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Established 1882

Vol. XVIII—No. v.

OTTAWA, MAY 31st, 1899.

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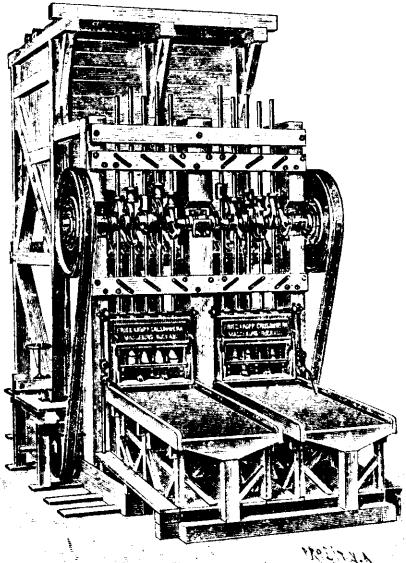
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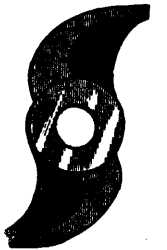


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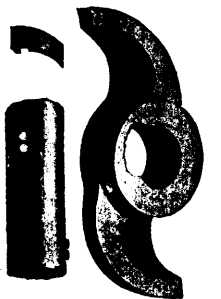
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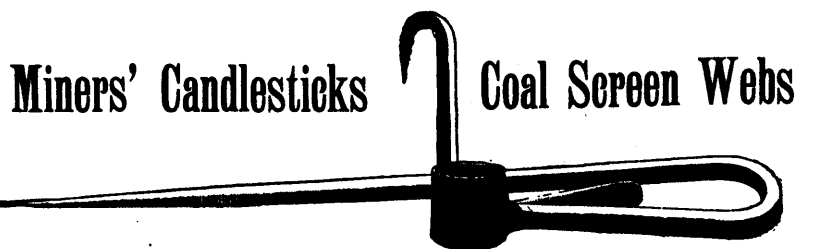
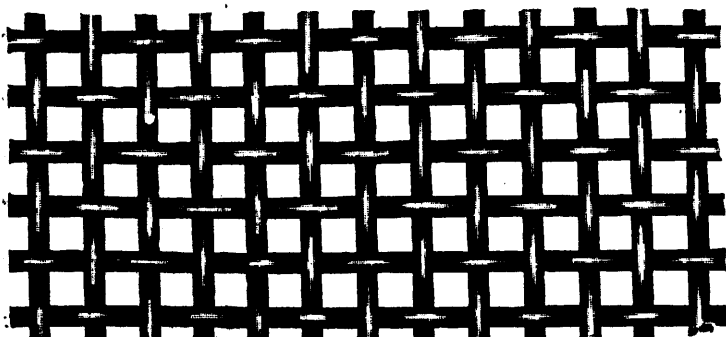


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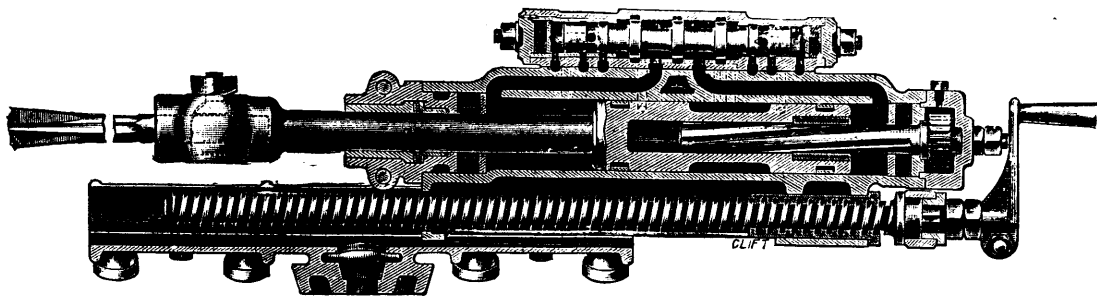
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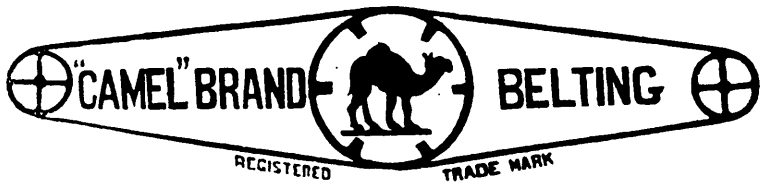
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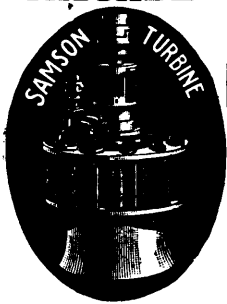
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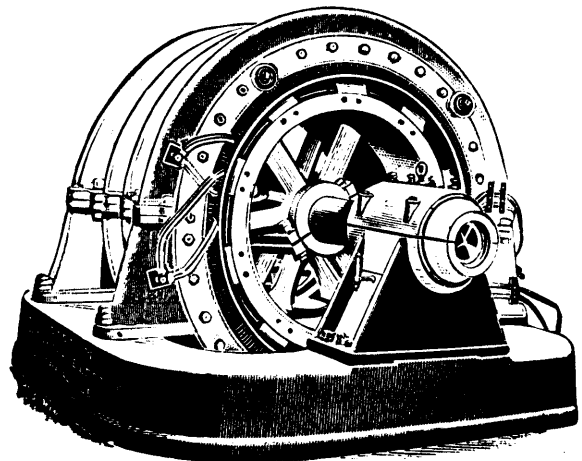
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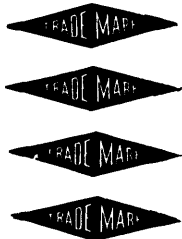
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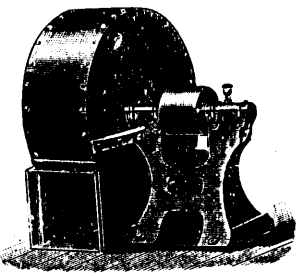
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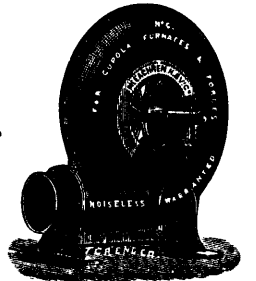
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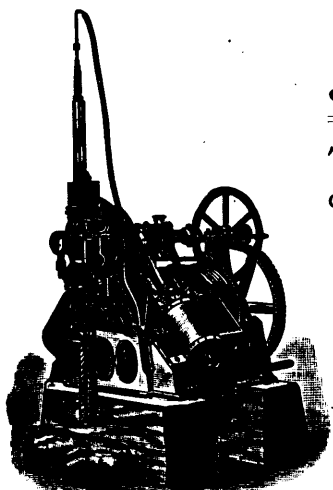
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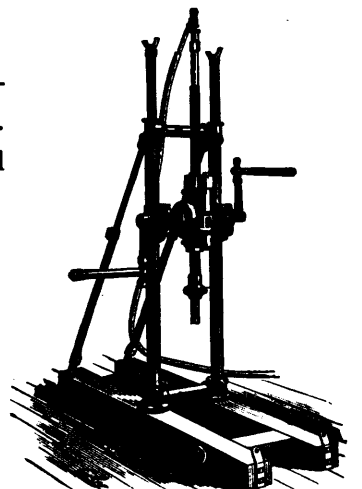
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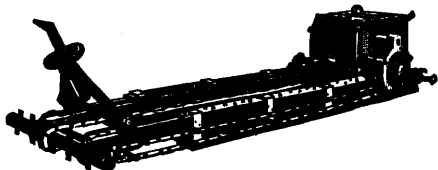
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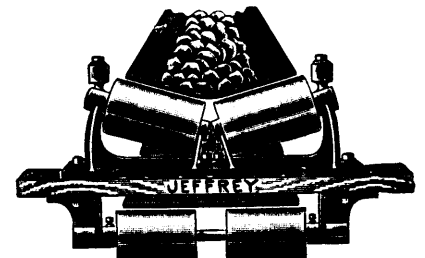
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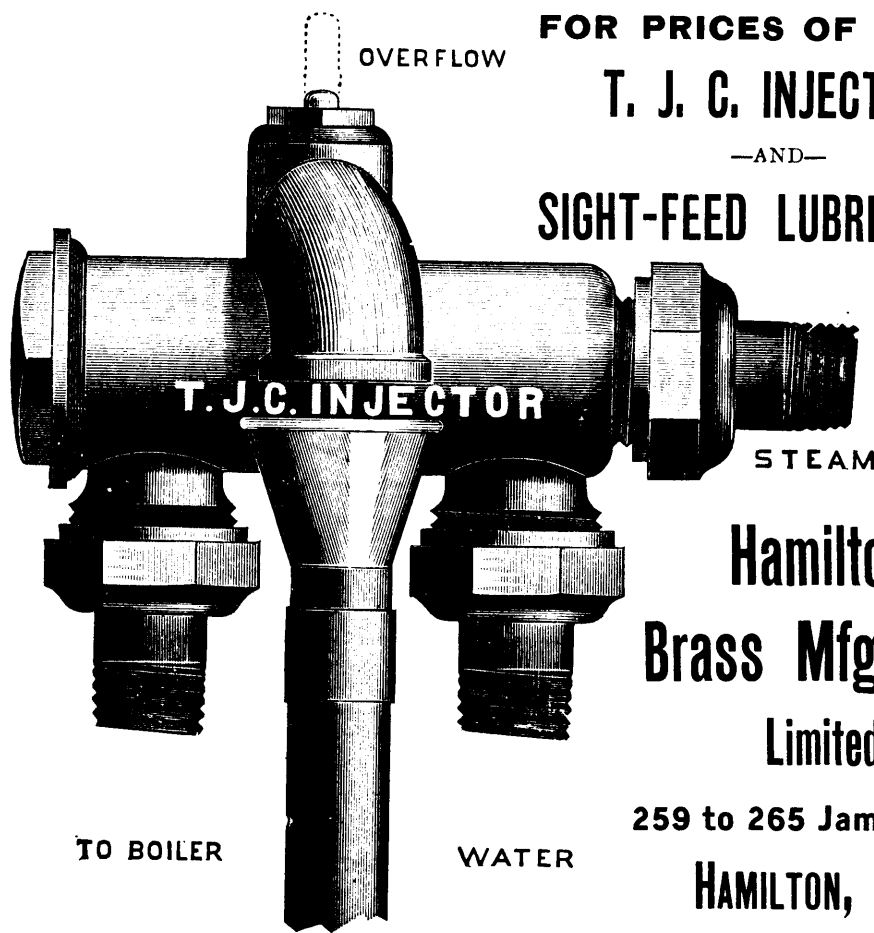


