoundland ores have been sold for 1900 delivery to United States furnaces to the extent of 200,000 tons, notwithstanding the import duty of 40 cents per ton. The pig iron produced in Ontario, in 1898, amounted to 48,253 tons, valued at $530,789. The production for the nine months of the present year was almost equal in amount, but the higher prices realized for pig brought in to the furnace companies $162,666 in excess of the whole of last year's return.

Other Minerals.

The Zenith zinc mine, situated near Rossport, on the north shore of lake Superior, produced this metal in 1899 for the first time in the history of Ontario in appreciable quantities. The ore was exported to Belgium and realized good prices.

There has been increased activity in the mica mines of eastern Ontario, consequent upon a better demand and better prices. The Webster Mica Mining Company of Sydenham has works at Sydenham, Perth and Ottawa, and mines near each of these places. The Kent-Stoness Company also produces and sells mica largely, and there are numerous small miners and dealers, the business centering mainly in Sydenham and Ottawa. Loughboro and Sydenham townships, Frontenac county, contain the largest number of "mines" or openings, but an extensive deposit was last summer discovered in the township of Bedford. Most of the mineral finds a ready market in the United States.

The corundum fields of Hastings and Renfrew counties are probably the most extensive known. A company called the Canada Corundum Company has received a concession from the Ontario Government covering about 1,200 acres, on condition of its erecting a mill and installing a plant for the production of corundum in marketable form and the manufacture of corundum goods. The company

binds itself to expend $100,000 in three years on these purposes, and one of its objects will be to produce aluminium from the corundum ore and rock.

The production and refining of petroleum continues to be the leading mineral industry of the Province in point of value of product, and the year has been a profitable one, with a normal output. The last remark will also apply to gas and salt wells. The areas in the western peninsula of Ontario within which these three substances are obtainable are now apparently pretty well defined, and the industries have been marked by no special features during the year now closing. In 1898 the value of petroleum (refined) and products was $1,970,-534; of natural gas $301,600, and of salt $278,886. It is not likely that the statistics for 1899 will differ materially from these.

The Ophir Litigation.

The decision of Sir John Boyd, Chancellor of Ontario, in the celebrated Ophir case is important as deciding the ownership of the Ophir mine on Sultana Island, but is of much greater importance on account of the far-reaching consequences of the broad principles of law enunciated by the Chancellor in his able and learned decision.

The action, which the Chancellor has dismissed with costs, was brought by the Ontario Mining Company against Edward Seybold, of Ottawa, E. B. Osler, M.P., of Toronto, J. W. Moyes, of the Metropolitan Railway Co., Deerpark, E. Johnston, of Duluth, E. H. Ambrose, of Hamilton, J. W. Brown, of Toronto, and J. S. Ewart, Q.C., of Winnipeg.

The property in dispute, which consists of the greater portion of Sultana Island, is situate in what was formerly known as the disputed territory.

The question of the boundary of Ontario was referred to arbitration and the award of the arbitrators was made on the 3rd of August, 1878. This award was repudiated by the Dominion and the matter was referred to the Imperial Privy Council, who decided in favor of Ontario on the 11th of August, 1884, and on the 12th of August, 1889 an Imperial Act was passed declaring the boundaries as found by the Imperial Privy Council, and finally putting an end to the boundary dispute.

Meantime and while the territory was supposed by the Dominion authorities to be west o. the boundary of Ontario, and therefore under control of the Dominion, a treaty was negotiated with the Indians and concluded on the 3rd of October, 1873, by which a large area including Sultana Island was ceded by the Indians to the Dominion. This treaty provided for the setting apart of mutually agreed upon Reserves for the Indians and in 1879 a Dominion Surveyor set apart a reserve known as Indian Reserve 38 B, which included Sultana Island and his action was approved by the Minister of the Interior though not formally confirmed by Order in Council.

It was claimed by the plaintiffs that the selection of the Indian Reserves under this treaty had been acquiesced in by the Province of Ontario. The Ontario Government by Order in Council dated 31st May, 1899, declared that they had not so acquiesced and definitely declined to acquiesce in the selection of Indian Reserve 38 B.

The trial judge found as a fact that there had been no acquiescence by Ontario.

Before the reserve was set apart in 1879 a lease had been issued on 23rd July, 1875, granting exclusive possession to R. Fuller *et al* for 21 years of certain islands in the Lake of the Woods including Sultana Island. This lease was assigned to the Keewatin Lumber Company who cut the timber on Sultana Island. This timber was in 1883 seized at the instance of the Indian Department but after investigation the seizure was abandoned by the Minister of the Interior. The Indians having pressed their claims the matter was further investigated by the Department of Justice in 1890, and a conclusion reached adverse to the claims of the Indians. This was followed by concurrent Dominion and Ontario legislation in 1891 resulting in an agreement actually executed on 16th April, 1894, between the two governments in regard to Indian Reserves.

On the 8th of October, 1886, the Indians surrendered Sultana Island to the Dominion in trust for sale and this surrender was on the 15th of March, 1887, confirmed by a Dominion Order in Council.

On the 15th September, 1888, Dominion regulations for the sale of the Indian lands were passed and in 1889 and 1890 patents were issued by the Dominion to A. C. McMicken, George Heenan and H. G. McMicken, of three locations on Sultana Island. Quit Claim deeds were executed by the Dominion patentees in favor of the Ontario Mining Company which was formed for the purpose of acquiring the whole of the balance of Sultana Island except that part occupied by the Sultana mine. Owing to the decision of the Privy Council in the St. Catharines Milling case no further patents than these three were issued by the Dominion authorities and these three patents were issued after a formal protest by the Crown Land Department of Ontario against the Dominion dealing with Sultana Island which it was claimed belonged to the Province of Ontario.

The Ontario Mining Company gave a working option on the properties to the Canadian Pacific and Prospecting Company who spent considerable money in development until an action of ejectment against them was commenced by the Keewatin Lumber Company under the lease of 1875. The rights of the Canadian Pacific and Prospecting Company were acquired by Mr. J. W. Moyes whose claim was recognized by the Ontario Government.

The Ontario applicants pressing their claims to grants of the land by the Ontario Government a petition was presented on the 9th of June, 1897, by the Ontario Mining Company asking the Commissioner of Crown Lands to confirm their titles to the three locations of which patents had been secured from the Dominion authorities. The matter was fully argued at great length by the Hon. S. H. Blake, Q.C., for the Ontario Mining Company, by J. M. Clark, Q.C., for Seybold, and by numerous other counsel for the various claimants before the Commissioner of Crown Lands who, on the 22nd of November, 1898, gave his ruling that one-third interest should be issued in respect of the prior applicants to the Ontario Government, to the defendants Johnston, Ambrose, Brown and Ewart one-third interest in respect of the bona fide expenditure of money in development of the property to the defendants Seybold, Moyes and Osler and the remaining one-third interest in the whole of the balance of Sultana Island was offered to the Ontario Mining Company on condition that there should be a waiver or abandonment of any larger interest in the property under the Dominion patents or under any applications which had been made to the Dominion Government.

The Ontario Mining Company refused to comply with this condition and upon the patents being issued under the Great Seal of Ontario to the defendants of the two-thirds interest issued a writ on the 15th of February, 1899, asking that it might be declared that under the Dominion Letters Patent the plaintiffs are entitled in fee simple to the lands and premises comprised in the Dominion patents, including the minerals precious and base thereon, and therein asking that the Ontario Letters Patent might be set aside and declared void, and for an injunction and other relief.

The action was tried at great length before the Chancellor of Ontario.

Advocates represented the parties to the litigation and the Minister of Justice, Christopher Robinson, Q.C., leading for the plaintiffs, and J. M. Clark, Q.C., for the defendants who succeeded.

For the Ontario Mining Company it was contended that the Dominion had exclusive jurisdiction over Indians and lands reserved for Indians and that under this authority and the authority of the Indian Act the North-West Angle Treaty No. 3 had been negotiated, the reserves set apart and surrendered and the Patents in question issued by the Dominion to the plaintiff's predecessors; that therefore the Dominion Patents were valid and the Ontario Patents should be set aside; the minerals were promised to the Indians and were expressly granted in the plaintiff's patents.

For the defendants it was contended that the plaintiffs being a Dominion Company and having no provincial license, had no capacity to hold land in Ontario and therefore had no *locus standi* in the action; that the lands in question were declared by Sec. 109 of the B. N. A. Act to belong to the Province of Ontario, and that the commissioners who negotiated the treaty with the Indians had no authority to oust the vested rights of the Province of Ontario; that Indian Reserves could not be set apart in Ontario without the consent of the Province, which had not been obtained; and that this particular Reserve had never been legally set apart or confirmed, that all title of the Indians had ceased upon their surrender and the jurisdiction to administer the land and grant patents was in the Province;

And that in any event the precious metals, gold and silver, were by virtue of the royal prerogative vested in the Province and its grantees.

The Chancellor pointed out that while the field of argument was somewhat comprehensive it was sufficient for him to decide two main questions.

(1) Whether the title in fee to the land can be validly conveyed by the Letters Patent issued by the Dominion.

(2) Whether the Government of the Dominion has the right to deal with the minerals, especially the gold, in Sultana Island.

After discussing the provisions of the B. N. A. Act and the decision of the Privy Council the conclusion is reached that the legal effect of the surrender by the Indians was to leave the sole proprietary and present ownership in the Crown as representing the Province of Ontario.

As to the precious metals the Chancellor quotes the law as laid down in McPherson & Clark's *Law of Mines in Canada*, at p. 24, that according to the law of England and of Canada "gold and silver mines until they have been aptly severed from the title of the Crown are not regarded as *partes soli* or as incidents of the land in which they are found."

It is shown to follow from the "Precious Metals" case from British Columbia and the Mercer case from Ontario that such gold and silver mines are included in the royalties granted to the Provinces by Sec. 109 of the B. N. A. Act and that therefore neither the Indians nor the Dominion Government have any interest in such royal prerogative rights

The decision of Mr. Justice Rose in the celebrated case of Caldwell *v.* Fraser is followed and the action of the Ontario Mining Company dismissed with costs the letters patent issued by the Dominion Government being invalid.

In our next issue we hope to discuss the practical effect of this decision to the mining men of Ontario.

EN PASSANT.

With our January number the REVIEW enters upon the eighteenth year of its publication.

We understand that Mr. Bernard McDonald, Mining Engineer, has been appointed to succeed Mr. W. A. Carlyle at the Le Roi and other properties of the B. A. C. Co.

Sad news reaches us of the death of Mr. Maurice A. Bucke, of the firm of Tretheway & Bucke, Mining Engineers, of Kaslo, B.C. Mr. Bucke was thrown out of a runaway and instantly killed on 5th instant at Jardine, Park County, Montana, where he was employed superintending the Bear Gulch and the King Solomon Quartz and Placer Companies. Mr. Bucke was very well known and highly respected in Canada. Only a day or two before his death he wrote us promising a contribution to the syllabus of the March meetings of the Canadian Mining Institute. Mr. A. C. Blair, of St. John, N.B., who was driving with Mr. Bucke at the time, was also injured.

It is not unlikely that Sydney, Cape Breton, will, next summer, be the centre of one of the largest mining engineering conferences ever held in Canada. The American Institute of Mining Engineers and The Canadian Mining Institute are at present considering the advisability of holding a joint meeting there in August.

St. Lawrence Coal Deliveries, 1899.

We are indebted to Messrs. Carbray, Routh & Co., Montreal, for the following comparative statement of the bituminous coal deliveries at St. Lawrence ports during the season of navigation just closed:—

	Montreal.		Sorel.		Three Rivers.		Quebec.		Total.	
	1898.	1899.	1898.	1899.	1898.	1899.	1898.	1899.	1898.	1899.
General Mining Association..	78,268	83,005	9,222	7,404	3,023	869	34,332	38,176	124,845	128,454
Dominion Coal Co.	606,988	742,215	6,831	6,757	10,046	20,900	68,132	51,222	692,000	821,044
Intercolonial Coal Co.	71,643	33,149					6,362	7,396	78,005	40,545
Cape Breton Colliery	1,905	839							1,905	839
Foreign	31,952	18,369	1,802	1,800			2,284	1,863	36,038	22,032
	790,756	877,577	17,855	15,961	13,069	21,769	111,110	98,657	932,793	1,013,964

The Mining Society of Nova Scotia held an interesting session at Halifax on the 20th instant. As customary the only official account of the proceedings and the papers read will appear in these columns next month.

The annual meetings of the Canadian Mining Institute will open on Wednesday 7th March, and be continued until the end of the week. We understand that a programme of more than usual interest is well advanced.

In another portion of this number our readers will find enterest-ing particulars, and, for the first time, some authentic figures of the yield of the celebrated Sultana mine, sold last year by Mr. Caldwell to a British syndicate. The total value of the ore mined and milled to date, amounts to $375,000, average value $15.00, working costs $2.50 per ton. A perusal of the prospectus, which, it is worthy of remark, is published "for public information only," will at once show the property to be one of value, and we trust to hear before the year is out that the new owners have realized good returns from their venture. British capital shrewdly invested and administered by competent mine management—a factor which has not been much in evidence in that country—will assuredly return good results in the Lake of the Woods.

A recent presidental address before the Institution of Mining and Metallurgy contained, among many good things, the following remarks in regard to the qualifications of a mine manager, which are particularly pertinent during the present great and general interest which is being taken in mining matters:

"A capable mine manager of to-day requires to be a man of parts. The days when it was considered that an illiterate man, whose whole knowledge consisted of an appreciation of the price at which a level should be driven, ground stoped, or a shaft sunk, coupled with an ability to do the manual work himself as well as, or better than, his men, was the best manager for a mine, have passed away forever, and although we still occasionally hear the 'practical man' quoted, no one in his senses would employ such a man nowadays in preference to a properly trained manager. A practical man is still required at the head of affairs, but he must have a wide grasp. He must, of course, have a good knowledge of mining as a first consideration, but he equally ought to possess a considerable acquaintance with the treatment of ores, and a fair knowledge of chemistry, so as to be able to investigate the causes of unexpected difficulties in treatment which may present themselves. He should be an accountant, a mechanical engineer, and an electrician, and able, moreover, to get a fair day's work done for a fair day's pay; I might add, that he must be a diplomatist, and more or less of a bush lawyer, in order to deal with those with whom he is brought in contact outside the actual working of the mine; and there may be other qualifications I have not mentioned. Very few men possess all these attributes in perfection, and perhaps the most necessary qualification that a man requires is a knowledge of his weak points and an ability to select capable and reliable men for those posts with the details of which he is least acquainted."

It was a courageous act on the part of Lord Chief Justice Russell to administer a public rebuke to the new Lord Mayor of London. In a recent company promoting case, with which the new Lord Mayor was connected, the official Receiver found the state of affairs disclosed so bad that he intimated his intention of calling the attention of the authorities to it. His Lordship under these circumstances, knowing Lord Russell's opinions on company promoting, deemed it prudent, when he went to the Law Courts to be sworn in, to have it publicly intimated that he intended taking proceedings in the courts to clear his character Lord Russell expressed his satisfaction at the declaration, and said the community would heartily rejoice when the Lord Mayor had "cleared his reputation." He dwelt at length on the need for legislation "to enforce the rules of common honesty in promoting of companies," and altogether administered such a rebuke as no public man has received in the lifetime of the present generation. We heartily congratulate his Lordship in his outspokenness, and respectfully suggest that "common honesty" in the working of public companies is as much a necessity of the hour as in their formation.

A thoughtful examination of the phosphate situation in the various countries of production and consumption would seem to presage a strong market for the future. The consumption is constantly increasing in a normal manner throughout all the countries of Europe. "In France" says *Le Phosphate*, "it is the most striking, each season greatly exceeding the preceding, and the five or six new factories that have been established in the last two years have found that their place on the market, at the same time that their predecessors were developing their means of production. The consumption in the United States is increasing, and this country has come to absorb a large part of its product. Japan, Australia, Russia and Italy are coming more and more to the use of phosphate fertilizers. The production is far from increasing in the same proportions, and if there are new sources of supply arising, there are also numerous deposits which become exhausted, and others which cannot increase their exploitation through lack of means of transportation. The sale of phosphate, as far as concerns the large productions, which are the ones that serve to regulate the prices, is centralized under a very small number of hands. The Omnium in Algeria has united the exploitations of this region with one seller. Tunis has only one important exploitation, and Florida and Tennessee are imported by five strong firms who keep back the sale of all the exploitations of those regions."

In his fourth annual report as director of the French Mint, M. de Foville gives some interesting statistics of the production of gold and silver in the world since 1885 From that date the production has risen from £22,500,000 to £60,320,000 in 1898, and M. de Foville estimates that the production for the current year will reach £62,000,000, notwithstanding the stoppage of the Transvaal output by the Government of Pretoria.

An interesting question arises and is briefly discussed by M. H. Gournay, in a recent issue of *L'Economiste Francais*, as to what becomes of all this gold. How has the world used it up and still fails to have enough? The answer given is by no means complete, but the writer notes that the arts and industries probably absorb about £25,000,000 worth of the metal every year. Another twenty-five to fifty millions sterling, he thinks, goes into the coinages of the various gold-issuing States, but all this is not new gold, because greater or less amounts of old coin are every year remitted. If we take a mean, therefore, of about £40,000,000 a year as the amount of new gold made into coins, including the consumption in the arts, we seem to have about £5,000,000 used up in excess of the output. Whether that be so or not—and we must not forget the prodigious efforts of Russia to establish a gold currency—it is certain that the world has not as yet given any indication of having too much gold. Many states still remain unprovided with the metal, and not least the markets of great countries like England, France, Germany, Russia, Austria, and, last,

but far from least, the United States. At all great monetary centres the cry at present is for more gold to enable credit to work without friction, and to prevent rates of interest on loanable capital from rising to a height that would produce disaster.

With regard to the production of silver, which is of far less interest to the world now, there is not much to be said, and it is hardly worth while to insert M. de Foville's table showing that production for the same period covered by his gold table. It merely shows that the output of fine silver has risen from 2,849 tons in 1885 to 5,909 tons in 1898. But we cannot give the actual value of the metal at different dates from the table because M. de Foville puts the silver in at "par" —we presume, the mint par as against gold—which, of course, is a totally misleading method of valuation. In reality the value of silver as a metal in the market is now 40 per cent. less than it was even as recently as 1885, so that the larger output of 1898 is worth on the London market very little more than the smaller one of 1885, and the world does not want all this silver. No important country, except Mexico, is now coining it as national standard money. It is only used for subdivisional coinage, and since the United States ceased to buy the metal automatically, issuing certificates against it at a false or mint par valuation, and since the Indian mints were closed to the coinage of silver rupees, every market has been over-supplied with the metal. The utmost consumption that can be estimated for is 5,000 tons, and the production is nearly 6,000, with a tendency to increase. Probably, however, more than this excess million may soon be consumed in arts and manufactures, and, were it not for the accumulations of Governments, it would not be surprising were the value of the white metal to rise rather than decline in the bullion markets of the world within the next few years.

Apropos of the value of mining shares, our esteemed contemporary the *Mining and Scientific Press* has the following:—The idea of basing the value of mining stock on the annual earning capacity of a mine, without due regard to the length of time during which the output can be maintained, is clearly an erroneous one, and is calculated to place a fictitious value on the stock. There is no reason because a mine is able to produce a million dollars net profit in a year that the stock should be given a valuation of $10,000 unless it can be shown by ore reserves in sight that it is actually capable of producing that amount. And even if it does output this amount the value of the mine constantly decreases as the ore is extracted unless development increases the ore in sight as rapidly as it is removed. An ore body is like a reservoir filled with water. There is but a given amout in the deposit and no more can be extracted than it contains, and when it has once been removed it is never replaced, though other ore bodies may be discovered in close proximity. Often these deposits are so erratic in form and value that a knowledge of their net value can only be obtained by mining and reducing the ore.

In another place we reproduce some interesting views of the property and plant operated by the 43rd Mining and Milling Company on Manson Creek, in the Omenica District of Cariboo, B.C. The work of development on this property has been done very thoroughly and systematically and we look for good returns next year to the shareholders.

Lord Strathcona did Canada another good turn the other day when he delivered a lecture before the Birmingham Chamber of Commerce on the resources of the Dominion, an address which has been widely copied, and most favorably noticed in the leading home papers. The *Colliery Guardian*, which reviews his address, in a leading article says:—"Canada has minerals in abundance—not only the precious metals, but coal and iron and other economic minerals—plenty of timber, unequalled water power, excellent means of communication, good home markets and a growing export trade. Readers must always remember that in dealing with Canada we are dealing with a territory nearly the size of the whole of Europe, which yet possesses a population no greater than that of London. If this fact is borne in mind the key to the situation will have been secured. Assuredly Canada is a vast unoccupied territory, and when in the process of time it has been more fully settled by immigration and by the growth of the population, there can be little doubt that the magnificent mineral resources which it is known to possess, as regards both coal and other valuable minerals, will be exploited to an extent at present little realized."

During the past year acetylene as a mine illuminant has been adopted with favorable results at a number of our metal mines in Nova Scotia and British Columbia. Those of our readers who may contemplate the use of this excellent light either below or on the surface will be interested in learning of some successful trials of an acetylene safety lamp on the continentt In a communication by Kuhn to the *Echo des Mines et de la Metallurgie* we learn that in the Neu-Diepenbrock III. mine owned by the Selbeck Mining Company, a miner's lamp fed with acetylene, designed by the Velo Company of Dresden-Lobtau, was tested and the results were satisfactory, although a few modifications in the direction of greater strength are recommended. This lamp, an open one can be used conveniently and without danger in the roads and working places; and its illuminating power is ten times greater than that of an ordinary lamp, while it better withstands damp and air-currents. The illuminating power of an acetylene lamp is not diminished in bad air; but the flame of an oil lamp on the contrary becomes reduced appreciably in a foul air-current. Moreover, while water falling from the roof easily extinguishes the flame of an acetylene lamp, it can be re-lighted more readily than can an oil lamp. The clear light given by the acetylene flame facilitates inspection of the workings by the overman; and an acetylene lamp placed 4 m. (13 ft.) from the point where men are working gives sufficient light for them to see exactly what they are about, including the management of rock drills. The cleaning of this lamp is a very simple matter; but it should be carefully overhauled before use, because a crack or a joint not perfectly tight might bring about an accident. The same authority shows drawings of a new safety lamp for collieries designed to obtain eight hours lighting when charged with 120 grammes (4 ozs.) of fresh carbide of calcium. The total expense of giving light with this lamp, including repairs and maintenance, does not exceed two cents for the ten hours.

The Treatment of Low Grade Copper Ores.*

Mr. J. E. Carne, F.G.S., in a valuable review of the copper mining industry, describes the process of treating the low grade auriferous pyrites of the Spanish Peninsula in successful operation at the works of the Tharsis Copper and Sulphur Co. Although these ores contain barely 3 per cent. of copper and traces only of gold and silver, the company is enabled, through realization of the by-products to pay very handsome dividends annually. Mr. Carne says:—

"During my stay in Glasgow, through the courtesy of the Proprietary, I was enabled to visit the Tharsis Copper Reduction Works. The Spanish ore treated at these works consists chiefly of iron pyrites with a percentage of copper pyrites equal to about 3 per cent

* Report Department of Mines and Agriculture, New South Wales.

of metallic sulphur, the sulphur being equal to from 46 to 48 per cent.; very small quantities of gold and silver are also present. The ore is first roasted at the Sulphuric Acid Works, in the immediate vicinity, to obtain the sulphur, about 4 per cent., however, being left purposely in the calcined ore; it is then mixed with 16 per cent. of salt and charged into roasting furnaces in charges of about 3½ tons, exclusive of the salt. The furnaces are known as blind muffles, the ore being within a central brick oven out of contact with the flames. The roasting continues for about ten and a-half hours. The fumes are led from the muffles into towers containing coke, over which water is constantly trickling, which absorbs the gases given off. A small proportion of gold is carried down in the acid solution, and is precipitated along with the other metals present by a small quantity of sulphide of calcium, which is allowed to trickle into the solution at the points where it issues from the base of the towers into the settling vats. The clear acid solution, which contains about 30 grains of copper per gallon, is in part used for washing the roasted ore, the balance being treated with scrap-iron to precipitate the copper.

The roasted ore is thrown into vats and hot water pumped on to the top; as it percolates through the mass it dissolves the soluble copper salts formed by roasting; the copper solution passes through the filter bottom into the adjoining compartment. The ore is then discharged into another vat and rewashed, the weak solutions being constantly charged into the ore vats until they attain a certain strength. The gangue is washed until no appreciable quantity of copper is left; the completely decopperised gangue, after exposure and oxidation, is known as "blue-billy," and is sold to the iron foundries for fettling purposes. The strong copper solution is pumped into vats and treated with iodide of zinc to precipitate the silver; the solution is after a time drawn off and treated with iron scrap to precipitate the copper in the metallic state; the resulting copper scale is washed and then smelted into ingots in the ordinary way.

The precipitates obtained with the sulphide of calcium and iodide of zinc are sent to Birmingham for treatment. In the above interesting and economic process there is, therefore, no waste, save the unavoidable losses of manipulation, all the commercial constituents of the ore being extracted.

Some Notes on Mine Surface Sampling.

By S. H. Pearce.

(Continued from November number.)

SPITZLUTTEN CONCENTRATES.

This material is frequently a very unsatisfactory subject to sample, and one is apt to be much puzzed at the erratic results obtained at times, but it should be remembered that the object of the Spitzlutte is to separate from the bulk of the mill pulp, a proportion, to which it is advisable to give a longer period of treatment; the material so obtained will therefore consist of coarse particles and include amalgam, etc., which has passed the traps designed to catch the same. This is one of the chief reasons why sometimes an assay of 30 dwts. is obtained where less than half that amount per ton would represent the actual value of the charge.

There are many ways of taking, or not taking a sample of this. Rod sampling, I consider, the most unsatisfactory of all, on account of the gold contents being so unevenly distributed over the tank.

The only way I am aware of that will give anything like consistent results, is to take a measured quantity, say a bucketful, of water and and concentrates, every hour or like period, and collecting in a common receptacle for reduction at the end of the charge, or the 24 hours, as desired.

In this, however, there are precautions to be observed. Where more than one Spitzlutte is used, which is generally the case, it is no use to take some from each, as the value of each is different, and a proper proportion cannot be obtained. The whole stream should be led into one launder, at the end of which the sample should be taken. In cases where it is not convenient to adopt a permanent arrangement, a temporary launder should be used. Holes or leaks should be avoided, as otherwise some of the concentrates will get away unsampled, and it cannot be said that this will not be of a different grade to the rest—it is usually much richer; silting in the launders is apt to *cause concentration, and coming away irregularly seriously affects* the sample.

Beyond this, the main thing is to see that the Spitzlutten are working regularly, and as nearly as possible under the same conditions always, which is good for other purposes than the sampling; the water supply sometimes varies and other things require attention, and I think it well to note here that it is not a good thing to regulate the concentrators first, and then take the sample, or the result will be that the sample will not be what is actually in the tanks, but rather what ought to be obtained; and you have no opportunity for being as sufficiently acquainted with the actual conditions as you should be.

The same advice in regard to all irregularly constituted material will apply here, viz: To take as big a sample as you conveniently can, and not to quarter down too far before drying. It is very advisable afterwards to grind to a 60 mesh sieve for the latter stages, as the particles are usually very coarse, and the results are otherwise liable to be very erratic.

The same remarks apply to the residues after treatment, in other respects there is no material difference between these and the sands residues mentioned later.

SANDS ORIGINALS (hose filled).

In the case of double-storied tanks, which are more used than any other, this is a most difficult and unsatisfactory subject to sample, as in the upper or collecting tanks it is deposited unevenly in value, either horizontally or vertically, or in any other direction. Vertically, it differs according to the value of the rock milled, horizontally it has a higher value in the centre, and decreases with more or less regularity towards the edges of the tank, according to the method of filling adopted. The variation may be from 5 dwts. or more in the centre, to 3 dwts. or less at the sides, even in a well filled tank, and for these reasons I do not at present see how any system can be efficient.

I have tried several without success, among which I might mention as being the most important:

Sampling from the hose is invariably too high, owing to a large amount of slime leaving the tank.

Cutting sections from the sides of the holes made to lower the tank is about as satisfactory as any of an unsatisfactory lot.

I have tried taking handfuls from each door as the tank is being lowered, but this method, besides being very unpractical, had the disadvantage of not including a fair proportion of slimes.

Rod sampling, generally, is not satisfactory, as there is a tendency for the rod to get choked up with the first few inches driven, and after that you drive down a solid rod, the bottom not being sampled at all. In the case of a closely packed mass like a hose filled tank, this may be overcome to a great extent by taking sections of about a foot at a time; as far, however, as sampling the whole tank is concerned, this will not help you very much, unless you are prepared to take a number of samples to find out first how the gold contents are distributed and to calculate out afterwards what the value of the tank is. I think it is simpler to calculate from the automatic samplers, as is the present general practice.

In the case of the sands being trucked without preliminary treatment to the other tanks, they can be sampled as in the case of residues.

SANDS RESIDUES.

With these we have an opportunity of sampling each truck on its way ta the dump; even here we are not free from difficulty. To-day, owing to better precipitation, there is not the same need for care in the matter of draining out of gold bearing solution, which in many cases, by giving too low a result, was a cause of discrepancy; it is well though to bear this in mind, in the case of wet tanks, which will sometimes happen in the best of plants, and therefore the only real difficulty comes in with regard to obtaining a fair proportion of slimes, which in the form of lumps, I need hardly say, are not a sign of good work done. These, owing to their greater impermeability, do not receive a proper treatment, and are quite a consideration in the shape of discrepancies, if not included in the sample. Here again rod sampling is not a good thing, as the lumps are hard enough to turn aside the rod, or at best it only scrapes off the outside which is the better treated part; it would seem therefore better to take handfuls. Beyond this I do not think I need do more than point out that usually the top of the cone of filled trucks is all clean sand, and that the slime lumps roll down to the corners, which means that some discretion will have to be observed, and that the best remedy of all is to have no slime lumps at all.

In quartering down, the whole sample should be passed through a ¼ in. sieve, so that the whole can be more intimately mixed before reducing.

SLIMES.

This material, on account of its more uniform character, presents the least difficulty of all. Sometimes there are some sands associated but which, with ordinary care, should give no trouble. The automatic sampler gives excellent results in any case.

In collecting this sample some care must be used in running off the supernatent water, after which it should be baled, or otherwise transferred to a bucket, seeing that nothing is left behind; here, if sufficiently thick, it can be mixed up by hand and a portion taken for assay; if preferred, a dividing funnel may be used, which is better if the pulp is very thin, or there is much sand present.

SLIMES RESIDUES.

For this material there are two methods in use: 1. From the tanks. 2. From the end of the discharge pipe.

In regard to the first one it should be borne in mind that the residues are homogeneous, horizontally, but not vertically, and that this sample requires a lot of care to obtain by any method a proper proportion of the whole. The advantage of this way is that there is less moisture or gold bearing solution, and therefore it is easier to handle subsequently. The disadvantages come in when the depth of charge is very great, or the tank is for any reason not well settled, in which case there is a tendency to get an undue proportion of solution, which should carry most of the gold.

I am inclined to think that the second method is the fairer of the two, though in most cases the two agree very well when taken on the same tank. The disadvantages of this method will be found in having a much larger sample to handle, and it also contains such a large proportion of water to be evaporated.

The sub division of these samples may be made precisely as in the case of the originals.

In dealing with the foregoing samples I have had necessarily to be brief and incomplete, as it is impossible to do justice to so extensive a subject in a short paper like this. I have left untouched, for instance, the many sampling devices that are to be obtained or made; or, also, the merits of any particular method of quartering down or reducing any special samples, such as concentrates or by-products.

Discussions are always the most valuable of all contributions, and I am less inclined to apologise for that which is omitted than for that which is said, but as a few concluding remarks I should like to say in the first place: Don't take all I have said for Gospel but try as many experiments as you can to prove how and where I am wrong. It is a subject in which most of you have had some experience, and I am as anxious to add to my knowledge as any of you.

There are naturally some points where discretion and judgment may be used to advantage, such as in the case of dividing up of wet pulp samples, but the trouble is that however desirous it may be to save labour, it frequently leads to carelessness, which tendency is accentuated by the monotony of the operations and the desire to get through quickly. For instance, in taking borings from the sample buckets; by use, the rod may open out at the end and then the clean section is not obtained; some remaining at the bottom of the hole; or the same result may happen through the sample being too wet. Don't say "Oh, that little bit won't make any difference," but remember that there is no case in which it might be more aptly said "If a thing is worth doing at all it is worth doing properly." As another instance, in the case of mixing up the wet pulp and quartering, I found on one occasion that this had degenerated into merely taking a small shovelful from the collecting box, and that without mixing, on which I need not comment.

One of the most important things to remember is care and regularity and cleanliness above all things. I have known occasions when it has been said, "What is the use of all this bother? Sampling does not give us any more gold." Those who have said this and still think it, never made a bigger mistake in their lives. Our President in his address drew our attention to what 1 per cent. more extraction means, and unless we have reliable samples taken regularly to give us comparisons, how on earth are we to know what we *are* getting, and I say to all of you who are interested in sampling, from manager to shiftsman, those of you who do not use all your endeavours to obtain the best you can, are neglecting one of the most important of your duties towards your employers

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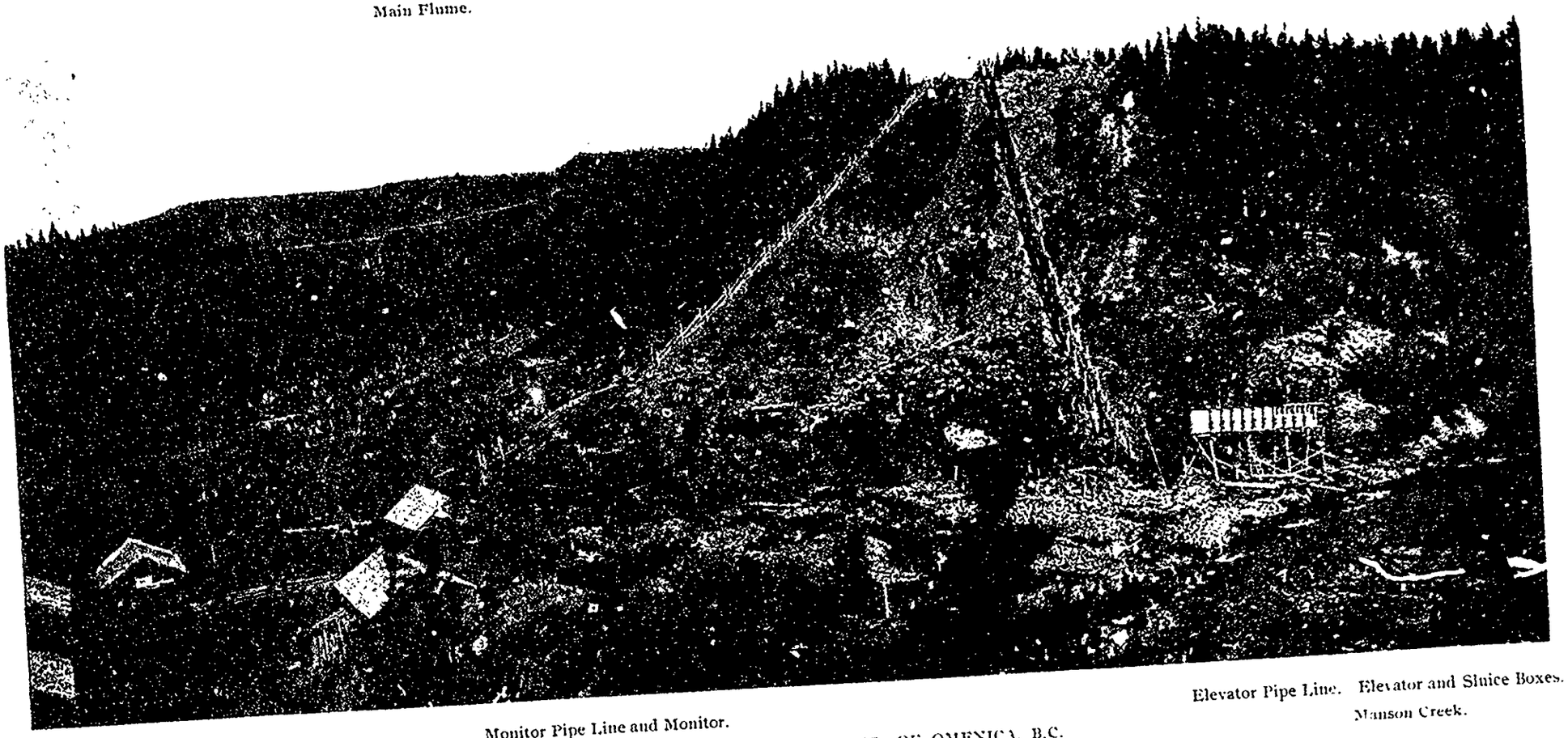
B.C. Labour Trouble.—Nelson, (B.C.) Nov. 23.—The labour situation remains just where it was. There are continual rumours of a settlement, but none have so far materialised. The union press persists in gross exaggeration of the stand taken by the mine owners. A cartoon in one of the papers represents Mr. J. Roderick Robertson, the general manager of the London and British Columbia Goldfields, who is also president of the Mine Owners' Association, driving four men in chains into a mine, with a whip whose curving lash spells "Slaving." Over the entrance to the mine are the words "All hope abandon ye who enter here." All Mr. Robertson and his associates have done so far is to refuse to pay the same wages for eight hours work as they were previously paying for ten. If the cartoonist had desired to make a real hit he might have taken one of the numerous wild cats about this country, and represented the hopeless future of unfortunate shareholders, who are driven in by promoters—who shall be nameless. The exaggeration of the case by these irresponsible journals only widens the breach between the two parties, instead of helpin to heal it. The owners will not be persuaded to give way by a gross misstatement of their case, while in many cases the miners are so ignorant and prejudiced that they are ready to believe anything they see in their own journals.