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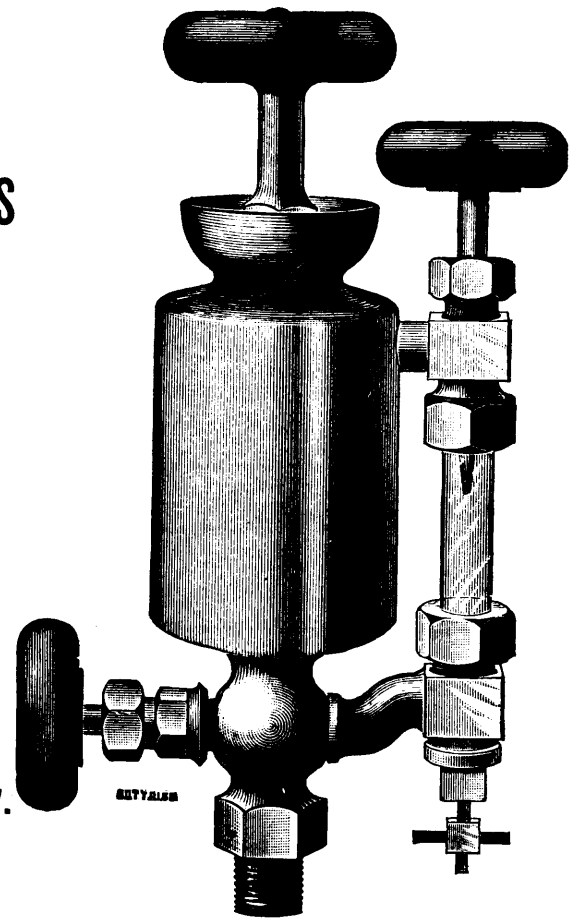
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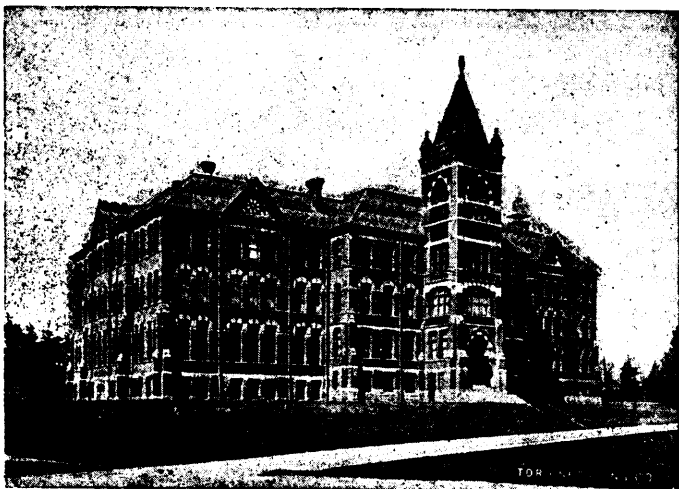
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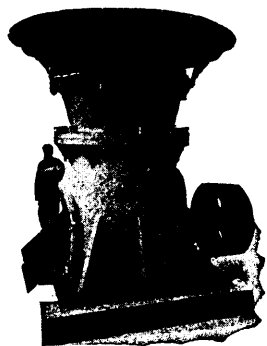
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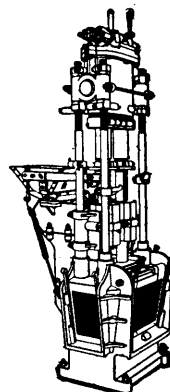
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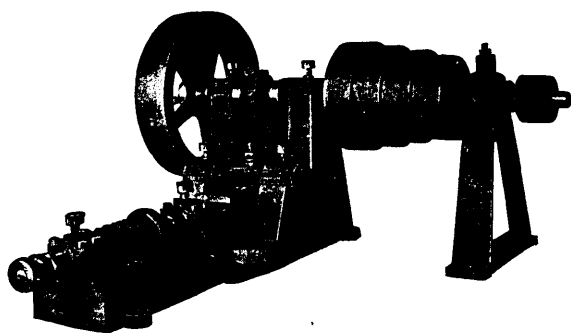
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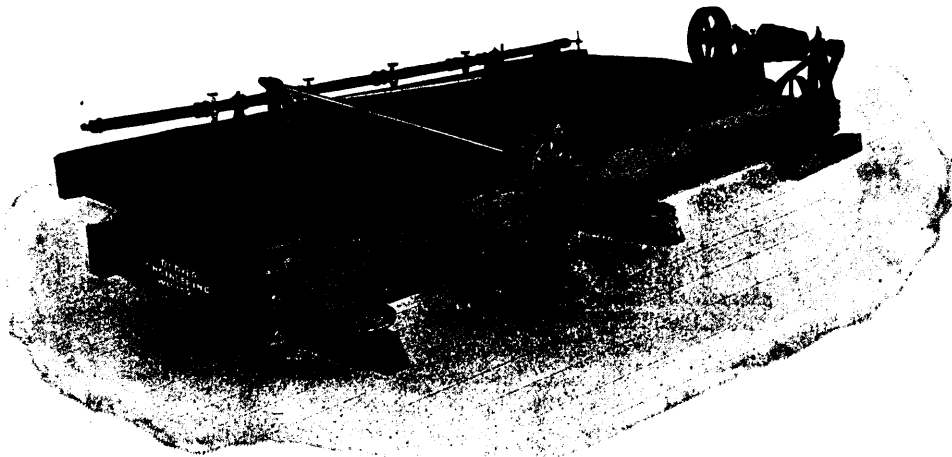
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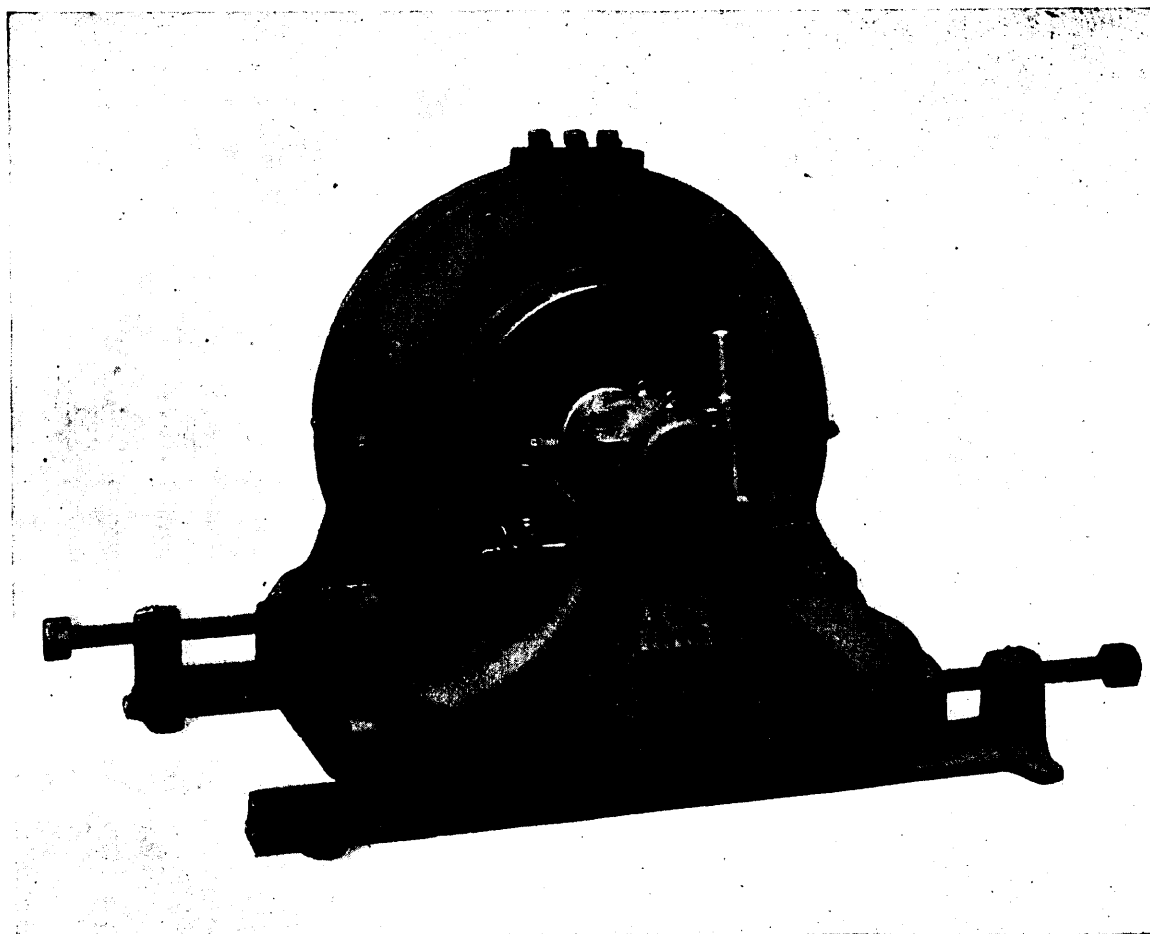
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Under the provisions of chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one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