Rossand Ore Shipments.—The ore shipments from Rossland mines for the eleven months ending November 30th amount to 164,000 tons, valued at $2,750,000 gross. The shipment for the corresponding period of 1898 amounted to 102,000 tons.

Main Flume.

Penstock, (200 feet above Elevator.)



Black Jack Town.

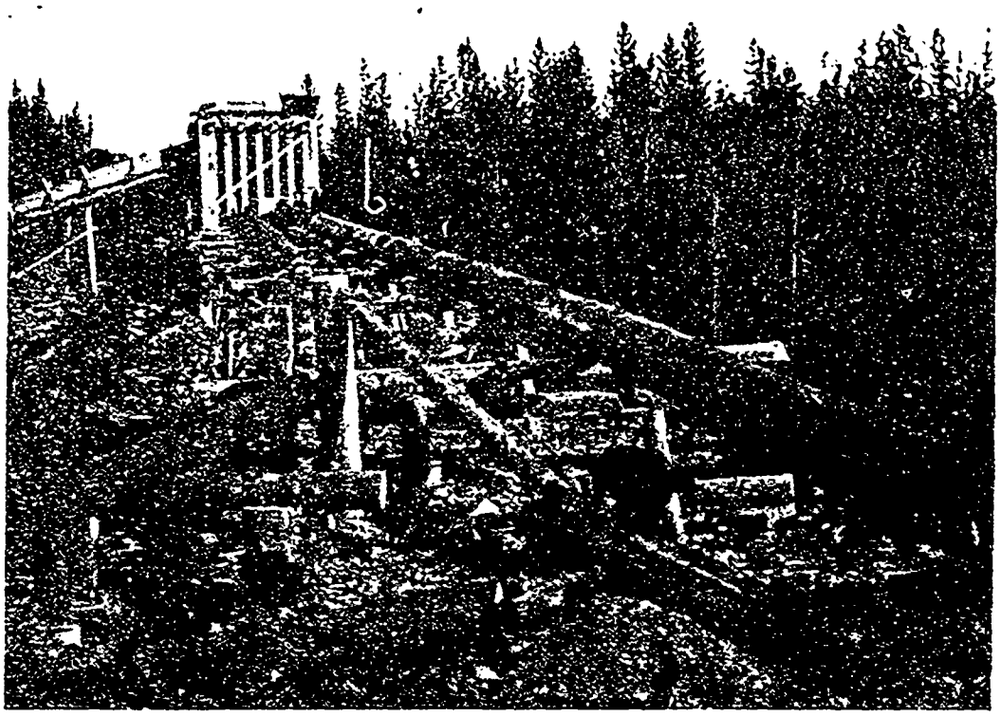
Monitor Pipe Line and Monitor.

Elevator Pipe Line. Elevator and Sluice Boxes.

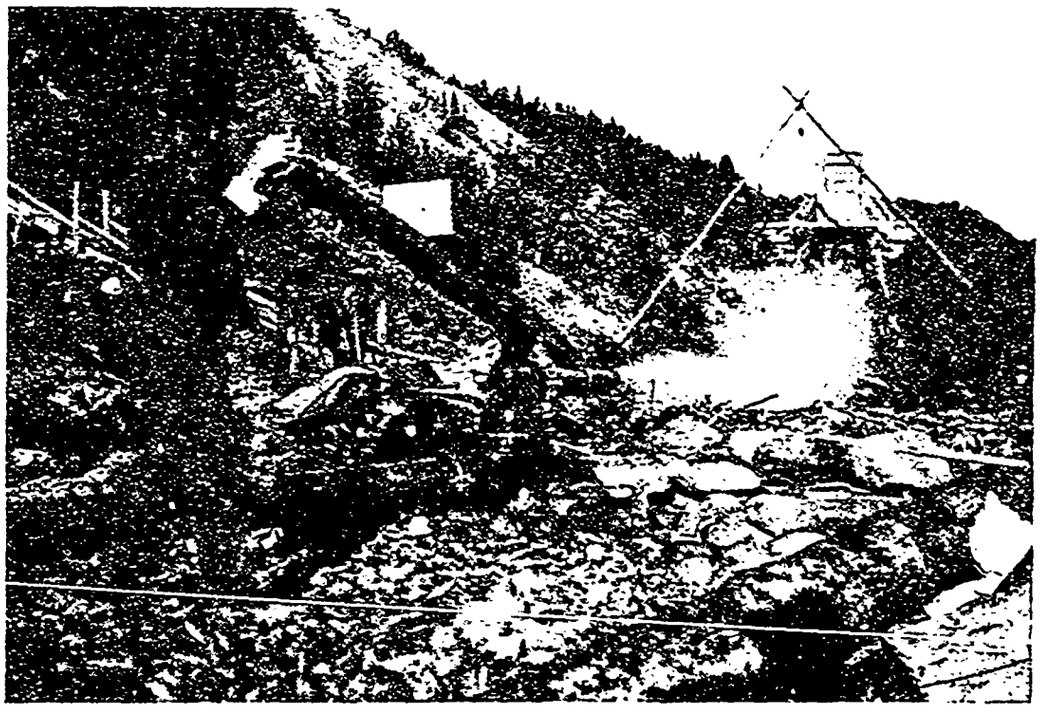
Manson Creek.

43rd GOLD MINING AND MILLING CO. OF OMENICA, B.C.

43rd GOLD MINING AND MILLING CO OF OMENICA, B.C

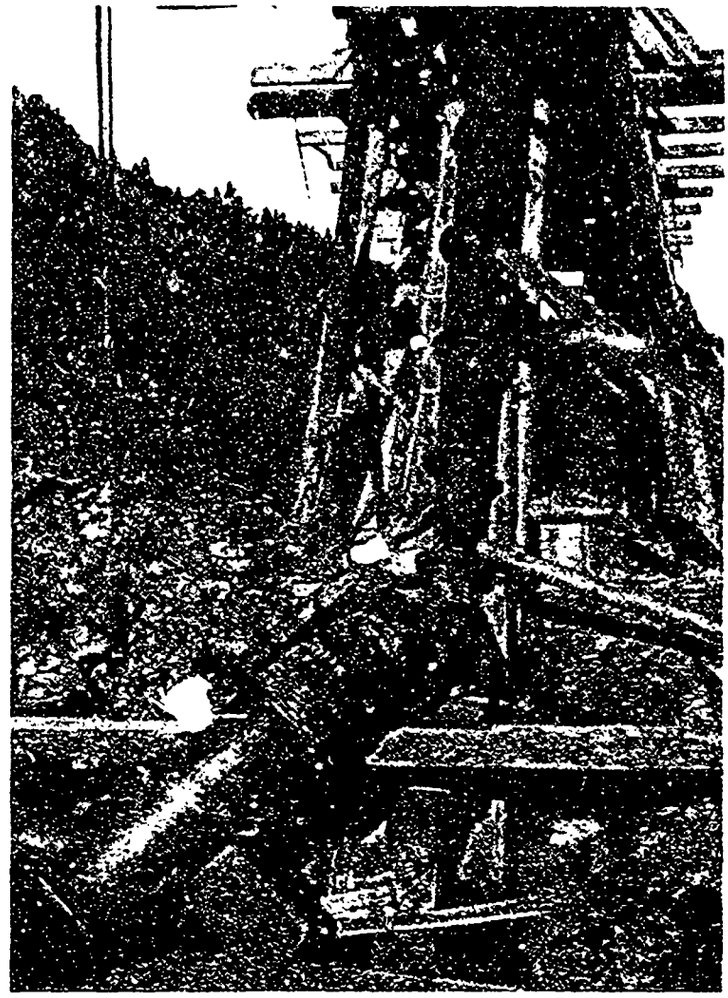


Penstock with Elevator and Monitor Pipe Lines



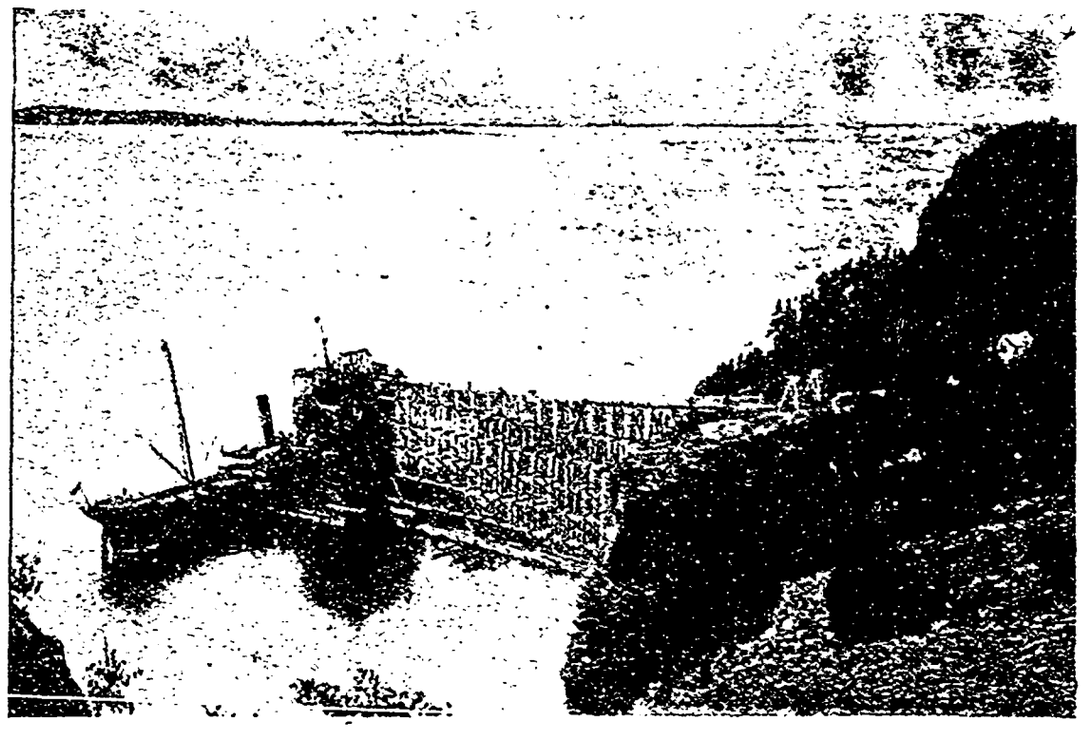
Monitor Working

3rd MINING AND MILLING CO OF OMENICA, B C

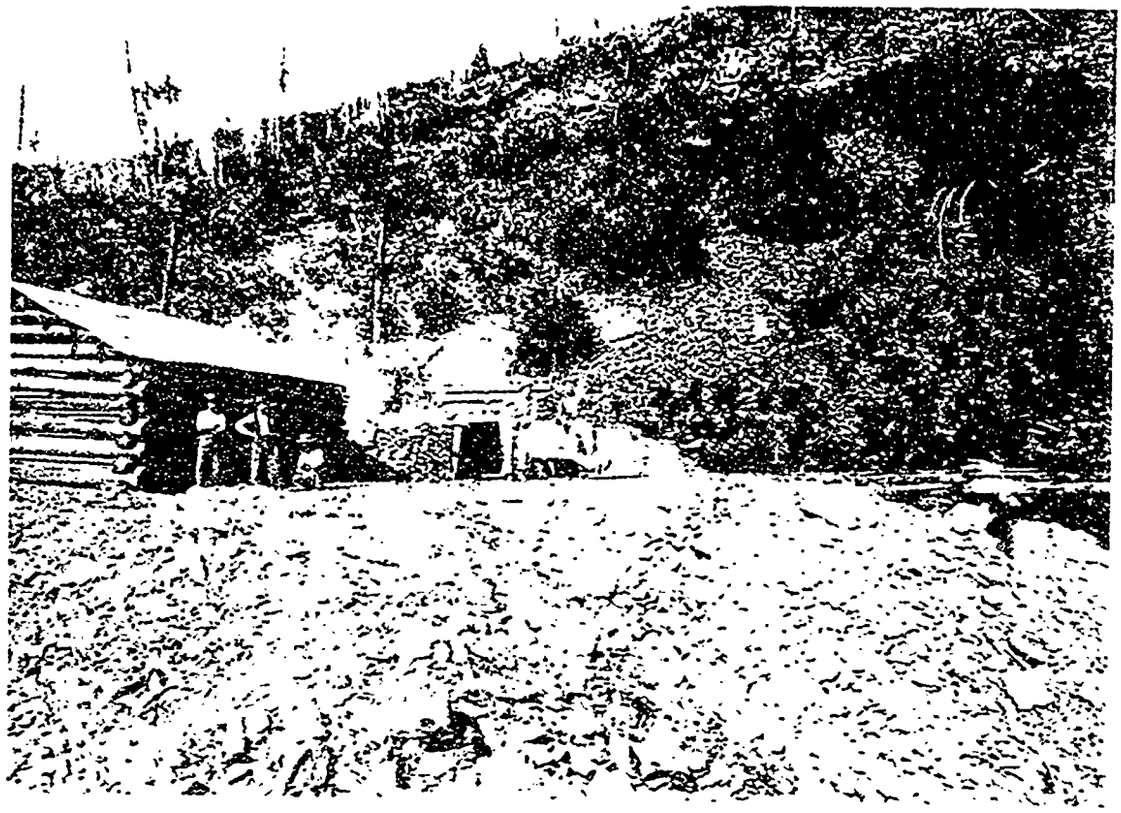


Hydraulic Elevator in Position

DOMINION IRON AND STEEL CO LIMITED.



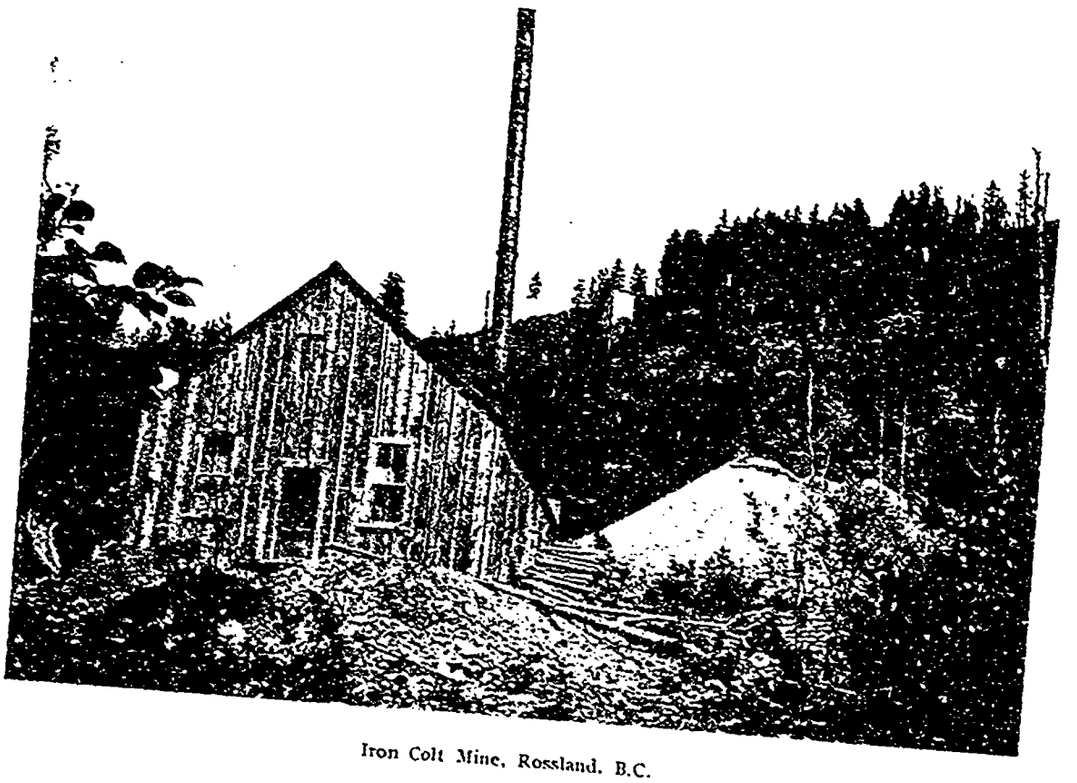
Shipping Pier and Loading Station at Bell Island Iron Mines, Conception Bay, Newfoundland, acquired from the Nova Scotia St l Co. Limited.



The Coxey Mine, near Rossland, B C

White Bear Mine, Rossland, B.C

Columbia-Kootenay Mine, Rossland, B C



Iron Colt Mine, Rossland, B.C.

Mining Errors.

By F. Danvers Power.*

As in every other line of life, so in mining, we have errors of omission and errors of commission, errors of ignorance and wilful errors. Were it my object to go thoroughly into this subject from all points of view, this paper would occupy more time than we are prepared to spend on it to-night; it is my intention simply to touch on a few of the principal errors that have crept into the practice of mining, in the hope that other members will from to time take the matter up more in detail and by showing the cause and effect, assist in gradually righting this great national industry.

Stock Gambling not Mining.

The very prevalent idea that mining is all chance, is the cause of many errors: fond parents think it a good opening for the fool of the family, and fools that have failed at everything else seem to be of the same opinion. Certain sharp individuals seizing the opportunity offered by the ignorance of the public, step in and employ their wits to fleece the unwary and so we get the foundations for the belief that miining is all chance and swindling. But here I might mention that the word "swindle" is often misused. A property showing every prospect of becoming a success from surface indications, may not come up to expectations after people have been encouraged to put money into it. This is not a swindle any more than any other error of judgment made honestly. The word swindle should be confined to those dishonest proceedings done with the object of defrauding, under the guise of fair dealing. That mining has enough and to spare of this sort of thing, we all know, but it is after all the fault of the public, and the public alone have the remedy in their own hands. In many cases the public do not care one iota whether the venture is a swindle or not, it is used as a means of gambling, they know very well that the market value of the shares is fictitious, but so long as they think that the "proper men" are in it, and they think they are in the "know," the shares are welcome to pop up and down like a will-o-the-wisp; but this is not mining, though it masquerades under that name.

The remarks that I make in this paper are only intended to apply to those cases where they fit, and not to mining generally, than which there is a no more legitimate industry.

Prospectus Writing.

Some persons have worked their way up to be past masters in the the art of word painting, and lay themselves out for prospectus writing; every point is seized, and capital made out of it. Should the mine have been previously worked and proved a failure, then its name is changed; as likely as not the name of some classical mine, e.g. Mount Morgan, Mount Bishoff, Mount Lyell, Tharsis, or Broken Hill is tacked on, either with the desire that an inference shall be drawn that the new property is as good as its namesake, or else in the hope that later on some new-chum will be beguiled into buying shares in the belief that they are those of the better known mine. Where there is a group of mines near a place from which the parent mine takes its name, there may be some excuse for adopting one of a similar sound, but when the mine is hundreds of miles away, it looks very much as if the owners were afraid that it could not work its own salvation. If a mine cannot make a name for itself, it would appear as if there was not much stability about it, and if it is established under a borrowed name, on account of old associations or other harmless reason, then it does not speak well for the judiciousness of the owners, and they may make worse mistakes in other respects. As a rule a similar name to a well known prosperous mine is simply employed as a catch word, and may be considered as a sign of weakness.

*Read before the New South Wales Chamber of Mines.

We are often supplied with an array of figures, the results of crushings, or washings, and these are sometimes placed in such a way as to lead one to believe they all come from the mine in question, whereas they are obtained from the district generally which may comprise many square miles. Even the crushings of any particular mine may be misleading, for the tonnage is generally estimated, and very often 25 or even 30 cwt. go to the ton, thus making the yield, per ton proper, considerably higher than it should. The yield per ton is also increased by selecting the stone; of course this is done at the expense of the quantity, but in such statements the quantity is often omitted. Speaking of picking, one often hears the remark that it was not "picked" because so many tons were treated. Now picking is not confined to hand specimens; there is such a thing as picking out the eyes of a mine, or in other words selecting the richer portions, and this often ruins a mine. One thing is certain, the more that has been taken out of the mine, the less there is left in it; and one wants something more than statistics of what has come out of the mine, before one can infer that there is as good ore as ever left in it.

Assays again are often misused, and are sometimes given simply to get the assayer's name into the prospectus, as if he was in a position to guarantee anything but the actual chemical work, unless he had been engaged to sample the mine as well. The assay may be all right, but the sample given the assayer may be all wrong. I have often had a man come to me with one piece of stone which he has declared was a fair sample of a heap of ore, that he had simply picked it up and had not selected it in any way. Why, if he were to smash that piece in half and have each assayed separately, he would be astonished at the results, and would go about saying the assayer was no good. The assurance some laymen show in presuming to give opinions on mining matters, and judge the ability of technical men which they are utterly unable to do with justice on account of their slight knowledge of such matters, is quite refreshing, and supplies no small amount of amusement to a mining man's life.

Vendors and Promoters.

Promoters frequently ruin the prospects of a mine by asking too much for it, and they attempt to hide their greed in various ways, even to the extent of trying to make a virtue of it. For instance, the following quotation is a common statement:—"The Vendors are so satisfied with the property, that they are taking the whole of their interests in shares and no cash whatever." This generally means that there will be a large nominal, but a small subscribed capital. The generous vendor thereupon accepts a lion's proportion of paid-up shares and allows the public the honor of subscribing money to pay for everything and supply their dividends, though often enough the subscribed capital is not sufficient to give the mine a fair show, and the reason the vendor does not ask for cash is because he knows he is not likely to get it. In the meantime, the promoters having the largest say in the management of the mine, direct the spending of the subscribers money, while they look on. Some promotors show their vaunted confidence in the mine by immediately selling their paid-up shares at a lower figure than the contributing shareholders can afford to do.

If they think they can get it, the vendors ask for a large sum of cash down, which amount is got at in various ways. The idea of valuing a mine in the same way as anything else would be valued, i.e., on the probable profits it will yield, being of no consideration whatever. Maybe the owner wants a life competency, reckoning that he has slaved long enough; or he may have a mortgage on a property that he wants to release; again he may wish to be paid for all the work he has done on the place whether useful or not, plus the value of the gold he has received, and the value of any gold that is ever likely to come out of the mine. A man seldom considers that if he continues to work in his small way it will cost him so much to win the metal, and that it

will be years before he can touch all the proceeds, besides having to take the risks of things not turning out as he expects.

Another way to receive value for a mine is to take so many partly paid-up shares. As a rule £1 shares are partly paid-up to 15s., but those who receive these never intend to pay a call, for they reckon that either they will be able to sell out before the calls reach that amount, or else that amount should prove whether the mine is a duffer or not.

If a mine has previously proved a failure, there are always plenty of excuses why it was so. A rush to a better field enticed miners to try their fortunes in another district; water was struck that the then appliances were unable to cope with; some rock caved in and killed a man, and so his mate did not care to go on working there; sulphides were struck and there were no means of working them, and so on *ad infinitum* except that they generally forget to state the real reason, viz., that the lode became too poor to work. Occasionally there is a modicum of truth in such statements, but as a rule local unwritten history tends to stray from the paths of virtue, and is good enough to pass on to some one else who is willing to swallow it without the proverbial grain of salt.

The acreage is another trap for the unwary. A large area sounds better than a small one, and we often hear the expression on the field that English Companies like large areas, and that you can take up as much land as you like on either side of the property under offer. True the English public, or any body intending to work on a large scale, like a large area, but they require that the area be judiciously pegged out, and have something of value on it, it is no use having several acres if a lode or lead only cuts through one corner.

It is interesting to note the ingenious way in which any doubtful quality of a property is passed over; as often as not it is stated in such a confused manner that no one can make head or tail of it; in such a manner is a bad title sometimes got over. Prospectus writers are not infallible, and all they put in black and white must not be taken for gospel truth, one must read between the lines. The faith these men have in the mines is something marvellous; they never have any doubts as to the profits to be obtained from these ventures, their chief difficulty is to persuade others to be of the same opinion. When a spec turns out a failure, they have a neat way of shifting the blame about from one to the other in a battledore and shuttle-cock fashion. If all mines were as rich as stated in the prospectuses then there would be a revolution in the metal world.

Directors.

Directors not only represent their own interests but also that of others. Many of them know nothing whatever of mining though they may be very good in their particular trade or profession; the want of mining knowledge, however, does not matter so much, so long as they have sufficient common sense to leave technical matters to those who do understand them. Some directors hamper and worry the unfortunate mine manager by giving him impossible or injudicious instructions to carry out, and interfere in matters that should be left to the manager. Let the directors be careful who they select in the first instance, and having appointed a man in whom they have confidence, then let him have a fairly free hand in the management. A man who has not the confidence of his Board of Directors is in a false position.

It is a moot question whether there should be professional directors or not. We hear the word "guinea-pig" applied to some who abuse their position by attending as many meetings as possible in a day in order to secure their directors fees, but this could be put a stop to by stipulating that a director should sit the whole meeting out before being entitled to his fee. A laborer is certainly worthy of his hire, and a professional director well up in his duties could do more in a quarter-of-an-hour than an ornamental one would do in four times that period. Those directors should be appointed who have the ability for that kind of work and are willing to do it. The days of figure heads are passing, the exposures we have had of late years tend to make the public look at persons on a directorate with a handle to their names as being closely allied to the confidence trick, especially if it is known that they are given shares to qualify them to sit on the Board, for such persons cannot be expected to have the same interest in the welfare of a company as those who have put their hard earned savings into it.

One can always get through business better when there are not too many present to take up time in unnecessary talk, still if the directorate is small, one may have a difficulty in getting a quorum. Some are bound to be too busy when wanted, or they will have some other excuse for not attending. If the directors make their living by this sort of work, then it is only natural that they give most attention to to those mines that pay the largest fees; thus a struggling mine that often requires their attention most, has to go to the wall.

Mine Management.

We have some mine managers in Australia who are as good as those in any part of the world, and as if to neutralise matters we have others who are as incapable as anyone could wish. We often hear that it is the mine that makes the man, and in some cases that is true, for greater extravagance is apt to take place about a rich mine than about a poor one, for the simple reason that the latter could not stand it; it may be because of this, that we often see better management displayed in the working of a poor mine than on a richer one, at the same time we must remember that a small mine is capable of the personal supervision of the manager more readily than a large one.

When an incapable manager is sent up to look after the mine, I do not know that he is so much to blame as the directors who put him in that position, and whose decision is often influenced by £ s. d., or the fact that they happen to know the individual personally in connection with other matters. Some otherwise good miners are spoiled by placing them in a superior position for which they are unfitted, as the fact that a man is a good miner is no proof that he will make a good manager, and things in the office often get into an awful mess. At one mine I had occasion to ask for the letter book so as to acquaint myself with the correspondence, the manager did not know what I referred to, until I took the book down from the shelf, or rather I should say what was left of it, for the manager not knowing what it was intended for had used it for toilet paper.

In any of my remarks of errors in mining, I shall be careful not to mention names of persons or places for obvious reasons, as my object is not to hold individuals up to ridicule; so although any instances I may mention are authentic, I do not consider it necessary to do more than mention the fact, without going into details.

One would think that the mistake of erecting a large plant before properly opening up the mine to keep it supplied, was a thing of the past, yet not so very long ago I had occasion to inspect a mine where 40 head of stampers were nearly completed, and there was neither ore nor water to keep the place going for twenty-four hours. Another possible result of this haste in erecting a plant before the mine is opened up is that one unsuited for the class of ore mined may be put up. Of course the treatment of an ore may require alteration, according to the position it occurs in; for instance, the oxidized ores near the surface might require an entirely different kind of treatment to the sulphides beneath, whether they be gold or silver.

While on the subject of machinery, it might be as well to sound a warning note on the erection of new and untried machinery in an out-of-the-way place, for even if the machine is given free, the expenses of erection and the delays bound to take place in the running of a new machine, to say nothing of breakages which cannot be well carried out

in the bush, cost more in the long run than the purchase of a more expensive but tested machine. I knew an instance where a man was ruined, and the mine thrown back for years simply by the purchase of a new fangled machine that was said to do much better work than an ordinary battery, which under the circumstances would have been better understood by those in charge, and certainly would have done better work.

There is another mine I have in my mind's eye where a number of Frue Vanners were erected on "made ground," that had not been given time to settle properly, and were worked by an enormous overshot water-wheel that also drove the stampers. Of course the vanners soon got out of plumb, and anyone who has worked such machines and knows anything about water-wheels can easily imagine how the machines would work under the circumstances. This mine was a very good instance of where one had nearly everything that one required, good roads, plenty of timber and water, a large lode, &c., but two very important essentials were missing, viz., common sense and gold.

Some directors think that because there is not much ore being won in the opening out of a mine that any one is capable of taking charge; this is a great mistake for if a mine is badly laid out at the beginning, it may cost thousands later on to rectify matters, or in extra labor that might have been avoided had a little more forethought been brought to bear on it. Some people have a mania for sinking vertical shafts, and start them before preliminary work has demonstrated how the lode underlies, and I know of places where such shafts have been sunk on the footwall side so that one had to drive farther and farther to reach the lode at every level. Prospecting shafts are seldom suitable, either in size or position, for main shafts, and should be sunk on the lode so as to obtain information about it at every foot, a vertical shaft only cuts the lode at one point unless it be a vertical lode. Prospecting shafts are not wasted, they always come in useful for stoping from, should anything of value be discovered. Even main shafts are sometimes better sunk on the underlay when the country rock is very hard and the lode has a regular underlay and is fair sinking. The position of a vertical shaft is a matter of great importance, for one not only has to take into consideration the depth at which the lode will be struck, so as to proportion the lengths of the cross-cuts, but one must also think of the pitch of the shoots, and avoid if possible any hard bars that may be in the immediate vicinity.

I once saw an inclined tram, situated directly at the back of a battery so that if a truck broke away it would go crashing through the shed in a manner that would make a bomb-shell child's play to those working inside. At another place there was a so-called self-acting incline that was put up in such a way that half-a-dozen men had to be called out of the mine each time it was necessary to start it. Yet another inclined tramway was always getting the trucks derailed which caused much delay, the reason being that there was no space left to allow for the expansion of the metal on a hot day.

There are many errors in the carrying out of mining work that are not obvious to a stranger, since they are hidden from view only to crop up at unexpected and awkward moments, such for instance as insecure foundations, shafting not being set true causing belts to run off pulleys, bearings to heat, etc. Other errors can at once be seen, such as piles of unsuitable machinery heaped up as old iron. One foundry man said that he never complained about the incapacity of experts or engineers, as were it not for the different opinions that each held necessitating new machinery, his foundry would have to close down. This speaks for itself. There is still another class of errors intermediate as it were between the other two, *i.e.*, those that are only obvious to those who understand something of mining, e.g., cross-cuts driven in unsuitable places which don't prove any more than other workings already in existence do. It is impossible to go into the various economies of mine management here, as what is suitable in one place may be entirely wrong in another, and every possible kind of blunder appears to have been made in some mine or another.

Some mine managers are better at manipulation than in expressing their thoughts, while others have no difficulty in preparing reports for publication with convincing force, notwithstanding that they handle the truth very carelessly. It is by no means so easy to get a well-balanced, well-informed and experienced manager.

A certificate from a School of Mines does not make an engineer, it simply states that you have studied the necessary subjects that form the foundation of an engineer's knowledge, the A. B. C. of his profession as it were. To consider himself a full-fledged engineer after passing his examinations and to act on that assumption by accepting a high position at once would be to cause himself much worry and anxiety, and his employers much expense. It is far better to start at the lowest rung of the ladder and work yourself up, as by doing so you are more in touch with the class of men who you have subsequently to take in hand. It is not necessary for a manager to be able to drill and timber as well as the men under him who do nothing else all their lives, and anyhow a man cannot be a specialist on all subjects, but he should have practical ideas and have sufficient command over his men to see that they are properly carried out. He should also have a good idea of the value of ground, and use his common sense in letting tributes and contracts. Unless there is an unusually good market for his product he should arrange to have a regular output, one wants to keep up a good average, not to pick out the best stone one week so as to beat a former record at the expense of subsequent results. Tact is a very necessary quality in a manager, a man who fraternises with his men is bound to be imposed upon, and a too zealous manager, by breeding discontent among the men, may do more harm than a careless one. To work a mine satisfactorily there should be sufficient development work done to show a good supply of ore ahead, and a proper set of books should be kept by means of which the officers can detect where any leakage is taking place, or when any particular class of work costs too much.

Experts.

An expert has three things to keep in mind; 1st, his own reputation; 2nd, the interests of his employer, if that employer wishes for a truthful report; 3rd, the public who may be influenced by his opinion to put money into the venture.

Sometimes a man has impudence to suggest that the expert shall be paid by results, as if the expert was responsible for the omissions of Nature, and as if his time and opinion on a property cost him nothing should the mine be no good. This is a case of "heads I win, tails you lose." Granted that it is disappointing for a man to have to pay for a negative result, if he intends to put money into a mine, such a report might save him losing more than the cost of a report, and if he be a vendor, he has no right to expect another to perjure himself for his benefit.

People like a decided report: to enter into explanations and lay down conditions that must be fulfilled, is looked upon by the public as a sign of weakness If reports are confined to a matter of yes or no, it might appear that the chances are even for an unexperienced man being right, whichever he chooses to select. This is however, not the case, for there are more bad mines than good ones, notwithstanding which a self styled expert generally gives a "favorable" report, for being of mushroom growth he is a time server and takes no heed of the morrow.

There is no human law to prevent anyone terming himself a Mining Expert, or Geologist, in New South Wales, anymore than there is to prevent a man from calling himself a miner or stating that he belongs to some other line he does not, except as a parasite; the con-

sequence is that there are all sorts of men who claim to be experts, and they crop up in dozens during boom time. Those who are qualified, consider it beneath them to expose such men, and if anyone undertook to do so, he would have his work cut out for him. Thus we find all sorts of persons who have failed at other callings offering advice on the spending of thousands of pounds. It is such men as these, who in a great measure give mining a bad name and throw ridicule on an otherwise legitimate calling. We find these pseudo-scientists making most astonishing statements. Thus, we hear of "Diorite of the first, second and third waters:" "Red, blue and yellow ox-hides," and similar extraordinary substances. Some people seem to think that the only qualification for an expert is an unlimited amount of cheek, and a fair variety of long words, termed by them "technical," no matter whether they are to be found in a dictionary or not. They arm themselvers with quivers of these, and fire them at random in their conversation, besides peppering them through their reports to give them the superficial appearance of being all right: but such persons are like the individual Mark Twain writes about in "Roughing It," where he remarks, "What Mr. Barlow customarily meant when he used long words was a secret between himself and his Maker."