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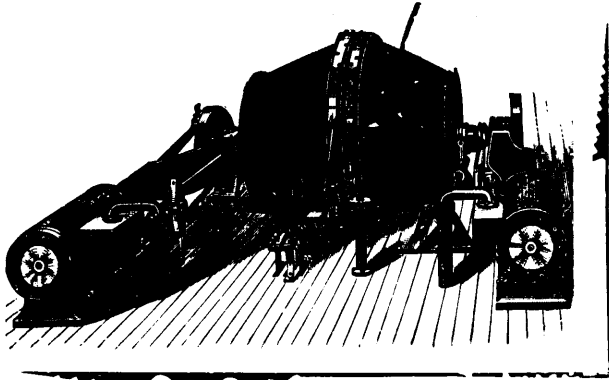
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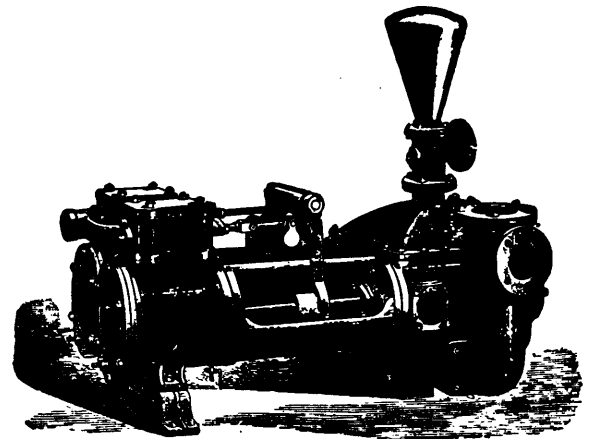
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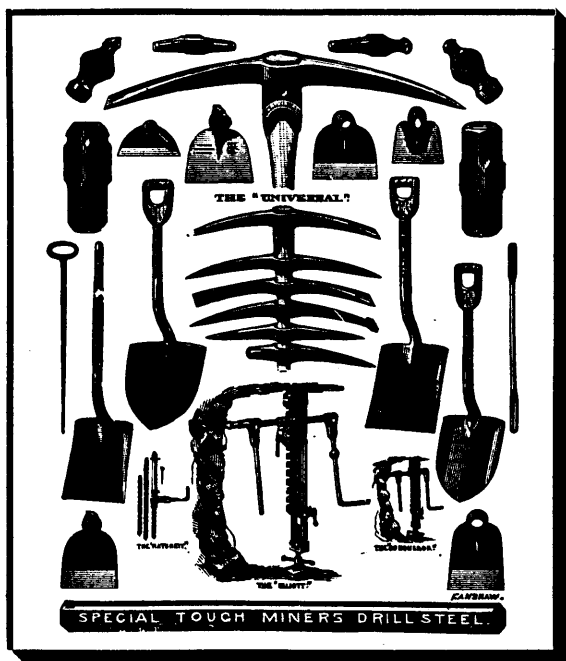
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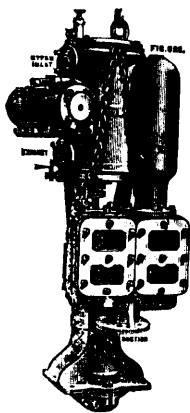


Fig. 620—"Griff"
Sinking Pump.

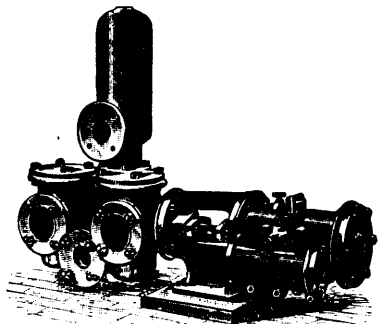


Fig. 598—"Cornish" Steam Pump
for Boiler Feeding, etc.

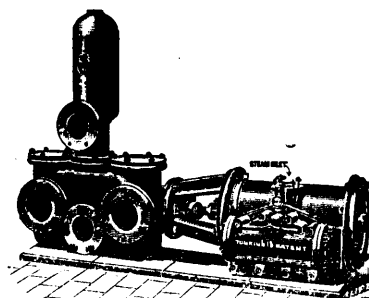


Fig. 600—"Cornish" Steam Pump
for General Purposes.



Fig. 621—"Cornish" Sinking Pump (Ram Type).

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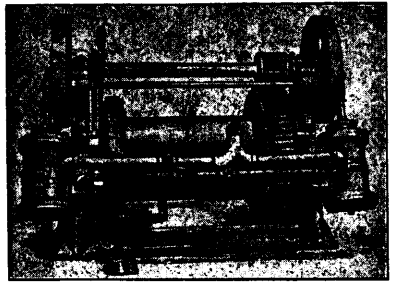
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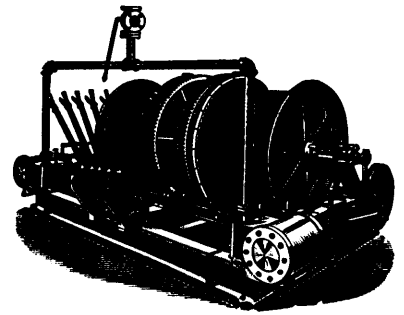
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VOL. XVIII., No. 5.

MAY, 1899.

VOI. XVIII., No. 5.

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(c) One hundred acres of freehold land in fee simple, free from incumbrances, to be selected from any part of the said lands belonging to or which may belong to the Oil Trust, in such portions and as and when required by the company for the purpose of erecting and constructing storage, oil or other tanks.

(d) The right in perpetuity to erect and remove derricks, tanks, workmen's houses, stables and other buildings, and drill or sink wells upon any portion of the said freehold land belonging to the Oil Trust, or over which they shall for the time being have the mining right in perpetuity; and any well so drilled or sunk and the products therefrom shall be and become the property of the company. And in addition the company shall forthwith become the owners of 10 acres of freehold land belonging to the Oil Trust, surrounding each such derrick so erected and well so sunk or drilled, but nevertheless the provisions in this paragraph (d) shall not in any way prejudice the right of the Oil Trust to sell or dispose of or otherwise deal with the whole or any part of the lands or mining rights belonging to the Oil Trust, provided that any land, wells or products actually acquired under this paragraph by the Company before the contract for such sale, disposition or dealing is entered into, shall not be or be deemed comprised therein unless with the company's concurrence.

(e) The sole right in perpetuity on any lands belonging to the Oil Trust, or over which it has or shall have the mining rights in perpetuity as aforesaid, to refine crude petroleum and manufacturing and lubricating oil and otherwise deal with the products thereof.

(f) The right to obtain in perpetuity from the Oil Trust, the Belgian Company and the Irish Proprietary Company the supply of the whole of the output of crude petroleum that may be obtained from

the wells now sunk on the property of any of the three companies, or which may hereafter be sunk thereon, except such oil as any of the three companies may at any time require for the purpose of its works, but so that the company shall pay for such crude petroleum the current market price within two calendar months from the date of each supply, and that none of the said three companies shall be bound to supply to the company any specified lot of petroleum for the time being actually gotten, which the company shall for twenty-one days after receiving notice from such company of the same being gotten refuse or omit to purchase the same.

(g) The free use in perpetuity of the wharves at Gaspé Basin, the property of the Oil Trust, for the purpose of the exportation or importation of goods and merchandise and petroleum or its products.

(h) If the company fail to purchase the oil after the expiration of the twenty-one days notice referred to in the preceding clause (f), the company shall, at the request of any of the said three companies, convey such oil through their pipe-lines to such place or places to which the pipe-line or lines may be laid, as such company may direct, at such price per barrel and upon such terms as may hereafter be agreed upon, and in case of dispute by arbitration, this right of the said three companies shall also at their request be extended to any company or companies or persons who shall have acquired or may hereafter acquire any lands or rights from them.

(i) The sole right to exploit and work any existing wells of the Oil Trust for three years from April 17, 1899, on paying to them two-thirds of all oil obtained from such wells, which said two-thirds shall be sold to the company at the current market price.

(j) The option to purchase all or any parts of the said lands if unsold by the Oil Trust, at a price (cash and shares) to be settled by arbitration in case the parties differ, except ten acres of land surrounding each well now or hereafter to be sunk or drilled by the Oil Trust.

Under the contract hereinafter mentioned with the Oil Trust, the Oil Trust has the following rights, subject to the provisions thereof:—

(A) To purchase the rights of the Company to sink or drill wells over all or any of the lands (except as therein mentioned), on payment of £5 per acre.

(B) To sell or lease all or any part of the said lands (except as aforesaid), provided they first offer the same to the company for one month, to purchase or lease same at the prices at which they have had offered for same, and if the company decline to so purchase or lease, then the Oil Trust shall pay the company £5 per acre as hereinbefore mentioned before selling or leasing the said lands as aforesaid

The freehold properties are held under Crown titles, and the owners of the lands over which the perpetual mining rights are held obtained their titles from the Crown.

The Petroleum Oil Trust, Limited, the parent of this offspring, was registered in 1891 with an authorized capital of £430,000; £330,000 in ordinary shares of £1, and £100,000 in preference shares of £10. £368,310 has been allotted and paid. The preference dividend of 7% per annum has been regularly paid, and in 1895-6 it was officially reported that the profits (presumably derived from sale of lands) amounted to £13,906. At its organization the Trust controlled some 40,137 acres freehold, with mining rights over 10,220 acres. When Mr. Obalski, the Inspector of Mines for Quebec, visited the property of the Company last year he found 33 wells completed and in operation. Some of these had been sunk to a great depth, the deepest being down to 3,600 feet. In two cases the oil flowed naturally, but since then pumps have been used. Of the last and most important discovery, made in the summer of 1897, at well 27, Mr. Obalski says: "As it was not expected that oil would be found at so slight a depth, no preparation had been made, and before the stream could be controlled about 1,000 barrels were lost. After tubing the well and connecting it with a tank, it continued to flow in an intermittent manner for some time, but after that a pump was put in and three wooden tanks were built, 16 feet in diameter by 12 in height, and pumping was carried on daily." It is pertinent here to observe that Mr. Obalski does not inform us whether he obtained this information from the management at second hand or whether he knew as an actual matter of fact that such a discovery had been made. We suspect he was informed for, in the very next sentence, he says "I was assured that these three tanks had been filled."

The company had so much to gain by demonstrating beyond a peradventure the truthfulness of these statements that we cannot understand why he was not permitted to see the *inside* of the tanks and measure up the quantity of oil which they contained.

In 1896, the Petroleum Oil Trust sold 5,041 acres of land to the Société Belge des Petroles du Canada for 7,750,000 francs in fully paid shares of 500 francs each of that company, and in the same year a contract was entered into with the Irish Proprietary Oil Fields of Gaspé, Canada, Limited, a subsidiary company, for the sale of an area comprising 1,500 acres of mining rights, the purchase consideration being £66,000, payable £333,333 in fully paid ordinary shares and £25,000 in cash and the balance in cash or shares. The prospectus of this undertaking contained many surprising statements. It announced that eight pumping wells were yielding a daily average of 8,000 gallons. Six others contained oil "which will flow without pumping when connected by short pipe lines to the main pipe line to receiving tanks. It is estimated that the daily output of these wells will average 7,000 gallons. The treatment of only 20,000 gallons daily of the company's crude oil would, apart from the by products for which there is a profitable market, give a daily production of about 12,000 gallons of refined or kerosene, or 3,600,000 gallons per annum, from which a profit of £72,000 per annum could be obtained, and double this sum would be obtained if the refinery was worked to its full capacity."

Owing to the extremely mysterious and secretive manner in which the Petroleum Oil Trust has conducted its operations in Gaspé, no one in Canada is in a position to confirm or refute these statements. Sir William Logan and Dr. Sterry Hunt, whose reports to the Geological Survey are conspicuously quoted in the prospectus, were dead years before its organization, and Dr. Robert Bell, we imagine, has not been on the ground since work was begun. The only other independent authority who has visited the property recently is Mr. Obalski, the Quebec Inspector of Mines, and he is careful to point out that though

operations have been carried on over a long period and at a heavy expenditure, "the work is only of a *preliminary character*, and while petroleum exists in the region of a superior quality, *it remains to be seen whether it is to be found in paying quantities.*" It is also significant that he was refused permission to examine the books of the company. Nowhere does he speak of a production of oil on such a scale as that claimed by the promoters, the only information he gives on this very material point being obtained at second hand from the management.

For the sake of the investors who have put so much money into it and for the good name of the country we sincerely trust that this enterprise is not what many claim it to be—a failure, and even worse. The success of these companies would do much to attract to Quebec the capital she so much requires for the development of her undoubtedly valuable mineral and other natural resources.

Mining in Ontario: Its Condition and Outlook.

Passing rapidly in review the present condition and outlook of the various branches of the mining industry of Ontario, the product which heads the list in value of annual output may be taken first. It is somewhat remarkable that petroleum has continued for so long to be produced on a considerable scale from a field of limited area without sign of notable diminution. In 1897 there were 25,556,591 gallons of crude oil brought to the surface, having a value after being refined, of \$1,777,591, the whole, or almost the whole, of which came from wells averaging a yield of not more than one-third or one-half a barrel per diem. The year previous the product was 27,380,588 gallons of crude, worth after refining \$1,884,580. There seems every reason to believe that petroleum will continue to be produced in Lambton county for many years to come, and will remain the basis of a prosperous and important industry.

Another non-metallic substance is found in great abundance in the Onondaga series of the rocks which underlie the most westerly margin of the tier of counties bordering on lakes Huron and St. Clair. The salt wells of Huron, Bruce, Lambton and Essex are still producing brine and evaporating salt, but the business is not a growing one. The output of the wells in 1897 was 54,686 tons valued at \$249,880.

The natural gas fields of Ontario are two in number, one being in Essex County and the other in Welland. The yield in 1897 was valued at \$308,448. The larger part of the product from both fields is piped across the international boundary line, that from Essex going to Detroit, and that from Welland to Buffalo. The prospect of course is that if this free export is continued, with its accompanying drain on the resources of the fields, the underground supply will sooner or later fail, and the natural gas industry will cease to have a being. The rock pressure has already been reduced, especially in Welland, and a pretty strong local feeling has grown up in favor of stopping the piping of gas to points outside of the Province. It is doubtful, however, if the Dominion Parliament would interfere with an established business to this extent. Efforts made to locate productive gas fields in other parts of the Province have not resulted in much success.

GOLD.