Some men delight to have half the alphabet after their names, and many of them join Societies for no other reason than to enable them to use certain letters. As a rule these letters mean that they pay a subscription of two guineas per annum to become members; the society does not guarantee that they are qualified in any way to be experts, but presuming that by his desire to become a member of a society he is interested in the subject it represents, the individual is permitted to assist by his annual subscription. There are some societies who are careful that candidates shall be well up in its special subject before becoming members, and must prove their ability by actual work done, others require that examinations shall be passed, and we all have a fair notion of what University degrees mean. Because the undiscriminating public detect some frauds decorating themselves with unmeaning initials, they go to the other extreme and laugh at those who use abbreviations of which they have reason to be proud.

'Determined beforehand, we gravely pretend,
To ask the opinion and thoughts of a friend:
Should he differ from us on any pretence,
We pity his want of good judgment and sense
But if he falls into and flatters our plan,
We really do think him a sensible man."

A man who undertakes to float a property has no use for an adverse report, and so searches about for a man who will write one that suits his purpose. All one expert could say in favor of a property was that "if it lived down and was rich enough it would pay." Another man reporting on a block-claim said that the lode would be struck at 200 feet; but he never went down the adjoining mine to measure the underlay, otherwise he would have found that 2,000 feet would have been nearer the mark, "but," he continued, "putting this on one side, a quartz formation on the block alone is worth the money asked." This quartz formation I may mention, was a buck-reef, only good for road metal, but too far off the road to be of any use for that purpose.

The following are extracts of a report on a deposit of copper stained quartz by a man signing himself a "Mining Captain;" the general tone and expression stamp him as a charlatan

"Having visited the above-named valuable property, I have the honour of forwarding my report on the same. I found a shaft sunk 5 feet, and a *crossteen* 2 feet long. I consider the *distance* from No. 1 opening to No. 5 comprises an *area* of fully two miles, and I have not the least doubt that if the property is judiciously worked and fully developed, that you will have a fine dividend paying one. Allow me to congratulate you on the prospects you have in this valuable property. Viewing this property in all its bearings, seeing there is a fine natural road direct to the mine, consequently the removal of the produce will be done exceedingly cheap compared with many other districts. The two walls are visible the whole way in the drive, and I can unhesitatingly say that I never in my experience saw two better walls to a copper lode. I then examined the *stone extracted* from the old Tom shaft, and proved it to be a very rich *lode of ore.* From the appearance of the ground and other signs, I should pronounce it to be a champion lode. *Yellow sulphates* and *coated ores* are found in the development of your mine to the greatest depth you may ever want to attain. Taking the copper discovered to be 25 fathoms deep and 50 fathoms long, and an average width of 2 feet, and about 5 tons to the fathom, you have 2,085 tons in sight. I would strongly recommend that the first operations should be directed to the erection of furnaces for smelting, as also an engine for pumping and winding, after these are completed and in full working order, I cannot see anything to prevent this from becoming highly remunerative."

Another party writes on a mine, now defunct: "*The assays* of iron ore at 80 feet deep is most encouraging, and in my opinion *shows that it is a fissure lode* of great magnitude, and that there can be no possible doubt as to the future success of the property."

The estimates in an ordinary report are not worth the paper they are written on. The usual way is to find the length of the reef, adopt a certain width, and assume a depth; then reckon out the cubic contents, put down the cost of mining as the cost of stoping only, and count the difference as profit; but being somewhat alarmed at the highly encouraging results, the expert knocks of a large percentage for contingencies, till the figures assume proportions that might possibly be believed; the public knowing these figures are scarcely ever upheld in practice are accustomed to reduce them still further, in fact, if they have proper figures shown them, they are apt to doubt the value of the mine, as there is no margin left for their reduction. Now in the first place the expert has no right to reckon those portions of the reef as ore, that will not pay to work, but should take the tonnage of the shoots, then he should charge each ton of ore with its proportional part of the development work, treatment, timbering, mullocking, trucking, pumping, winding, management, stores, wear and tear of machinery, office expenses and the various items connected with it.

The expression "ore in sight" is often misused. Properly speaking "ore in sight" consists of a block of ore exposed on four sides, say between two levels connected by two winzes. That which is only opened up by one level or the surface and one winze or shaft is called "probable ore in sight" if you have every reason to think the ore will occupy a block the two sides of which are developed. The "possible ore in sight" consists of a hypothetical block that one may reasonably expect will consist of ore

To fully appreciate the absurdity of some of the reports that are circulated about, it is necessary to inspect the property they refer to. Reefs get diverted out of their course in the most marvellous manner, in order to run from one end to the other of a claim, and the wish being father to the thought, miracles are worked that defy all the laws of nature. In an attempt to bring matters down to a mathematical basis, I have come to the conclusion that the value of a mine increases in direct ratio to the distance it is from those who find the money to work it.

To sum the whole matter up, those who enter mining in the same intelligent manner that they would any other avocation are just as likely to make a living at it as in any other line; to attempt to make a success of a property which nature has not endowed with the elements of success is like a man establishing a shop for the sale of high-class goods in the slums. He may come across a bigger fool than himself who is willing to buy him out, but the chances are against him.

The Adjustable Comet Crusher.

The superiority of Comet gyratory type crushers over rock crushers of the jaw type is practically conceded for the reduction of quartz rock and for ballast and "road metal" work. Weight for weight their capacity is much greater.

For example, a size C reducing hard quartz to 2 inch ring and under, puts through 500 tons a day at a well-known Idaho mine. Its weight is 18,300 pounds. It displaced two 9 inch by 15 inch jaw crushers, each weighing 16,900 pounds. Weight for weight the capacity of the Comet was double. The cost of wear and repairs was also much less.

The comparison of actual outputs showing so significant an advantage for the Comet does not appear to show its full superiority as one of the Blakes is rated to be of a capacity of 8 tons an hour, or 192 tons in 24 hours, while the Comet "C" is rated at 15 to 30 tons an hour, or 360 to 720 tons in 24 hours.

In other words, the Comet was not forced to make a showing. It was not fed up to its capacity. It was a comparison of usual practice by one disinterested millman who got the most he could out of the two jaw crushers, and then substituted one Comet of about half the weight to do the work of both.

In larger sizes of any desired capacity (the largest Comet made being capable of crushing 2 or 3 tons a minute) the comparison as to weight is even more favorable to the Comet, as the framing of the straight jaw machines has to be inordinately heavy to resist the strain imposed.

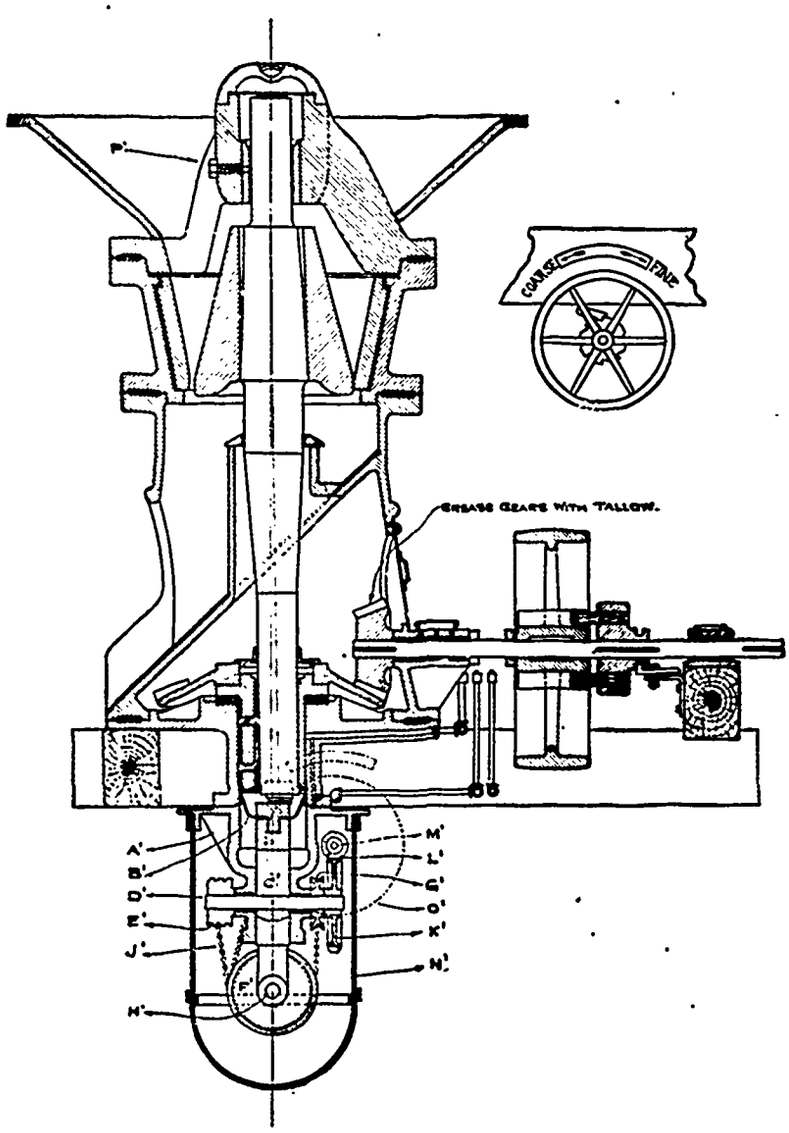
Theoretically we have in the straight jaw machine an intermittent action, while the Comet gives a continuous crushing around a cone of circular section.

In point of strength, the straight jaw machine has flat members, not the most economical form for resisting stresses, while the Comet has one central fulcrum capable of resisting to the limit of integral strength of the steel or chilled iron of which it is composed, and the enclosing ring in which any surface stress is backed and supported in the best form possible.

If a piece of the hardest hematite of a flattened and elongated form, which is not unusual, gets into a flat jaw crusher the jaws have no advantage; they must crush the solid mass at one stroke But with the Comet crusher such a piece is broken as easily as "the butterfly upon the wheel." It becomes a lever of the first order with the cone as fulcrum, and is shattered by cross breaking.

It is not surprising then that the owners of Lake Superior iron mines are recognizing the merits of a crushing machine which has long since won its way in the gold mines.

The details of the Comet crusher are shown in the plate presented herewith. They merit careful attention, for the work that these machines do is as severe as any that steel and iron are called upon to perform. To devise a veritable stone eater which will chew up the toughest and hardest rock continuously, and at the same time run smoothly and with comparatively small power, is no small achievement in dynamics, and while running, the cone can be moved up and down with an easy adjustment so as to vary the size of product. It is not necessary to stop the machine and screw or shim it up. The adjusting



gear is always ready, and by means of it the wear on the heads and liners can be equalized to promote the endurance of these severely tried wearing parts.

The stresses imposed on the bearings are severe, and good oil and lubrication are of prime importance. Fraser & Chalmers, of Chicago, the sole makers of Comet crushers, have determined upon and recommend to their customers a superior fire-proof oil which has given most satisfactory results in practice.

Where cool bearings are so important and stresses are so severe, Fraser & Chalmers have considered it the best engineering practice as well as considerate of their customers, to make bearings ample. The driving shaft is given two good bearings. Overhung bearings have been tried without the outboard bearing, and trouble has resulted despite extra efforts to keep the single bearing from heating and cutting. It is a poor point at which to economize bearing surface, and a substantial outboard bearing is a good means of securing immunity from trouble, which it would be unwise to abandon.

October 28th, 1899. G. H. F.

The Application of Electric Power to Mining in British Columbia.

By GEORGE P. LOW, Editor of the Journal of Electricity.

Kootenay district includes that portion of British Columbia lying on the Canadian boundary immediately north of Spokane, Wash. It is an exceedingly rough country. The crest of the Rocky mountain range forms its eastern boundary and the Selkirk and Purcell ranges, paralleling the Rockies, run through its center and thus separate it into its east and west divisions, each of which has an average width of from sixty to seventy-five miles, by a length of over two hundred miles. The district is very heavily wooded with dense underbrush or of bleak and barren granite formation, according to altitude or precipitousness, and the wild, rugged grandeur of mountain scenery, which has, above all other features, made the Canadian Pacific Railway world-famed, is mostly located within its confines. Curious indeed too are the formation of it lakes and water courses. Inland fresh water seas, almost innumeral , and of all shapes and sizes, mark the country on every hand, and the multitude of rivers supplied from them eloquently bespeak permanence for the sources of the mighty Columbia. Water is everywhere, as are also the Indian and frontier names, euphonious or otherwise, such as the town of Illecillewaet, the Spillimacheen river, or Horse Thief Creek. But an idea of the broken and erratic topography of the Kootenay district cannot be better conveyed than by reference to the seeming antipathy which the Columbia and Kootenay rivers bear each other in their early courses. The Columbia has its source in upper Columbia Lake, whose head or southern extremity is about fifteen miles above the Canadian boundary line. Thence the Columbia flows in an almost due northwesterly direction for practically two hundred miles, whence it turns southerly and then westerly, first through the West Kootenay district and then into the United States and on to the Pacific Ocean.

A few miles east of the Columbia, at a point some sixty miles below its source, are two comparatively small lakes a mile or so apart. From the northerly one the Beaver Foot River rises, eventually reaching the Columbia: in the southern lake the Kootenay finds its source and continues down in a south-easterly direction, parallel with and at a distance varying from ten to fifteen miles from the Columbia River, though the streams flow in opposite directions for about sixty miles. When the head of the Columbia is reached and further paralleling is impossible, the Kootenay approaches within three miles of its rival river, but quickly turns from it, flowing away one hundred and fifty miles further south into Montana, whence it retraces its course into British soil and finally joins the Columbia near Robson, some thirty miles north of the boundary line. Before doing so however, it forms the Kootenay Lake, which is perhaps sixty miles long and from four to eight miles wide, and from the lake it continues to the Columbia through a broad, resistless water course something less than fifty miles in length. It is near the lower end of this portion of the Kootenay River, which forms the connecting link between Kootenay Lake and the Columbia River, that the Bonnington Falls are located, and at the lower Bonnington Falls is the generating station of the West Kootenay Power and Light Company, Limited. Thirty-two miles distant is Rossland, which is one of the newest and most prosperous and promising gold mining camps in British Columbia, and in which electricity is not only fast superseding all other forms of power in mining work, but it is also even put to characters of mining service ordinarily classed as impossible of accomplishment. It has been my fortune to make personal examination of the principal electric power transmissions of the West, and it is without hesitation that I state that in none of them is the West Kootenay transmission exceeded in points of thoroughness, of engineering design and commercial advantage. While the heroic manner in which it has grappled with every phase of the power problem as applied to mines, and the thoroughness with which it has worked out the complete solution of these problems, enables it to stand alone as one of the most perfect mining transmissions to be found on the Pacific coast. After a long familiarity with experiences which have been had in California transmissions in attempts, generally futile, to operate mining hoists by induction motors, one is quite unprepared on reaching Rossland, to be informed that for months the War Eagle hoist at that place has been operated by a 300 horse power induction motor and that the service therefrom has been absolutely perfect, so perfect indeed, that the Le Roi mine is to have its steam hoist displaced by a hoist operated by a 500 horse power induction motor after the plan of the War Eagle hoist as soon as the Kootenay Company has enlarged its plant and can furnish power for its operation. All electrical and mechanical details concerning these and many other features of all-important interest will be given in this article.

Among these further features may be briefly enumerated the extraordinary thoroughness and reliability of the water power development, the difficulties which attended the building of the pole line over a rugged route wherein could be found but a few miles of practically level line out of the entire distance, and where, in its length of 32 miles the altitude of the line varies at different points by over 2,200 feet. A novelty in the line of construction consists in the use of roofed poles and cross arms, and the Columbia River is crossed with a single span 1,500 feet in length without the use of supporting cable. The plant was built essentially for power purposes, and of its present load only about twelve per cent. is in lighting, the remainder being in both synchronous and induction motors in mining duty for the operation of compressors, hoists, rock breakers, roasters, bricquetting machines, blowers, machine shops and other equipments used in and about mining and smelting work.

At Bonnington Falls, the Selkirk Mountains rise to an elevation of over 1,300 feet above the river, or to an elevation of about 3,500 feet above the sea level, and the beautifully snow capped peaks of the rugged range, together with the grandeur of the chain of the falls, forms a charming and picturesque scene. At low water the falls, both upper and lower, are capable of delivering 267,000 horse-power, but the West Kootenay company has thus far attempted to utilize only a portion of the lower falls, which, under the 40-foot head available at extreme low water, are capable of delivering 100,000 horse-power. The Kootenay river is 400 feet wide at the lower falls and in developing a portion of its water power, the West Kootenay Company constructed a canal 650 feet in length and some 26 feet in width, all through the hard country

rock. Towards its lower end the canal widens out into a forebay 54 feet in width, the forebay being closed in by a solid concrete dam 32 feet high and 26 feet in width at the bottom, tapering to six feet in width at the top. Between two high bluffs at a point in the head race, 250 feet above the concrete dam, has been constructed a wooden dam sloping at an angle of 42 degrees up stream and having a vertical height of 44 feet. The sills and timbers of this dam are spaced five feet apart, and all of the timber, including sills, are of 12 x 12 material solidly bolted to the rock, the whole being then planked by a double layer of four inch planking. In the bottom of this dam are five sluice ways and its object is to break the impact of water flowing into the head race from the canal during high water, or, in general, to insure the control of the water entering the forebay at all times.

Lower Bonnington Falls have an extreme difference of level of 32 feet, which measures the head of water available at the power house. The main concrete dam is provided with three feeders, two of nine feet each and one of ten feet. The upper ends of the feeders are closed by gates which measure respectively 12 feet by 13, 12 feet by 13, and 13 feet by 14. These gates are of wood, and consist of a framing of 12 x 12 timber to which is solidly bolted eight-inch planking. The two outside frames extend upward of 38 feet and to the walls of each pit are bolted the racks for raising and lowering the gates. The gates are further provided each with a small iron flood-gate, 12 inches by 12 inches in size, and the main gates are raised and lowered by means of headgate irons rigidly bolted to the top of the dam. The winch controlling the headgate irons are operated by one man. The three steel penstocks, each nine feet in diameter by 20 feet in length, run through the concrete dam into the hydraulic section of the power house near the base of the dam. The back of the dam practically forms one side of the power house and tail race, the latter extending at right angles to it and consisting of a pit approximately 30 feet in depth by 20 feet in width, extending nearly the length of the power house, which is 66 feet. In the clear water the tail race is flanked by built masonry and concrete retaining walls, which vary from four to six feet in thickness, and extend upward to approximately the level of the power house floor. The floor plan of the power house shows the arrangement of the turbines and their mode of connection to the generators. Bolted to the lower end of each penstock is a 13-foot casting, containing one pair of 39 inch horizontal cylinder gate turbines. To these castings or wheel housings are bolted the draft tubes, which are 22 feet in length and ten feet in diameter at the lower end. The housing is supported on each end by the retaining walls of the tail race and are further carried by I beams. The turbines for driving the exciters are supplied with water taken from the main turbine housings.

To be more explicit, the three 40-kilowatt, 125-volt multipolar exciters are direct-driven from independent horizontal, 12-inch registered gate turbines which are contained in the cast iron flumes, the latter in turn supported by transverse beams of the large wheels, while bolted to the cast iron flumes are the draft tubes and feeders. The latter are connected to the shafting of the large wheels from which they derive their water supply. The portion of the power house containing the generators and switchboards together with the transformer house built thereon as an L, is bedded on the solid granite rock, which, after being suitably dressed and surfaced with concrete, gave almost perfect foundations for the heavy machinery to be placed therein. A single roof covers the entire structure with the exception of the transformer house which is independently roofed. The building is fireproof, with walls of brick and roof of wood, covered with galvanized iron. The inside dimensions of the turbine house are 25 feet by 64 feet, those of the generator room are 31½ feet by 66 feet, while the transformer house measures 17½ feet by 28 feet. A flight of nine stairs takes one from the floor of the generator room to that of the transformer house, the difference in elevation of the two floors furnishing space for the blowers of the air blast transformers and ducts, as will be described hereafter. The height of the building from floor to the ridge of the roof is 40 feet, and ample room is thus provided for substantial framing on which to carry the tension leads.

The next feature of interest is found in the 300-kilowatt synchronous motor operating the 40-drill compressor at the War Eagle mine. Three-phase current at 2,300 volts is applied to this motor which runs at 200 revolutions per minute. It is of the revolving armature type, has thirty-six poles and consequently, bears the designation "A P 36-300-200." A General Electric multipolar exciter, is driven from a large pulley on the free end of the motor shaft, and this exciter has an output of nine kilowatts at 125 volts when operated at 1,450 revolutions per minute. The compressor which is of double duplex type, is driven through independent ropes applied direct.

The method originally installed for starting the synchronous motor consisted of a 30 horse-power induction motor belted to a counter shaft through a friction clutch, this shaft carrying a spur gear by means of which the armature was brought up to speed. It can not be said that this equipment has been satisfactory, although it is in practical operation. The difficulties in its use rest first in the fact that in bringing the armature up to synchronism the compressor must, as well, be brought up to speed; and second, the 30 horse-power motor is too small for the duty required. It takes most exactly eight minutes to bring the motor up to synchronism, in doing which the 30 horse-power induction motor delivers from 120 to 130 horse power, and, incidentally, has its temperature raised to a point somewhere above that conducive to a ripe old age. Although the small motor was still in service at the time of the writer's visit to the mine, it was shortly to be replaced by one having more than double its capacity It should be stated in justice to the engineer of the Kootenay company that the starting device here discussed was not of his design or sanction. With the exception of the time consumed in starting, the equipment gives the best of satisfaction. A number of small motors ranging up to 20 horse-power in capacity are used in and about the War Eagle mine for ventilating purposes, driving conveyors, etc., and all these motors are of the induction type except that on the compressor.

At the Iron Mask mine is a 75-kilowatt "S.K.C." synchronous motor, made by the Royal Electric Company of Montreal. It is a two-phase motor, with connections altered for three-phase service and is started through an "S.K.C." induction motor and water rheostat. The water reostat consists of three fan-shaped blades plunged edgewise into a three-compartment tank of water, thus enabling the water resistance cut into each leg of the three-phase circuit to be varied according to the depth of immersion. The 75-kilowatt motor is belted to a jack-shaft which drives two double-acting compressors having a combined capacity of ten drills. This is the only Stanley equipment on the West Kootenay circuit and its service is most reliable.

In the Big Three mine is a 75-kilowatt General Electric synchronous motor, driving a seven-drill compressor, while at the Gertrude mine is a 50 horse-power General Electric induction motor operating a hoist. The British Columbia Bullion Extraction Company has one 50 horse power induction motor driving a rock breaker, and one 75-kilowatt synchronous motor operating all machinery about the mill including generators for electrolytic work.

These motors, as well as all others referred to hereafter, are of Canadian General Electric manufacture. On the properties of the British-American Corporation are four 150 horse-power induction motors, each operating a double drum hoist through equipments which are in every way similar to those at the War Eagle mine. All underground work in and about Rossland is operated at 220 volts. Aside from mining work, the principle power installation is that of the general

machine shop of Cunliffe & Abblett, where a 50 horse-power induction motor is installed. There are many small motors ranging from one to five horse-power in size for the furnishing of light power in different industries in Rossland, B.C.

One of the most interesting points to be brought out by the Kootenay-Rossland transmission is the demonstration of the fact that the operation of synchronous and induction motors in large units for the driving of hoists and compressors will not necessarily create serious disturbance in the voltage of the distribution circuits, provided high voltage, ample fly-wheel effect and capacity prevails. During daylight the power and lighting circuits are operated in parallel, although they are separated and operated independently from the power house by night.

The War Eagle hoist, however, is operated on an independent circuit by day, but at night it is cut into the power circuit at the Rossland sub-station. The result of this arrangement is shown in the reproduction of the recording voltmeter chart which is that of the lighting circuit. From 6.45 p.m. to 5.00 a.m. the chart shows the regulation of the lighting circuit when on an independent line from the power house. At 5 a.m. the War Eagle hoist is taken from the power circuit and put on an independent line to the power house and the remaining power load is coupled in with the lighting load and carried on the second line to the power house. The voltmeter curve, therefore, from 5.00 a.m to 6.45 p m. shows the regulation of the plant when all power with the exception of that for the War Eagle hoist is in parallel with the day lighting load. The chart is that for an ordinary day, and, indeed, the charts run so evenly from day to day that each almost duplicates the the other. The day in question there were in operation from 5.00 a.m. to 6.45 p.m. three 100 horse-power synchronous motors with an average load of 280 horse-power on compressor work; five 50 horse-power induction motors with an average load of 210 horse-power on the same, 3 of which were on hoists; three 30 horse-power induction motors with an average load of 76 horse-power, and one 40 horse-power induction motor carrying an average load of 32 horse-power. The lighting load consists of 300 horse-power, which is high in proportion to the night lighting load because of the heavy 24-hour load carried. The report from the generating station for the same day shows that the variation reached 108 amperes at 110 volts, or an approximate variation of 205 horse-power, considering which the regulation is remarkably good. The secret of this is stated to lie in always maintaining a high voltage in relation to the motor ratings, with ample generator and water wheel capacity.

The conception and commencement of the work on the remarkably interesting transmission of the West Kootenay Power and Light Company, Limited, are largely due to the efforts of Sir Charless Ross, Bart., and Mr. Oliver Durant. The charter was obtained in the name of Mr. Patrick A. Largey, president of the Center Star Mining and Smelting Company, Oliver Durant, manager, and C. R. Hosmer, manager of the Canadian Pacific Railway Company's telegraphs, and it was afterwards transferred to the West Kootenay Power and Light Company. Preliminary surveys were made early in 1897, but it was in July of that year that the location of the plant was definitely settled and actual construction begun. The plans of the company contemplate the the ultimate utilization of the entire three falls.

The Ymir Gold Mines.—"During last month 2,790 tons have been milled, producing 1,489 ounces of bulion and 175 tons of concentrates. Have shipped 126 tons of concentrates and no smelting ore. Total receipts for month from above are $21,112; expenses, $5,364. On account of the bad state of the roads entire production has not yet been shipped; estimate of balance 49 tons of concentrates, 40 tons of ore; net estimated value $4,128 additional." Office Note.—The foregoing makes the profit for the month of October $19,876, approximately £4,000.

Stock Gambling vs. Mining.

A depreciation in the price of copper may have the effect of cheking the demand for copper mines and prospects and turn the attention of investors to gold mines once more, for since the copper boom promising gold properties have been largely overlooked. Those seeking investment in mines should always consider carefully not only the present but the future prospect. Copper is never stationery in price for any great length of time, but gold is always worth $20.6718 for each ounce of the pure metal. A few months ago 15 cents per pound was considered a high price for copper, but it went above it, and the rush for copper mines, copper prospects and copper stocks indicated the public confidence that the high price would last for all time, or at any rate until a fo ne could be made. Now the price is falling and copper stocks are falling with it and those who bought in at or near top figures are losing their money and condemning mining as an investment. There is little use in warning those who make these ventures, for if they did not gamble in high-priced copper stocks they would risk their money in other enterprises equally uncertain, but their loud complaint at the loss of their money in mines deters others who would otherwise invest on a rational business-like basis from making any investment at all, and legitimate mining gets a set-back. For many years mining suffered from the effect of speculation and ill-advised investment and a period of depression followed, during which the industry secured a firm foothold, depending upon merit alone, and has come to be looked upon as a legitimate business offering greater profits for investment than any other industry, but an era of wild speculation in which many lose fortunes is almost certain to have a reactionary effect and for the good of the mining industry at large it is better to see copper settle slowly downward to a reasonable price than see it advance to 20 cents. Competitive metals will cause it naturally to seek its proper level in the commercial world. The investment of money in a *bona fide* mining operation, the management of which is in the hands of competent and experienced men, is as safe an investment as one can make in any business offering a possible large return for capital invested, but the investment of money in the high-priced stocks of mines in the management of which the investor has not only no voice but little knowledge of existing conditions is quite another thing.—*Mining and Scientific Press.*

LARDEAU DISTRICT.

Notwithstanding the very marked indications that we had in October of an early winter, very little snow has actually fallen, and that little appears to be rapidly vanishing; from which fact it would appear that it is unwise to prophesy until the matter in question is beyond dispute or until it has happened. But sufficient has fallen to render the various mining camps practically isolated, and it is only by the occasional arrival in town of a wearied—though hardly travel-stained—miner that we hear how things are progressing around us.

The managers of the Adair group (Big Bend district) have decided to quit work for the winter, and report having been in 3 feet of solid yellow copper when operations were discontinued. On this point some very natural doubt arises; that there was yellow copper present is certain, but 3 feet of solid ore is another matter altogether. It is to be hoped it will not shrink to 6 inches by next spring when the work is recommenced, but even 6 inches of solid yellow copper is very well worth careful attention. Unfortunately the owners of claims are so apt to deceive themselves as to the value of their property; many of them, as I had occasion to remark some time ago, received their mineralogical education on top of a freight car while performing the very unpleasant duty of brakesman, but a little thing like that cuts no figure when they describe the wonderful ore they have in their claims, and in consequence the utterly absurd figures they ask for them from prospective purchasers. No doubt it is part of the eternally hopeful nature of the prospector to imagine what is often a vain thing; but time and experience alone will enable a man to form a just idea of the real value of his claim. Other people, however, besides our hardy and virtuous prospecting friend are occasionally very wide of the mark in estimating values, as, for instance, a short but very explanatory article in a local paper recently informed its readers that the way to estimate the value of any copper ore was to consider each 1 per cent. per ton as 20 lbs. of metallic copper; and that *taking copper at $4.00 per 100 lbs. (!!)* each 1 per cent. would be worth 80 cents. The odd thing is that, notwithstanding the extraordinary valuation, actually one may reckon on a

smelter giving you somewhere about $1 per unit and very little more; so that the result is not so far out as the calculation is.

Well, to return to business. The Boston and B. C. Co. are working their claims in the Standard Basin with a large staff of men, and though a few came to town the other day complaining of the grub (which seemed good and ample at the time of my visit there(, yet others have gone up to fill their places. $3.50 for 8 hours work all the winter is worth a little necessary discomfort. The manager reports all well there; No. 2 tunnel is in 85 feet, and No 3 tunnel has reached 30 feet in length. With work progressing at this rate, the company will be in a position early next spring to say whether they had the real lead at first which was questioned by some experts —or if they have found it elsewhere. In any case they mean business, and deserve success.

Some little placer work is being carried on at the old Consolation claim in French creek (a claim that has yielded well some times and had wonderfully hard luck at others when all looked favorable), but no particular news has come from there lately, indeed it is but recently the working party went up, so news can hardly be expected yet.

The Rosebery, on Carnes creek, is working light this winter, the manager prefers there should be no danger of a shortage in supplies, so no more men than necessary are kept on. The lower tunnel is in fully feet, of which 300 feet is run on the lead, and the ore still showing up well, the copper vein referred to a month or so back getting a little stronger.

Illecillewaet, with the Albert canyon properties, is absolutely quiet, there is nothing at all going on there as far as any reports are to be trusted; and yet there certainly is some very fine ore in the locality which has been known to exist for years. It is to be feared that the fiasco of the Waverly and Tangier business has rather given that camp a "black eye," but with intelligent management it surely ought to come out all right—mineral is undoubtedly there, and in considerable quantity.

The Lardeau, and Lardeau-Duncan districts are by far the most active this winter. In the latter it is very satisfactory to note the work done and the results obtained on the Old Gold and Primrose property, which was begun to be worked systematically when there was no railroad thought of and no trails or "tote roads" to speak of. This absence of communication made all work very expensive and difficult, but work has been done on the claims till now the management is satisfied they will be in a position to ship ore next spring, and as a recent assay gave a value of 150 oz. silver, 55 per cent. lead, and some gold, the ore should certainly be valuable. Not very far away is the Black Warrior group, on which is a 25-foot vein carrying very high values in silver, the locator asserting that it will run from 100 to 2000 ounces per ton, and while it is more than likely that a streak of gray copper running through the galena will carry the higher value, the whole 25 feet will certainly not do so, though the silver values in this district are wonderfully high. The Silver Cup is going ahead with a force of some 40 men, and the ore is being sacked ready for shipment, which should be a very large and very valuable one.

The Towser is also busy with 14 men, and the Beatrice people hard at work on their property. A small shipment from the Ethel this fall, some 6 tons, reaped a value from the smelter of $370.00 after all expenses were paid, and these, owing chiefly to the difficulty of transportation, are still very high. No doubt the rival railroads, when they are there, will very greatly modify this difficulty, which has always been a very serious one.

The last mine that need be referred to at present, and by no means the least, is the Nettie L., frequently mentioned in former notes, which is fully holding the high position claimed for it as a producer of remarkably rich ore. The lower tunnel—some 200 feet below the upper one—where the richest ore has been found, is now in 500 feet and should tap the vein inside of another 50 feet. However, actual mining had to be suspended temporarily until an arrangement was fixed for ventilation, the air at that distance in naturally being far from pleasant; this has now been done and work resumed, while from the upper workings the ore is being steadily extracted. It is doubtful (owing to recent soft weather) if there is yet sufficient snow for rawhiding; but if there is, it seems probable that there will be a very satisfactory addition to the funds of the Great Western Mines, Limited, by the New Year, which I venture to wish may be happy and prosperous to us all.

A. H. H.

Revelstoke, B.C., 10th Dec., '99.

LAKE OF THE WOODS.

The Rainy Lake Co. have resumed operations on the *Electro-Gold*, the property adjoining the Winnor—the latter is also their property, but work has been stopped there, and will not be taken up again this winter. The *Winnor* shaft is about 85 feet deep, with a short drift on the vein. The buildings comprise a blacksmith shop and boarding-house; the shaft is enclosed by the walls of a log building. The shaft is about three-eighths of a mile from the C.P.R. track, with which it is connected by a good road, which meets the track at the eastern extremity of the new siding named Garwood. The *Electro-Gold* shaft is down 45 feet; it is claimed to be on an extension of the Scramble vein. At this point the vein, or system of veins, is some forty feet or more in width. I am informed that some good assays were obtained at this shaft. A new boarding camp has just been finished; the old one will be converted into a sleeping camp. The *Electro-Gold* is about a mile and a quarter from the above mentioned siding on the C.P.R., and the road out to it is nearly completed; it is quite an easy country for a road. Mr. Royal Smith, of Rat Portage, is the foreman. I believe the C.P.R. will carry ore in carloads from the Winnor at Garwood siding to the Keewatin Reduction Works for seventy cents a ton. For continuous shipments, a lower rate would be granted. The distance is about eight miles.

The Briggs.

Mr. N. J. Steichen, of Boone, Iowa, treasurer of the Briggs Mining Co., has permanently located in Rat Portage. He and two other gentlemen took all the treasury stock that the company would sell at $2.50 per share. Work at the mine is going ahead steadily.

The Virginia Co.

The shaft on the Lizzie Mine is down 208 feet, and there is about 300 feet of cross-cutting and drifting. Specimens of native silver and of native copper have come out of the shaft. Mr. J. S. Rayburn is still in charge.

Mikado.

Three gold bricks, valued at eight or nine thousand dollars, were on exhibition in the window of the Imperial Bank last week. One of these was the cyanide brick, and represented the monthly clean-up, the others came of the plates, and were the result of the fortnightly clean-up.

A new stopping place with comfortable accommodation for a considerable number of guests, and a good large stable, has been built at the mouth of Clear Water Bay on the winter route to Shoal Lake, between which place and Rat Portage a daily stage will be run by Bert Griffiths of the latter place. There will be change of horses at this stopping place, and the round trip from Rat Portage and return will be made in one day. This will place the Mikado and other properties in the Shoal Lake country in easy communication with Rat Portage. C. F. Fraser will run a stage to the Regina and Camp Bay Mines, also to the Virgina, Gold Panner and other places in the Sturgeon Lake country. We have no snow yet, and it is only a few days since the cold weather set in. It is hard on the saw-log and railway-tie men, for at best their hauling season will be a short one now.

Rat Portage, Dec. 13, 1899. J. M.

The New Granby Smelter.

We are indebted to a recent issue of the *Engineering and Mining Journal* for the following details of the new smelting plant now under construction in the Boundary District of British Columbia for the Granby Con. Mining and Smelting Company.