The gold fields of western Ontario have now been under development for three or four years, and their true character is being established. It is no longer possible to entertain the exaggerated views of their richness which were common at first, and it may be regarded as settled that, speaking generally, the district is one of low grade ores. Surface showings have in some cases given high values, and occasionally these have been well maintained on opening up the veins, but in the majority of cases development work has demonstrated that the gold contents are comparatively low, certainly under \$10 per ton. To offset this feature,

however, there is the fact that there are numerous deposits—it would hardly be correct to call them veins—which are of most unusual dimensions. In few parts of the world, indeed, have bodies of ore been discovered which can rank in size with the tremendous dikes of Hammond Reef and adjoining properties on Sawbill Lake, and similar lodes on Steep Rock Lake, at the Alice A. mine near Little Turtle River, and in the Jackfish Bay region on the north shore of Lake Superior. There is scarcely a more attractive proposition to a miner than a large body of free-milling low grade ore of fairly uniform value. Risk and uncertainty are reduced to a minimum, and the question becomes one only of economy of working, which can usually be best attained by operations on a large scale. On the Hammond Reef a 10-stamp mill was in steady operation during most of 1898 treating ore from various parts of the property. The results have warranted the purchase of a 40-stamp mill, which is now on the ground, and in process of erection. Power for working the mill and the machinery will be developed from a waterfall at the outlet of Clearwater Lake. On Steep Rock Lake, farther down the Seine, other large low grade veins, the property of Messrs. Upham and Shores, of Duluth, are being tested at the present time, the intention being if the ore proves to carry values up to a minimum of \$3 per ton, to put in a large stamp mill next winter. At the Alice A. Mine near Little Turtle River another zone or belt in the country rock some hundreds of feet in width has given good results from preliminary tests, and the announcement is made that arrangements have been concluded in England, for the construction of a 50 or 100-stamp-mill. The future of gold mining in Ontario appears to rest in no small degree upon the successful working of these large low grade deposits. Nature has placed many of them conveniently adjacent to waterfalls on the Seine and other rivers, and in many cases power can be developed and transmitted electrically to the mines, at very low cost. This is an important consideration in a region where there is no coal and the supply of wood is meagre and not very good in quality.

The number of gold properties at present under development in northern Ontario is very large, and the money and energy being expended upon them will doubtless add not a few working mines to those already in operation. On the Lake of the Woods, the Sultana, Mikado and Regina remain the chief mines actually producing bullion. The first named is, as is well known, the private property of Mr. J. F. Caldwell, and no statements are made public as to the output or profits of the mine. The mill now works 30 stamps, and mining is down to the sixth level. A feat of considerable engineering skill was performed at the Burley mine situated on the extension of the Sultana vein at the bottom of Lake of the Woods, by which a coffer dam has been sunk to the bed of the lake, and the water shut off, the intention being to sink a shaft and intercept the vein, which was located on the property by boring with a diamond drill through the ice. The Mikado and Regina are owned by English Companies. The former is situated on Shoal Lake west, and the shaft is down about 250 feet. The mill is a 20-stamp one, and after amalgamation all the product is subjected to the cyanide process, with the object of recovering all the very fine gold. A rich pocket was struck last year in No. 2 shaft, from which some valuable ore showing free gold was struck, but its extent and worth were very much exaggerated by the local papers. The main shaft at the Regina mine is down now to about 460 feet. The gravity stamp mill used in most of the mines of western Ontario is here replaced by one of the Tremaine pattern, consisting of seven 2-stamp mills, equivalent in capacity to about 30 stamps. The other machinery was also largely remodelled during 1898. Near the Mikado are the properties of the Toronto and Western Company, one of which, the Sirdar, has shown ore well under the diamond drill. The Camp Bay section of the Lake of the Woods is coming into prominence by reason of some promising

prospects located there, notably, the Bully Boy, Boulder, Stella and Triggs. Developments on the Boulder property have shown that a number of small veins come together some distance below the surface, and form one large vein 50 feet wide showing free gold across its entire width. Some good finds have also been made east of Whitefish Bay, near Sturgeon and other lakes. On the property of the Virginia Company here some magnificent samples of quartz showing gold have been obtained.

In the lower Seine country the Golden Star and Olive mines have at present the pre-eminence. The history of the former has indeed bordered on the sensational. Three years ago a bond on the property for \$30,000 was thrown up by the holders. The mine was opened up with judgment and skill, and the stock a short time ago was selling on the Toronto market at 70 cents a share, representing a value of \$700,000 for the mine, leaving out of account an additional \$200,000 of stock lately issued by the company. The shaft is down about 400 feet, and a 10-stamp mill is situated on J O 41, an adjoining location under lease to the Golden Star Company. The ore has yielded unusually well, and three dividends have been paid at the rate of one cent per share. The latest quotation for the stock is 52 or 53 cents, and the head office has been moved to Toronto. The Olive mine is also now equipped with a 10-stamp mill, and the shaft has reached a depth of about 230 feet. Dividends have been paid on the Olive stock as well, and shares are now quoted at 70 cents, the par value being \$1. The formation at the Olive is sericite schist, which contains narrow but rich veins of quartz. A number of properties near Mine Centre have been developed to a greater or less extent, some of the most promising being the Independence, Decca, Emperor, Ferguson, Lucky Coon, etc. The Foley mine, which was the first to get to work in the protogine area, has been idle for nearly a year, waiting, it is said, a process of reorganization which has been on foot for some time. Further up the Seine river, operations have been carried on since last fall at the Sawbill mine, where a Toronto syndicate has been sinking the shaft in the hope of finding payable ore, but without marked success. The Big Six on Clearwater Lake, A L 282, and a number of locations in the neighborhood of Island Falls are being opened up under encouraging auspices.

In the Manitou and Lake Minnetakie regions prospecting and developing work has been active during the past year, and will doubtless be not less active during the season just opening. In the so-called "New Klondike" district some unusually favorable surface propositions have been followed up upon H W 416, H W 419, and other locations.

In Eastern Ontario the operating gold mines are the Deloro and the Belmont, the former in Hastings County and the latter in Peterborough. The Deloro is the only mispickel property being worked in the Province. The mill which was burned down has been rebuilt, and stamps substituted for roll for crushing purposes, the tailings being treated by the bromo-cyanide process, which is the peculiarity of the method in vogue at this mine. The underground workings of the Deloro are quite extensive, and the operations appear to show that this refractory class of ore can be treated at a profit. The Belmont mine is owned by Mr. A. W. Carscallen, M.P., and is operated by the Cordova Exploration Company. It is also regularly producing bullion. The ore is free milling.

The production of gold in Ontario in 1898 was 16,075 ounces, valued at \$271,906.

The silver mining industry has not yet recovered from the effects of the depression induced by the fall in price of silver, but two or three of the mines in the Port Arthur region are again being operated, among them the West End Silver Mountain, Rabbit Mountain and Porcupine. Some very rich ore has been taken out.

NICKEL AND COPPER.

The distinctive metal of Ontario is nickel, the principal producer of which in the form of nickel-copper matte is the Canadian Copper Company, whose mines are at Copper Cliff, near Sudbury. These mines have been worked of late on a more extensive scale than ever, the shaft in the Copper Cliff mine being down to a depth of over 800 feet, the greatest depth of any mine now operated in the Province. The Stobie and Evans mines of this company have also been in commission, the latter principally for the removal of arches and pillars left in ore down to the third level. The total production of matte at Sudbury in 1898 was equivalent to 8,373,560 lbs. of fine copper and 5,567,690 lbs. of fine nickel, representing a value of \$268,080 worth of the former metal and \$514,220 of the latter. Considerable prospecting for copper and nickel lands is going on, and R. G. Leckie, on behalf of the Canadian Mining and Metallurgical Co., has purchased a number of properties in the Sudbury district, among them one from Mr. T. M. Kirkwood, upon which a good deal of work had been done, and a smelter partially erected. The latter has been dismantled since the purchase. A persistent extremely unwise agitation has been carried on to have an export duty placed on nickel ore and matte respecting which a more extended reference is made elsewhere in this issue.

The high price of copper now ruling has doubtless added to the Canadian Copper Company's profits, and it has also led to renewed interest in the copper deposits of the province. At Grand Portage, in Gould Township, on the north shore of Lake Huron, Mr. J. A. Powers has been opening up a vein of chalcocite, carrying also bornite and chalcopyrite, and shipping the ore to New York. The old Bruce Mines have been unwatered by Lord Douglas of Hawick, and it is thought that mining may be resumed in these once-famous mines, which were very large producers of copper in their day. The McGowan mine near Parry Sound has been optioned to a Duluth syndicate, who have 35 or 40 men at work raising copper ore, which is shipped to New Jersey.