A spur track, 2½ miles in length, with a very easy grade, runs from the main line a short distance above Columbia, to the north end of the works. The power house is within 1,000 ft. of the smelter buildings, and about 100 ft. below them. There is ample room at the smelter site proper for as large a plant as the company will ever care to put up, and there is ample dumping room for years to come. The main power with which the blowers, sampling works, etc., will be driven is to be given by a duplicate set of 16-in. turbine wheels, operating, as before mentioned, under an effective head of 45 ft. This will develop 250 H.-P. net. These are mounted in pairs on horizontal shafts and are cased in a steel flume mounted on I beams. These wheels are connected with the flume by a steel intake pipe, 4 ft. 7 in. diameter, and discharging into a single draft chest and draft tube, 16 ft. long, set at 45° downward inclination.

The wheel used is the New American, made by the Dayton Globe Iron Works. One of the great advantages of this wheel is that it works at its greatest efficiency when the gates are three-quarters open. These two pairs of turbines are each directly connected with one Westinghouse rotating arm, alternating-current generator, having a capacity of 180 kilowatts, 250 volts, the full lode efficiency being 93.5 per cent.

The foregoing description applies to the main power battery. During the day all will be in use, running at three-quarters capacity, but they are so arranged that one battery will run the works at night, hence giving an opportunity every evening to overhaul one battery. By this arrangement they are practically equal to duplicate engines. There will also be in the same power house a single 10-in. turbine wheel, developing 40 H.-P. net. This is directly connected with one Westinghouse 4-pole lighting generator of 22.5 kilowatts capacity, 125 volts. This is for lighting the entire plant, and is self-contained. Moreover, when the works are running, and it is necessary to shut down for repairs, or in case the large power battery is not running, the works would still be lit. It was considered better engineering to have the lighting plant separate from the power generator.

There will also be in the same power house one single 13-in. horizontal turbine wheel, which will develop 55 H.-P. This wheel is belted to a Still-well-Bierce & Smith-Vaile Company triplex pump, of the double-action type, having a guaranteed capacity of 750,000 gallons each 24 hours, against a maximum pressure of 100 lbs. to the square inch, or against a 200-ft. head. This pump will furnish water and pressure to granulate the slag, as it runs continuously from the furnaces.

There is yet another battery in the power house equal to the first mentioned, namely 16-in. wheels, to supply extra power should such be required. The power house is 100 ft. long by 30 ft. wide, and all the batteries are set in line, on one long concrete foundation. The end of the flume enters at one end of the building, about 35 ft. above the centre of the wheel, the water being tapped out of the side of the flume, and thence conducted by various steel intake pipes to their respective water wheels.

The smelter proper consists of two double-decked, steel-jacketed furnaces, 160 by 44 in. The total height of the furnaces from the charge to the furnace floor is 14 ft. The jackets come within 18 in. of the charge floor. The height of the lower set of jackets is 7 ft. 6 in., and that of the upper set 2 ft. 6 in. The furnace has a continuous flow water jacket and bronze slag spout. The tuyeres are 5 in. in diameter and 9 in number. The lower side of the furnace has 3 water jackets on the side and one on each end, while the upper jackets number two on the side and one on each end.

The bottom of the furnace is of the movable type, and the brickwork is supported by a cast-iron bed-plate, mounted on eight wheels, and is raised and lowered by 8 jack screws built in the wheel frames. The tuyeres are made of cast-iron at the furnace end, connecting with the blast pipe through 6-in. boiler tubes, which are joined to the cast-iron end by air tight expansion joints. All jackets are hung from the wrought-iron I beams, which are supported in turn by the cast-iron deck plates resting on the columns.

On each side, and in the centre of the furnace, are small water-cooled tapping jackets, for tapping out when the furnace is blown out. The furnace, above the feed door, is of brick, bound with suitable buckstays, and

there is a charging door on each side of the furnace, opening the entire length, and about 2 ft. high.

The gases pass off from the top, in a 4-in. diameter town-take pipe, which is connected with the big flue-dust chamber leading to the stack. This pipe is fitted with a damper, and should anything go wrong in the flue chamber the gases can be led into the air by another pipe, 3 ft. in diameter, which passes up through the top of the building.

These furnaces should smelt from 150 to 240 tons each a day, the capacity of the works will not exceed 500 tons a day, unless it should be decided to add two furnaces, something which may very probably be done within a year or two. The furnaces are set in a building 69 by 164 ft., and are 39 ft. apart from center to center. This is exceptionally wide, but metallurgists are now building their furnaces much further apart than was their practice a few years ago.

The down-takes of the furnaces are connected with the big flue chamber, 10 by 10 ft. on the inside, and 300 ft. in length. The stack is 11 by 11 ft., inside measurement, and 150 ft. high.

The blower room is 50 by 58 ft., and is 12 ft. from the furnace building. *It will contain 3 No. 8 Connersville blowers, one for each furnace, and one* in reserve. These are connected with the furnaces by a 54-in. diameter blast pipe, all blowers being connected with the one main pipe. There is room in the building for another blower should the plant be increased. The blowers are special patterns, and each one has its own driving pulley, with one outboard bearing. Each of these blowers is driven by an 88-H.P. variable-speed Westinghouse induction motor, which is belted directly to the blower. Two will be in constant operation and one in reserve.

The main sampler building is 64 by 70 ft., and is surrounded on three sides by ore bins. The ore train as it comes into the smelter will be carried by an incline to a series of receiving bins, parallel to the front of the sampling works, 23 ft. above the floor of the same, and 35 ft. distant. These receiving bins will have a total capacity of 1,000 tons. The bins are filled directly from the cars, which have a bottom dump. During the day the ore from the receiving bins is taken by small iron cars, which dump into a No. 5 Gates gyratory crusher. This crusher has its opening a little below the *floor of the sampling works and crushes a ton at a time. After this rough* crushing, which reduces the ore to lumps the size of a man's fist, it is elevated to the top of the building by a continuous steel bucket elevator. It is next sampled by the Snyder automatic sampler. The bulk of the ore is distributed to the bins on three sides of the sampling works by a special cast-iron spout. After being cut the sample passes to a 7 by 10-inch Blake crusher. Once more it is cut by a smaller Snyder sampler, from which the sample goes to a set of 10 by 18 in. economic rolls, which reduce it still further. One more cutting, by a smaller Snyder sampler, and the sample is delivered on steel plates, where it is again cut by hand, and then goes to a fine sample grinder.

Le Roi.—The company's manager at Rossland cables as follows: "Total estimated value for month of November, $108,000; 9,400 tons shipped, yielding 3,752 oz. gold, 8,400 oz. silver, and 116 tons copper.

Sufficient Working Capital having been subscribed by the Directors and their friends, this Prospectus is advertised for Public information only.

The Mine is a going concern, equipped with a modern thirty-stamp Mill and accessories. It has already produced Bullion to the value of $375,000. See Mr. W. M. Strong's Report.

Mr. John F. Caldwell, the late owner of the Mine, accepted payment of the whole of the purchase price of the Property in fully-paid Shares.

THE SULTANA MINE OF CANADA, LIMITED

(Incorporated under the Companies Acts, 1862 to 1898.)

CAPITAL - £275,000

In 275,000 Ordinary Shares of £1 each, of which £50,000 is reserved for Working Capital.

Directors.

LEONARD FAWELL, Esq., J.P., Director Lake View Consols, Limited *(Chairman).*
Sir GERALD FITZ-GERALD, K.C.M.G., Deputy-Chairman Anglo-American Telegraph Co., Limited.
W. RHODES, Esq., Director Mashonaland Agency, Limited.
WILBERFORCE BRYANT, Esq., Chairman Messrs. Bryant & May, Limited.

Advisory Director in Canada.

JOHN F. CALDWELL, Esq., Winnipeg.

General Manager in Canada.

WM. M. STRONG, Esq., M.E.

Bankers.

THE LONDON CITY AND MIDLAND BANK, LIMITED, Threadneedle Street, London, E.C.
THE IMPERIAL BANK OF CANADA, Rat Portage, Ontario.

Auditors.

Messrs. RICHARD RABBIDGE & SONS, 32 Poultry, E.C.

Solicitors.

For the Company—Messrs. SIMS & SYMS, 70, Queen Victoria Street, London, E.C.; and 6, Rue Monsigny, Paris.
For the Vendor—Messrs. WITHERS & WITHERS, 4, Arundel Street, Strand.

Secretary and Offices.

HUGH C. RABBIDGE, Esq., 32, Poultry, E.C.

PROSPECTUS.

THIS Company was formed and incorporated in July, 1899, to acquire, further develop and work the well-known Sultana Mine, situate on Sultana Island, in the Lake of the Woods Gold Fields of Ontario, Canada.

The Mine is distant seven miles from Rat Portage, which is an important town on the main line of the Canadian Pacific Railway, and is easily accessible by water communication in summer, and by road in winter. The Company have been in possession of the Mine since August 12th last.

The Directors caused an exhaustive examination of the property to be made on behalf of the Company by Mr. William M. Strong, M.E., who reports as follows:—

"Rat Portage, Ontario, August 14th, 1899.

"To the Directors of the Sultana Mine of Canada, Limited.

Gentlemen,

"In accordance with your instructions I have made an examination of the Sultana Mine, and herewith hand you my Report.

LOCATION.

"The Mine is situated on the shore of the Lake of the Woods, Province of Ontario, Canada, and is in direct water connection with Rat Portage, a town of about 5,000 population, on the line of the Canadian Pacific Railway, and distant about seven miles. The largest freight boats plying on the Lake of the Woods can land at the Sultana docks.

PROPERTY.

"The Sultana Mine comprises the mining locations designated by the Government Survey as N 42, N 43, and D 209, having a total area of 95⅝ acres more or less.

TITLE.

"The title to the property is perfect, and directly from the Crown.

ORE.

The ore bodies at the Sultana Mine are enclosed between the walls of **a typical contact vein** which courses the property in a north-easterly direction, and by surface exposures of ore together with underground development to a depth of 441 feet is shown to have **great lateral extent and permanency in depth. The total value of ore mined and milled to date amounts to over $375,000,** as shown by United States Government Mint Certificates, and vouched for by the Imperial Bank of Canada, Rat Portage, Ontario, through which agency the bullion product of the Mine has been handled.

"The mill value of Sultana ores is shown by actual crushing of a large tonnage of ore, to average about $15.00 per ton.

"The cost of working is proven by actual results not to exceed $2.50 per ton of ore treated, leaving all values in excess of this amount as profit.

"The property is a going concern, equipped with strictly up-to-date and first-class mining and milling plant, buildings and fixtures, requiring only further systematic and liberal development to not only maintain the past profitable history of the Mine, but by the judicious enlargement of the plant, as development of the underground resources of the mine proceeds, obtain greatly increased profits.

"I estimate that with the present equipment, six months' development work sinking No. 1 Shaft, drifting in the ore and developing other resources, the mine should be capable of earning a profit of $250,000 per annum, and with further development and an increase in the compressor plant and mill, an annual profit of $500,000 and upwards should be obtained.

"At a central point on Location X 42, Sultana Shaft No. 1 has been sunk to a depth of 441 feet, **following a rich ore chute of large dimensions. In the workings the ore has been mined to a width of 40 feet in places,** and the richer portions above the sixth level have been taken out, leaving however, a large amount of ore suitable for milling at a satisfactory profit with a milling plant of 50 stamps. **This ore chute in the shaft bottom still maintains a width of 20 feet and a length of over 100 feet, with an average of value over $20 gold per ton, and the present indications warrant the belief that the chute will widen as greater depth is attained.**

"From the underground workings of Shaft No. 1, **drifts are now being extended to develop other known pay chutes,** as well as to explore the ground north and south.

"From a point in the first level, about 150 feet south of shaft, a cross-cut has been made connecting the Mine with Air Shaft No. 2. **Here a mass of high grade galena ore has been encountered which gives promise of developing into a large body of ore. The assay value of this ore varies from $80.00 to $150.00 per ton. A large sample of "Shipping Ore" taken by me from this point, upon assay showed a value of $242.82 gold per ton.** This ore can be hand-sorted and shipped to a smelter as it comes from the mine, without further treatment.

"The **Gagne Vein** occupies a position between the **Sultana Vein No. 2** and **Sultana Vein No. 1,** and while from 2 to 5 feet wide, **carries high values,** and appears to make a junction **with Sultana Veins No. 1 and 2.** At such junction points rich ore is usually sought for and often found.

"On the **Pasha Vein,** near the north end, a shaft has been sunk to a depth of 50 feet in heavily mineralised quartz and mixed ore, encountering low values, but the appearance of the formation at this point would warrant extensive exploration in the expectation of disclosing richer ore.

"East from the **Pasha Vein** and on Location X 43 is found the **North Bay Vein,** which shows a strong continuous body of mineralized quartz and mixed ore, but as yet no work has been done to develop the ground.

"The ore bodies of the Sultana Mine in their character and manner of occurrence bear a striking resemblance in general to the ore bodies of the great mines on the "Mother Lode" of California, and from personal experience there I am of the opinion that the Sultana Mine will have a record when a depth of 2,000 feet or more is reached, similar to that of successful California mines of an equal depth at the present time, *i.e.*, the rich ore chutes will continue on downward, maintaining their average size and values, and the lower levels will be found to be as rich as the upper ones.

EQUIPMENT.

"SHAFT No. 1.—7x18 feet and 441 feet in depth, has been cased off for man-way and equipped with ladders as required by the Mines Act of the Government of Ontario.

"The hoisting plant consists of a double drum, double cylinder, link motion, winding engine with double break levers, and has the following dimensions. Here follows a list of measurements :—

"The shaft is equipped with a 2½ ton self-dumping skip with steel wire rope 1 inch in diameter. The skip-road is well and safely constructed and fitted with steel track rails and substantial back stringers or guides to prevent the skip from jumping the track in the shaft.

"The shaft is well ventilated by means of two air shafts, and is provided with a suitable pumping equipment which handles easily all water that finds its way into the mine. **The winding engine having duplicate drums will admit of placing two skips in the shaft for operating at such times as the increase in milling equipment may exceed the capacity of the present hoisting plant.**

"PASHA SHAFT.—Has reached a depth of 50 feet and is fitted with suitable head-works and is provided with a line of sheaves supported on poles for the purpose of carrying a steel hoisting rope and operating the same by means of a small hoisting engine in the engine-room of Shaft No. 1.

"The air compressor plant is located in the engine-room of the mill, and one engineer attends to both the mill engine and air compressor.

"The compressor is of the duplex, condensing type, the cylinders of which are 14 inches and 18 inches in diameter, with an 18 inch stroke, and is rated to operate six No. 3 L.G. Rand Drills. There is also on the ground a small straight-line air compressor rated to operate 3 drills.

"The stamp mill is of latest construction and of the modern California tpye. It consists of 30 stamps in 3 batteries of 10 stamps each, and each stamp weighs 900 pounds. The ore enters the mill by means of a self-dumping car which runs up an incline from the No. 1 shaft-house. The ore then passes a "Grizzlie," the coarser part entering a No. 3 Gates Crusher and delivered to the ore bins below. From the ore bins the ore enters 6 Imperial Challenge Feeders which deliver the ore to the stamps. Amalgamation is effected both inside the battery and on outside apron plates. The pulp from the batteries, after passing over the apron plates, is conducted to 6 latest improved Frue Vanning Machines fitted with endless corrugated rubber belts, each 6 feet wide.

"The power to operate the mill is derived from an engine of the Corliss type, the cylinder of which is 14 inches by 36 inches. The nominal rated horse power of this engine is 120 h.p.

"In connection with the mill and distant from it about 400 feet **is the Mine, provided with a Chlorination mill and roaster** for the treatment of the concentrates from the Frue Vanners, and has a capacity for treating 6 tons of concentrates in 24 hours.

"The milling capacity of the present installation is about 2,000 tons per month. The following data I quote from the record of the mill :—

"Assay value of feed ore—gold per ton, $10.00 to $20.00.

"Amalgamation extractions of ore values, 85 per cent. to 90 per cent.

"Tailings, values per ton of ore treated, 40 cents to $1.00.

"Concentrates, 1—1½ to 2 per cent.

"Chlorination extraction of concentrates, 85 per cent. to 90 per cent.

"The Mine is further provided with a **Bullion Melting Room and Assay Office with complete equipment.** A two-forge blacksmith shop, machine shop, miners' dry house, mine office and club room for men, commodious and comfortable boarding house, large and roomy stable, with capacity for storing one years' supply of feed for 6 teams, 11 dwelling houses for employees of the Company, having families.

"The buildings are heated by steam and lighted by electricity, and the plant is protected by an efficient fire hose and chemical equipment, by means of which all points can be quickly reached and controlled in the event of an outbreak by fire.

"For the purpose of communicating with Rat Portage during the season of navigation—about six months in the year—the Company own a steam launch which can make the run of seven miles in forty minutes.

"For the purpose of handling heavy freight a suitable barge, the property of the Company, is used.

ASSAYS.

"For the purpose of determining the assay values of Sultana ores 'in place,' I obtained samples from various levels in Shaft No. 1 and from surface exposures of ores at other points on the property. The samples were taken to be representative of ore remaining in the Mine, and upon assay gave the following gold values per ton of 2,000 pounds average.

"Here follows a list of 25 assays of ore from different parts of the Mine, the average of which, after eliminating the highest, gives an average assay value of $16.37, or over £3 per ton of 2,000 pounds.

CONCLUSIONS.

"In view of the facts set forth in this Report I am of the opinion that the Sultana Mine, with sufficient capital for the purpose of development, and a policy of active operation, will be in a position at an early date to return large dividends to the Shareholders.

"Respectfully submitted,

"(Signed) WILLIAM M. STRONG, M.E.

Acting upon Mr. Strong's suggestions, the Directors have allowed the Mill to be temporarily shut down for the purpose of making necessory alterations, with a view to increasing its capacity, and in order to push forward the development of the ore bodies. There are now nine rock drills at work on development, and the Directors are so well satisfied with the progress of the work, that they confidently expect that when the Mill is re-started there will be a large tonnage of payable ore opened out.

The high grade galena ore mentioned in Mr. Strong's Report appears to be a recent discovery, as the Directors had no knowledge of it at the time of the purchase. The Manager is now sinking a shaft, from which he intends to cross-cut it at a depth of 60 feet.

It is the intention of the Directors to erect additional stamps as soon as the Mine is sufficiently developed to justify them in doing so.

Repeated reference is made to the Sultana Mine in the Reports of the Bureau of Mines of Ontario, published by order of the Provincial Legislature, and extracts therefrom are printed with the Prospectus.

The Vendor, Mr. John F. Caldwell, fixed the purchase price for the Mine at £225,000, which sum has been satisfied by the allotment of 225,000 fully paid Ordinary Shares of the Company, and the property is vested in the Company.

Three contracts, severally dated the 26th of July, 1899, have been entered into between the said Vendor and the Company, which may be inspected at the London Offices of the Solicitors of the Company.

At the request of the vendor the Directors in their personal capacity have severally subscribed a portion of the Share capital required for providing the working expenses of the Company, and for so doing have received in common with other persons certain profits from the Vendor.

Application for a settlement on the London Stock Exchange will be made in due course.

Prospectuses may be obtained at the Offices of the Company or from the Solicitors.

LONDON, November 27th, 1899.

Hall Mines.—Results of the company's smelting operations during November: Lead smelting—19 days, 15 hours. 388 tons of purchased lead ore were smelted, together with 128 tons of Silver King ore from the company's mine, from which were produced 105 tons of bullion, containing (approximately): from Silver King ore, 1,540 oz. silver; from purchased ore, &c., 102 tons lead, 9,790 oz. silver, 387 oz. gold.

Whitewater.—Cablegram from Mr. Williams, engineer of Whitewater Mine (Mallinson's Syndicate):—"Developments opening up splendidly, will place at our command a valuable body of high grade ore. I consider the mine is very valuable. Advise erection of machinery; will have to pay the wages of £200 per month from December 7th.

The Ben d'Or Mines, Limited.—Statement of cost of mining and milling for term ending 1st November, 1899:—

DR.

To cost of mining from Aug. 23rd to October 31 inclusive	$2,843 50
To cost of milling 1,082 tons ore and expenses in mill from 23rd Aug. to 31st October inclusive	1,326 00
Powder, fuse, caps, &c.	170 00
Estimate of charcoal used in time 0.2 bus. per diem.....	34 00
Balance profit for term ending October 31st	16,868 28
	$21,241 78

CR.

September 6th—By proceeds clean-up.....	$6,358 00
October 5th— " "	7,692 40
October 30th— " "	7,191 38
	$21,241 78

The Requirements of a Blast Furnace.—Few people who have not actually run a blast furnace realize what it means to fill the capacious maw of one of those monsters. A stack of 200 tons daily capacity, running on 50 per cent ore, must have delivered to it each day something more than 400 tons of ore, 250 to 300 tons of coke and over 100 tons of limestone, besides sand, coal and minor supplies—say 900 tons raw material. Add the 200 tons of pig iron product shipped out, and we have a daily freight movement of 1100 tons, taking no note of the disposition of the slag. The mining of the ore requires the labor of 150 to 300 men, the coal mining, coke making, quarrying of limestone and transportation at least 300 more. The furnace itself employs about 150 or more hands. Starting up a furnace of ordinary capacity, therefore, calls immediately for the labor of nearly 1000 men ; for the use of at least 1000 railway cars and many locomotives ; for perhaps several steamers and vessels on the lakes ; for capital, from the mines to the pig iron, of one million to two millions of dollars, and last, but not least, for a high order of managing ability.

Newfoundland Copper.—The report to be submitted to the first ordinary general meeting on 14th inst., states that the accounts cover a period of 18 months' working, from the commencement of operations to 30th September last, during which time a considerable amount of prospecting and development work has been accomplished, the net result of which is the present Sleepy Hollow mine, which has yielded results of a promising character. This mine has been seen and inspected by three experienced experts, and each has reported favourable on the prospects it offered for the production of copper in the event of the necessary development work being carried out. It is upon this work the company is now engaged, and the property is being opened up in a thoroughly miner-like manner, and with a view to economical working as extensions progress. The latest detail report from the mine is dated 3rd November, in which the manager predicts an early improvement of considerable importance in the lodes at the depth he is now attacking them. 1,170 tons of copper ore sent to this country has sold well, and there is now another shipment ready as soon as a vessel can be obtained to load it. The work of the company up to this time has been entirely one of exploration and development, but is now assuming a more definite and fixed character.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

The Following Courses are offered

1—Three Years' Course for a Diploma in

(A) Mining Engineering.
(B) Analytical Chemistry and Assaying.

2—Four Years' Course for a Degree in

(A) Mining Engineering.
(B) Chemistry and Mineralogy.
(C) Mineralogy and Geology.

3—Post-Graduate Course for the Degree of

Doctor of Science (D.Sc.)
For further information see the calendar of Queen's University.

4—Prospectors' Course.

The School offers to Mine Foremen, Assayers, Prospectors and Mining Men generally, Special Courses of Instruction beginning January 9th, 1900, and continuing eight weeks.

Next Session begins October 2nd,
. . . 1899 . . .

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

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

Dr. W. L. GOODWIN,

DIRECTOR

SCHOOL OF MINING, KINGSTON, ONTARIO

DOUBLE STRENGTH — VICTOR ELECTRIC FUSE

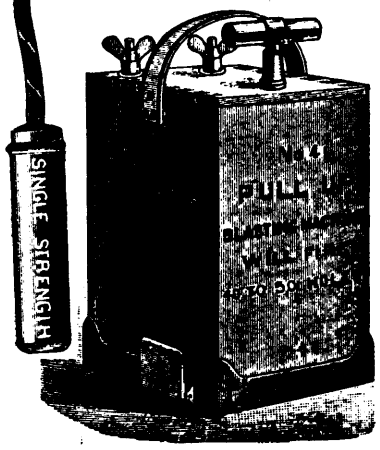
Electric Blasting Apparatus.

ADAPTED FOR FIRING ALL KINDS OF EXPLOSIVES USED IN BLASTING.

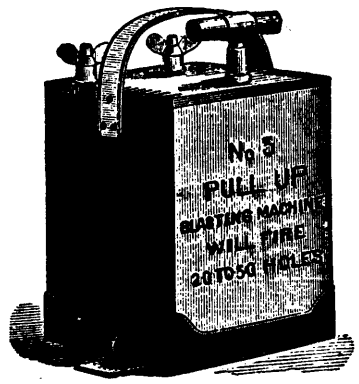
Victor Electric Platinum Fuses.

Superior to all others for exploding any make of dynamite or blasting powder. Each fuse folded separately and packed in neat paper boxes of 50 each. All tested and warranted. Single and double strength with any length of wires.

INSULATED WIRES AND TAPES.
BLASTING CAPS, FUSE, ETC.



Price, $50.



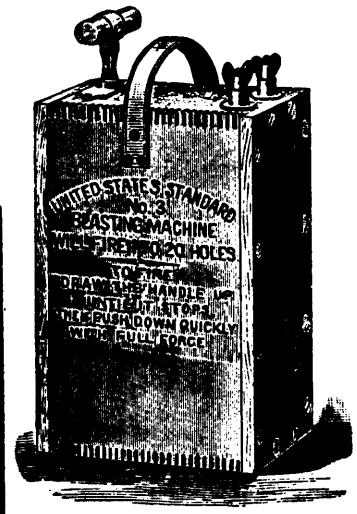
Price, $25.

Blasting Machines.

The strongest and most powerful machines ever made for electric blasting. They are especially adapted for submarine blasting, large railroad quarrying, and mining works.

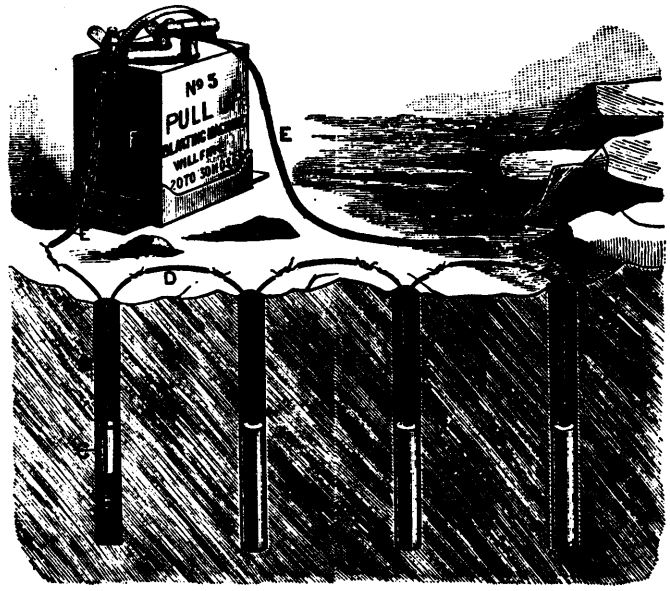
VICTOR BLASTING MACHINE.

Fires 5 to 8 holes. Weighs 15 lbs. Adapted for Prospecting, etc.



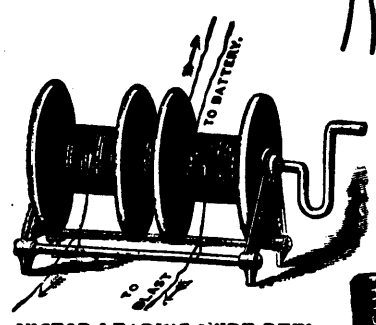
Price, $25.

SHOWING CHARGE HOLES CONNECTED IN SERIES

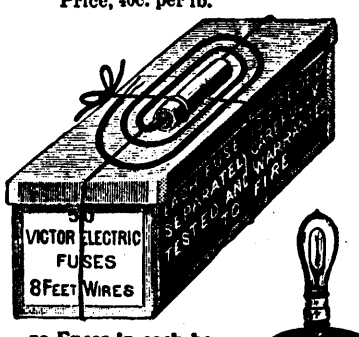


A.—Hole in Rock.
B.—Dynamite Charge in Hole.
C.—Electric Fuses in Dynamite Charge.
D.—Connecting Wire joining Fuse Wires together.
E.—Leading Wire from Battery to Fuse Wire.
F.—Electric Blasting Machine or Battery.

CONNECTING WIRE.
Price, 40c. per lb.



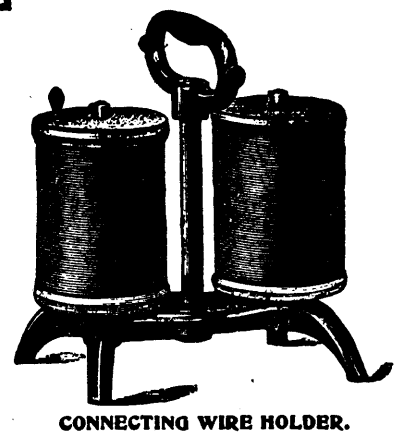
VICTOR LEADING WIRE REEL.
Price, $4.



50 Fuses in each box.

Price, $15.

BATTERY TESTING LAMP. Price, $3.50.



CONNECTING WIRE HOLDER.
Price, $2.

SINGLE STRENGTH

MANUFACTURED ONLY BY

JAMES MACBETH & CO., 128 Maiden Lane, New York, U. S. A.

For Sale by Dynamite Manufacturers, Agents and Dealers, everywhere. Special Discount on Export Orders.
Catalogue mailed free on application.

VICTOR ELECTRIC FUSE — DOUBLE STRENGTH

THE SNOW STEAM PUMP WORKS,

MANUFACTURERS OF

Steam Pumps, Pumping Engines and Hydraulic Machinery.

General Agents for Canada, DRUMMOND, McCALL & CO., Montreal,
Local Agent F. R. MENDENHALL, Rossland, B. C.

Pumps Kept in Stock at Montreal and Rossland.

MONTREAL...

PIPE FOUNDRY CO.

LIMITED.

MANUFACTURERS OF...

CAST IRON
WATER AND GAS **PIPES**

OFFICES:

CANADA LIFE BUILDING

MONTREAL.

WORKS: LACHINE, QUE. PRICES ON APPLICATION.

The Montreal Car Wheel Co.

. MANUFACTURERS OF .

Works:
LACHINE,
Que

CHILLED WHEELS

Offices:
CANADA LIFE
BUILDING.

For Railroad, Electric Car, Street Railway and Lumber Truck Service, Etc.

THOMAS J. DRUMMOND, General Manager.

MONTREAL.

CANADA IRON FURNACE CO. Limited

MANUFACTURERS OF

Brand:
"C. I. F."
Three Rivers.

CHARCOAL PIG IRON

ALSO MAKERS OF PRESSED AND REPRESSED BRICKS.

Canada Life Building

MONTREAL.

PLANTS AT
RADNOR FORGES, QUE.
LAC A LA TORTUE, "
THREE RIVERS, "
GRANDES PILES,

GEO. E. DRUMMOND, Managing Director and Treasurer.

THE DOMINION WIRE ROPE CO. LIMITED

MONTREAL, CAN.

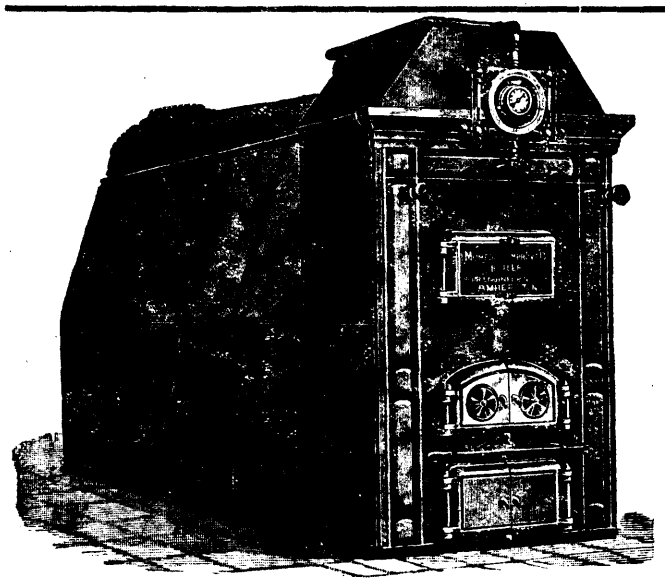
Manufacturers of **"LANG'S" PATENT WIRE ROPES**

FOR COLLIERY AND GENERAL MINING PURPOSES.

ALSO BEST STEEL WIRE ROPES FOR ALL PURPOSES.

BRANCH OFFICES: Vancouver, B.C. Rossland, B.C. Winnipeg, Man. Toronto, Ont. Ottawa, Ont. Halifax, N.S.

CATALOGUE ON APPLICATION.



The Mumford Improved Boiler

Has internal firebox, water circulation similar to a Water Tube boiler, large heating surface and special arrangements for preventing and removing scale. Tests show high economy. Built with sheet steel case or for brick casing as desired.

ROBB ENGINEERING COMPANY, Limited

AMHERST, N.S.

FRASER & CHALMERS

CHICAGO, ILL., U. S. A.

AND LONDON, ENGLAND.

Mining Machinery,

Stamp Mills,

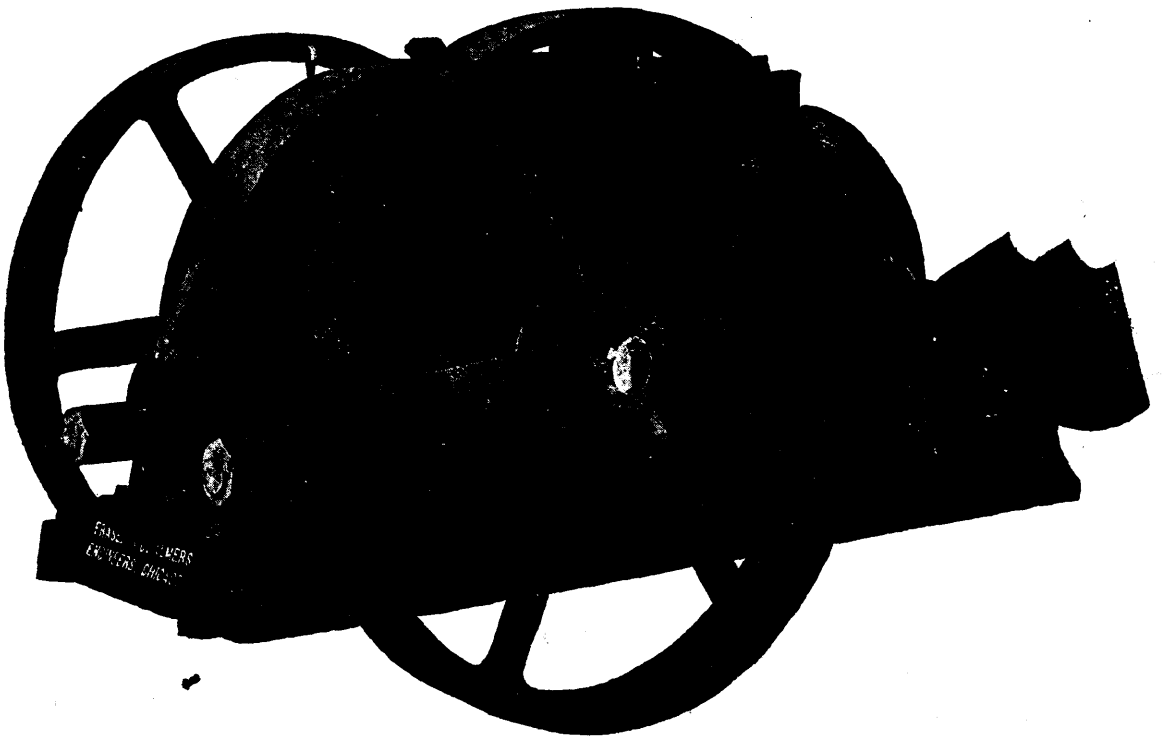
Smelters,

Rock Crushers,

Riedler Pumps

and

Air Compressors



Hoisting Engines,

Frue Vanners,

Sederbohm, Adams and Wood Boilers,

Corliss Engines,

Concentrating Machinery.

FRASER & CHALMERS have the best manufacturing facilities for making anything in the Perforated Metal line, Placer Grizzlys with Taper Holes, Stamp Mill Screens, Trommels, Coal Screens, &c. Screen Samples on Request.