IRON.

A decided improvement has taken place in iron mining in Ontario, consequent upon the demand for ore from the blast furnaces at Hamilton and Deseronto, mainly the former. A number of old iron mines in Hastings County and along the line of the Kingston and Pembroke Railway have been reopened, and are producing both magnetite and hematite ores. The Deseronto furnace, which makes charcoal iron, has been filling orders for its product from England. It is to have a rival at Midland, where the Canada Iron Furnace Company of Montreal and Radnor Forges of Que., is about to erect a charcoal furnace having a capacity of 100 tons per day. Several deposits of iron ore have been located on the north shore of Lake Huron, and when the Ontario and Rainy River Railway is completed, it will afford an outlet for the magnetites and hematites of the Mattawin and Atik-oka ranges, now lying waste for want of transportation facilities.

OTHER MINERALS.

A little lead mining has been done in Madoc Township, the ore being cobbled and shipped to Belgium. A Belgian syndicate has also got control of a zinc mine near the source of the White Sand River on the line of the Canadian Pacific Railway north of Lake Superior, and is exporting the ore to Belgium. Some 30 carloads have gone out already. The ore contains about 40 per cent. of zinc, and is worth \$30 per ton. A zinc property is also under prospect in the Township of Balfour, west of Sudbury.

The discovery of extensive deposits of corundum in Eastern Ontario has not yet led to their being worked, and very little is being done in mining the non-metallic products in which that section of the province is so rich, such as mica, talc, actinolite, graphite, phosphate of lime, etc.

Summing the situation up, it may be said that the outlook for mining in Ontario is full of promise. The period of "booming" is happily over, or nearly so, and efforts are now confined to legitimate mining and reasonable methods of promotion. The old mistake of rushing up a mill for treating ore before making sure that ore in quantity was present, is not so often made as it was in times past. Experience is bringing wisdom, and with a continuance of present methods the mining industry will ere long be firmly established in this province on no small scale.

The Nickel Question.

There must be no export duty on nickel.

An export duty on this or any other mineral would be a serious reflection upon the intelligence and statesmanship of the Canadian people.

Export duties are always a mistake.

The notion that a Canadian export duty (increasing the injury to all parties) would be a neat piece of retaliation, need not occupy us. Retaliation is not the best object of statesmanship. The proposal of an export duty is distinctly unwise because premature—to say nothing of all other reasons for opposing it.

The Canadian Copper Company, the only Company that has exploited our nickel resources with any measure of success, employs close upon 1000 men and has four smelters in active operation. It is the largest metalliferous mining enterprise in the Dominion. The great bulk of its machinery and supplies is purchased in Canada, and Canadian railways benefit very considerably by its business. Its development of our nickel resources has been one of the best advertisements of the mineral wealth of the Dominion. An export duty would throttle the operations of this Company.

The prime mover in the agitation to promote this duty is S. J. Ritchie, an American citizen, a discredited shareholder, and in its early operations, the Managing Director of the Canadian Copper Company. Ritchie's visionary schemes were repudiated by his co-directors, he was deposed from office and defeated in the Courts in an expensive litigation with the Company.

Hence his disinterested (*sic*) and patriotic (*sic*) endeavors to excite an ignorant Canadian press and a few hungry Company promoters to injure the Canadian Copper Company by placing an export duty upon its ores and mattes.

Dr. Rossiter W. Raymond, one of the most eminent mining and metallurgical authorities on this continent, in a contribution to the REVIEW in 1897, writes: The mining industry of the Dominion cannot yet bear the burden of erecting prematurely and by main force all the industries which may become desirable hereafter. Additional duties laid upon it will only weaken it, without producing the benefit intended. Neither the copper mines nor the nickel mines can stand the proposed exaction. Let the mining industry have a free chance to develop and strengthen itself; to gather a population of consumers around it; to give natural birth to associated industries.

If nickel refining is so much desired why not encourage it with a bounty, or free coal! A fairly prosperous and steadily increasing iron smelting industry has been built up in the Dominion by this policy, and such a course would be more reasonable and statesmanlike than

the imposition of a ruinous export duty. Let us have nickel refining by all means, but not at the expense and to the detriment of our nickel mining and smelting industries as they at present exist.

Canada does not enjoy a monopoly of the nickel resources of the world and an export duty on nickel would place New Caledonia and other nickel producing countries in a position to supplant our present position in the markets of the world.

Mr. Joseph Wharton of Philadelphia, an owner of nickel mines at Sudbury, and one of the principal refiners of this metal, says:— (see Monograph Mineral Industry of the United States, 1896), "It is conceivable that the intimations of an export duty upon nickel ore and matte which from time to time appear in the Canadian journals may some day be realized, and cause serious search to be made in this country for the deposits of nickel ore which doubtless exist and of which the now dormant Gap mine is an instance. Such an export duty would, no doubt, direct attention afresh to the great deposits of nickeliferous pyrrhotite in Norway and Sweden which have been for several years neglected. Barring such a contingency the Sudbury region seems destined to remain for a long time one of the two chief sources of nickel for the world, the only rival to meet it upon equal terms being the island of New Caledonia with its unlimited resources of nickel silicate, only a part of which are controlled by the French Company "Le Nickel."

The Federated Canadian Mining Institute, the representative organization of the mine owners, mining engineers and mine managers of the Dominion, at its annual meeting in March, 1897, unanimously adopted a resolution condemning the agitation to place an export duty on nickel, or any other Canadian mineral, as detrimental to the best interests and expansion of mining development in the country.

Again we repeat there must be no export duty on nickel. Further, we are confident, such a duty is not seriously contemplated by the present Administration.

A Pernicious Fallacy.

Elsewhere in this issue we have pleasure in reproducing a paper "On the Gold Bearing Veins of Bag Bay," near Lake of the Woods, by Mr. Peter MacKellar, F.G.S., of Fort William, presented to the February meeting of the American Institute of Mining Engineers. In this paper Mr. MacKellar is to be congratulated on having presented, in a very interesting way, the facts characterizing the occurrence of gold in veins intersecting the granitic rocks of the Archaean in the Bag Bay district. The views he expresses as to the mode of formation of the veins seem to be the proper conclusion to be arrived at from the facts adduced. The same cannot be said, however, as to his general conclusion that there is a gradual increase in the gold content of the veins as greater depth is attained. This pernicious old fallacy, which dies so hard, is here revived again, and stated on an inference from the recorded facts. This inference does not seem to be warranted. We think that the conclusion which the ordinary reader will draw from the paper is that here, as in all other districts, the gold content will be found to vary as different depths are reached, sometimes increasing and sometimes diminishing. When we consider that the greatest depth reached in the district would bear to the thickness of the earth's crust about the proportion which half the height of one letter on this page of the REVIEW bears to the full height of the page, it seems absurd to say that the crushing will be noticeably more effective at such depths than it is at the surface.

NO NICKEL EXPORT DUTY

Indisputable Facts why such a Duty Should Not be Imposed—
S. J. Ritchie's Malevolent Agitation to Throttle the Canadian Copper Co.—A Strong Statement by Major Leckie.

The month has been notable for a revival of the discussion on the proposed export duty on our nickel ores and mattes shipped to the United States, the *Montreal Star*, *Toronto Globe* and other papers having devoted considerable space to the subject. Our own views upon this question are very well known. We are decidedly opposed to any such pernicious legislation and we have quoted in these columns many of the most eminent mining and metallurgical authorities to show the danger that threatens our nickel mining and smelting enterprises if the malevolent representations of Mr. S. J. Ritchie, backed up by a few ignorant and unscrupulous company mongers, should result in an export duty being placed on this mineral. One of the latest pronouncements on the question is a letter to the *Globe* from the pen of Major R. G. Leckie, a past president of the Mining Society of Nova Scotia and of the Federated Canadian Mining Institute, and a gentleman who for the past thirty years has been very prominently identified with the gold, copper, iron and coal industries of the Dominion. Major Leckie, as every one knows, is a strong Imperialist, he possesses a thoroughly intimate knowledge of the nickel question, and the facts which he recites in support of his contention that an export duty would throttle our mining industry—a contention with which we most heartily concur—are well worthy of the consideration of everyone having the welfare of our mineral industries at heart. Major Leckie says:—

The Minister of Crown Lands, in referring to the discussion of our nickel industry, described it correctly as "principally uninformed."

Permit me to put before you as concisely as I can the facts relating to the production and distribution of nickel. All the writers who advocate an export duty on nickel ore and matte assume that Canada controls the nickel markets of the world. This assumption is entirely gratuitous, but having been reiterated for years by interested parties to avenge a personal grudge, the Canadian public has come to accept this misleading statement as a fact. The truth lies in the opposite direction. The latest available statistics are to be found in *The Mineral Industry*, edited by Mr. Richard P. Rothwell, an eminent engineer and statistician. On page 496 the output of the world for 1896, the last year of complete returns, was 4,624 tons. Of this, New Caledonia produced 2,972 tons and Canada 1,541 tons. In the following year Canada produced 1,813 tons, but the shipments of New Caledonia are not given. The editor remarks: "The total output was perhaps as little as 4,000 metric tons owing to the large stocks of metal that were carried forward from 1896."

PRODUCTION OF NICKEL TODAY.

At present writing, in 1898, the world's production of nickel is considerably in excess of the consumption, and there must be a comparatively large accumulation of stocks. From this the inference is, of course, that unless there should be some sudden and unforeseen new demand for the metal the production must be restricted, page 497. The Société Le Nickel is doing nothing at all, except making shipments from accumulated stocks, and is said to have at least 100,000 metric tons of 6 to 7 per cent. ore on its wharves. The owners of the Katepehai mine have 20,000 tons of 8 per cent. ore, which was offered last year at 11s. per unit delivered in any American port, with a minimum tenor of 8 per cent. Ni guaranteed. The Si Reis mine was shipping

1,000 tons per month. This mine is only 28 miles from the coast, with which it is connected by a railway. Besides this several small mines are being exploited. The freight on ore from New Caledonia to Glasgow is 20 shillings per ton. There were, therefore, on the wharves in New Caledonia a surplus of ore containing 8,100 tons of nickel, independent of current production, waiting a market, or equal to two years' consumption of the whole world. The mines more recently developed by Mr. Higgins are reported to be still richer and more extensive than any in operation on the island, and he is only waiting a market for the ore.

NICKEL IN NORWAY.

In Norway great deposits of nickel-bearing pyrrhotite have been opened, but they are low-grade. Prof. Voght, an eminent authority, states that "metal assaying 98 to 99.50 nickel can be produced in Norway at 40.2c. per kg.," equal to 18½ cts. per pound.

Some richer deposits have been opened, running from 3 to 6 per cent. nickel, and have been secured by a New York gentleman. I am asked to examine some other properties there next month, with a view to purchasing them and supplying the English as well as the American markets. Mr. Rothwell reports a discovery of ore in British Columbia assaying 7 per cent. nickel and another one near Bowrie, South Australia, assaying 19 and 26 per cent. Extensive masses of pyrrhotite, carrying nickel and copper, are found near St. Stephen, N.B., and are being exploited. According to Mr. Thos. Macfarlane, F.R.C.S., the ore carries nearly 3 per cent. Cu and Ni, which is equal in value to many of the mines in this district. Mr. Macfarlane is an accomplished metallurgist and has had many years' experience in Norway in charge of nickel and cobalt mines and works.

THE YEARLY CONSUMPTION.

In the annual report of the Geological Survey of Canada for 1897, the most recent issue, it is stated: "It would thus appear that the world's requirements of nickel are from 4,500 to 5,000 tons per annum, of which amount Canada supplies from 30 to 40 per cent., and that the sources of supply at present worked are more than capable of taking care of the demands made upon them." Page 145 S. The consumption of nickel in the United States is calculated to be about 800 tons a year, and this principally in the shape of nickel oxide.

These figures condemn the theory—the misleading and perilous illusion that Canada controls the nickel markets of the world. I may add that I know that a cargo of New Caledonia ore was offered to the Orford Copper Company delivered in New York at the same price as Sudbury matte. The ore can be smelted and refined more cheaply than the Sudbury alloy, which is composed of copper, nickel, iron, sulphur, arsenic, etc. The cost of mining in New Caledonia is very low. French convicts and native labor are employed by contract at a few cents per day, with board, but are under the direction of free European foremen. About Sudbury surface men are paid \$1.25 to \$1.40 per day, miners \$1.50 to \$2, and mechanics \$2 to \$2.50. In Norway excellent labor can be obtained at half these rates.

Freight from New Caledonia to Glasgow averages about \$5 a ton, from Sudbury to New York the rate is \$7. Therefore, both in cost of production and freight to market, the Canadian miner is at a disadvantage.

TREATMENT OF ORE.

The metallurgical treatment of the ore from an economic point of view is quite as important as the mining. The methods in use previous to the discovery of nickel ore in New Caledonia were not suited to its nature and a new process was devised and patented by Mons. Garnier, after whom both the ore and the process are named. The hydro-silicates are smelted with alkali waste from the chemical

works, and the nickel separated as an oxide. This method was tried unsuccessfully on the Sudbury matte, which is a complex alloy of copper, nickel, iron, sulphur, arsenic, etc. The Orford Copper Company, originally an Eastern Townships organization, bought the first shipments of ore made from this district as copper ore, but soon discovered that it carried a notable quantity of nickel, and promptly informed the Canadian Copper Company of the fact. The difficulty of saving the nickel economically soon became manifest, but the Orford Company undertook a series of experiments, at great cost and extending over a period of more than two years, which resulted in the development of a method thoroughly successful and which is now known as the Orford process. Until this point had been reached the Canadian Copper Company could not find a market for its product, and had an accumulation of 6,000 to 7,000 tons of matte at Copper Cliff, a photograph of which is given in the Geological report (Dr. Bell's), 1890, at page 55 F. The Orford Copper Company added to its plant cupola, calcining and reverberatory furnaces capable of treating all of the matte produced by the Canadian Copper Company. For the refined product, principally nickel oxide, it was necessary to find a market. To this Mr. R. M. Thompson, President of the Orford Company, devoted his time, and interviewed every large consumer of nickel in Europe, and succeeded in establishing a market and a reputation for Canadian nickel. He has visited Europe three or four times a year, and is there now on this very business. The Rothschilds and their friends are the owners of the producing New Caledonia mines, and the fight for a market has been severe; the price having been forced down from 60c. to 25c. At this low figure operations have only been made possible by the present excellent and economical management of the Canadian Copper Company and the reduced cost of separating and refining the metals, effected by the improved methods of the Orford Copper Company.

NICKEL MARKET LIMITED.

It will be seen that the nickel market is a very limited one, and cannot be forced. The principal demand is for alloying steel for armour plates, but in this it is being replaced to some extent by chromium. Ferro-chromium and chrome, nickel, containing about 75 per cent. of chromium and 25 per cent. of nickel, are now used by the most successful makers of armour plates. The value of nickel ore is much over-rated. An ore yielding 4 per cent. pure copper is worth more to the metallurgist than one carrying 2 per cent. nickel and 2 per cent. copper, which is more than the average yield of the ores of this district. The drawback to our nickel is the cost of separating it from copper, and other associated metals and metalloids, which are practically impurities. A very small percentage of copper or sulphur in steel is ruinous.

But Canada produces from 2,000 to 3,000 tons of chrome iron yearly, which is shipped principally to Pittsburg and Philadelphia. Why not place an export duty on that as well as upon nickel-copper matte? It has not been asked for simply because through it Mr. S. J. Ritchie, the chief agitator in this export duty matter, cannot assail the interests of the Canadian Copper Company.

Coming to the cry of monopoly, which has been reiterated *ad nauseam*, why will those who write on the subject not make themselves acquainted with the facts? The Canadian Copper Company has no monopoly nor anything approaching a monopoly of mines, mineral lands or smelting works. It is true that it is at present the only company mining and smelting copper-nickel ores in Canada. When it was brought to the verge of financial ruin by the incompetence of its first management, the directors, being men of wealth, advanced and became responsible for several hundred thousand dollars, which enabled the company to continue operations and meet

its liabilities honorably. Had the directors not done so, the mines and works at Copper Cliff would have added one more wreck to the numerous abandoned mines and smelting works which may now be seen in this district. This is the only company which has continued operations, and the only one now producing and shipping copper-nickel matte. It has kept the industry alive, and why should it now be ruined by prohibitory legislation? All other companies which mined and smelted ore in this district have ceased to operate years ago because the business did not pay. If they could not make a profit when nickel was selling for 60 cents a pound, how can they succeed when it now brings only half that figure?

OTHER MINING COMPANIES.

The Dominion Mineral Company owns the Blezard and Worthington mines and other mineral lands, and a well-equipped smelting plant. The shareholders number among them some of the wealthiest men in Montreal, yet their mines and works have been silent for the last half dozen years. The Vivian Company, which owns the Murray and Violet mines, with smelting works of 200 tons daily capacity, has ceased operations years ago. Yet it is controlled by a wealthy directorate, and has had the advantage of the oldest and most successful copper and nickel refining firm in Great Britain. The Drury Mining Company of Chicago owned mines and smelter in the Township of Drury, but after having produced 1,500 tons or so of matte became bankrupt, and was succeeded by the Trill Mining Company, which does not appear to be quite a success. The Canadian Copper Company does not own even a large proportion of the copper-nickel deposits supposed to exist here. These are held mostly by speculators who will neither work nor sell at a reasonable price. But how can one imagine a monopoly where, according to one of Mr. S. J. Ritchie's pamphlets, there still remains in the ground 665,000,000 tons? The estimate given was 666,000,000, but of this quantity about 1,000,000 tons have been raised in the last ten years. At the same average rate of consumption the resources should last for 6,665 years. Surely even the imagination might rest well satisfied with this; but Mr. Ritchie makes the matter altogether ludicrous.

Regarding the American tariff on nickel some misapprehension exists. The great bulk of nickel is used for making nickel steel, and in the condition of oxide of the metal. The amount of metallic nickel used is comparatively small, and it is only upon this that duty is imposed; ore, matte and oxide being on the free list. Both the Orford Copper Company and the Canadian Copper Company have asked Congress to remove the duty on metallic nickel. Our Canadian tariff, although admitting nickel free, still maintains the duty on nickel oxide, nickel anodes and nickel alloys.

UNFAVORABLE CONDITIONS FOR REFINING IN CANADA.

The cost of materials for refining nickel and matte would be much greater in Canada unless works were located near the coal fields of Nova Scotia. Here bituminous coal costs about three times what it does in New Jersey; it is subject to a duty of 60 cents per ton. Fluxes necessary for the separation of the metals can be obtained cheaply at chemical works near New York, but would be costly here. Under such comparatively unfavorable conditions a refinery here could not compete successfully with those more favorably situated, unless that it were to receive some such favorable consideration from the Government as is bestowed upon the iron and steel industries. If the companies already referred to, the Vivians, the Dominion, the Drury, and others, could not make a profit when nickel was quoted as worth 60 to 65 cents a pound, how can they be expected to make both ends meet when nickel has fallen to about one-half of these figures? And in addition to that, it is now proposed to burden the

product with an export duty of anywhere between 50 and 100 per cent. of its value, with a view simply to kill the industry.

On the 18th instant Major Leckie gave us a call on his way east, en route for Norway, and handed us the following notes for publication in the REVIEW. We have also forwarded them to the *Globe*. Major Leckie presents many additional facts of interest to those who are following this discussion, and his letter is a scathing commentary on the glaring inaccuracies and misrepresentations that characterize the writings of Mr. S. J. Ritchie in his advocacy of a nickel export duty. Major Leckie writes:—

ORFORD COPPER COMPANY ORIGINALLY A CANADIAN ENTERPRISE.

In the discussion of this nickel question there appears to be rather a confused idea regarding the corporations interested. The Orford Copper Company, which I have the honour to represent, originally was a Canadian organization, and I was one of its first directors. Twenty-two years ago it opened a nickel mine, and erected a smelting furnace for reducing the ore in the Township of Orford, near Sherbrooke, from which the company takes its name. It also purchased and developed copper mines at Eustis, ten miles from Sherbrooke, and erected a smelting plant capable of treating 200 tons of ore a day. The mines have been continuously at work since then, and are to-day large producers of ore.

The sulphur gas arising from calcination of the ore was destructive to vegetation for miles around, and there was no market for sulphur at that time in Canada. I was fortunate in being able to make a five years' contract with the Standard Chemical Company, whose works were at Constable's Hook, N.J., by which we got paid a good price for the sulphur, and the burnt ore was returned to us ready for smelting. A furnace was erected near by for treating this ore and so originated the Orford Copper Company's smelting works in the United States. The furnaces were far in advance of any then in existence, and have furnished the models for other works subsequently erected in different parts of the world.

DEALINGS WITH THE CANADIAN COPPER CO.

Some ten years later the Canadian Copper Company came into existence, and was seeking a purchaser for its ore. Among others, the Orford Copper Company was asked to buy, which they did. Mr. Ritchie, who was then manager of the Canadian Copper Company was ignorant of the fact that the Copper Cliff ores carried nickel. This discovery was made by the Orford Copper Company, which promptly and frankly informed the Canadian Copper Company of the fact. This company afterwards proceeded to erect a smelting plant of its own, and in course of time accumulated a stock of matte, amounting to over 6000 tons for which a market could not be found. A photograph of this accumulation of unsaleable matte can be seen on page 183 in Mr. Bell's *Canadian Mining Manual* for 1898.

THE FIRST REFINING OF CANADIAN NICKEL.

At that time the only refiner of nickel in the United States was Mr. Joseph Wharton, an able metallurgist and man of large means. His works were adapted for the treatment of his own ore raised from the Gap mine, and the process adapted to the handling of comparatively small quantities, but sufficient for the demands of the United States.

Mr. R. M. Thompson, himself an experienced metallurgist, aided by a very able staff, undertook to solve the problem of treating the Sudbury matte economically.

Experiments, extending over a period of two years, were conducted at much cost, and which finally resulted in developing a method by which the Canadian matte could be successfully treated on

a large scale. This is known among metallurgists as the Orford process. Since then the Orford Copper Company has been the principal, though not the only buyer of matte, from the Canadian Copper Company. Mr. Wharton is still a buyer. The Nickel Works at Havre, France, Wiggins of Birmingham, and the Vivians of Swansea, besides German and other concerns are buyers of nickel ore and matte, coming from other parts of the world.

ORFORD COPPER CO. NOT FINANCIALLY INTERESTED IN THE
CANADIAN COPPER CO.

Neither the Orford Copper Company, nor any of its shareholders nor officers, nor anyone connected with it has any stock or interest in the Canadian Copper Company. On the other hand, no shareholder nor officer of the Canadian Copper Company has an interest or stock in the Orford Copper Company. Their relations are simply those of buyer and seller. The Orford Copper Company buys where it can do so most advantageously, either from Canada, New Caledonia or Norway. The Canadian Copper Company sells only to those who will pay the best prices. For years past, however, it has been experimenting on new inventions and suggestions with a view to refining its own metal if it can be done profitably. It has a laboratory and works near Cleveland, under the charge of experienced chemists and metallurgists, and has already spent over \$200,000 in trying to find a process which would enable it to place its own metallic nickel and nickel oxide in the market. So far without success, as it finds it to be more profitable to leave that part of the business to those who have proved themselves successful. Mr. Ritchie insinuates, in a sneaking way, that there is some corrupt understanding between the officials of the Canadian Copper Company and those of the Orford Copper Company. On this point the president of the Orford Copper Company wrote the *Mail and Empire*, 16th December last, as follows:—
“At a certain date a contract in writing was made between the Orford Copper Company and the Canadian Copper Company; this provides for certain payments to be made by the one company to the other; these payments have been made monthly. No other payments of any kind or benefits of any kind have been given by me, or by the Oxford Company, or by anyone connected with it to the Canadian Copper Company, or anyone of its stockholders, or to anyone connected with it; and no person connected with the Canadian Copper Company is connected with the Orford Copper Company, or interested in its stock or in the profits it makes under its contracts with the Canadian Copper Company.”

“Your suggestion imputes to me dishonourable conduct; if you have any doubt left as to the untruth of the statements that must have been made to you, and upon which you based your suggestion, put your suggestion in the form of an allegation and I shall prove its untruth in your courts.” This was to the *Mail and Empire*, not to Mr. Ritchie. It would be useless to waste powder and shot on a dead duck.

MAJOR LECKIE SCORES RITCHIE

As for myself, notwithstanding Mr. Ritchie's allegations, I have never owned a single share in the Canadian Copper Company, have never been in its service, and have never received from it or its officers a dollar, directly or indirectly, for any services performed. Mr. Ritchie's letter, therefore, starts with a gross falsehood, which is continued throughout the five columns given to him, and winds up with a piece of personal vulgarity quite characteristic of him. It would be tiresome to go on recounting and correcting the inaccuracies of Mr. Ritchie's letter, because where he is not falsifying, he is indulging in arrant claptrap—“browbeating the Canadian Government, &c.” is rather comical?

Mr. Ritchie is not a Canadian, neither is he a British subject. Whence all this benevolent interest in the welfare of a Canadian industry and his enmity to those of his native country? It arises simply from his hostility to the Canadian Copper Co. But why should his fancied wrongs or hallucinations be elements in the discussion of the nickel question? The character of his letter should be its own condemnation. Where he attempts to deal with figures relating to comparative costs of smelting and refining, he exhibits a complete ignorance of the subject. His argument all through, if personal abuse can be called such, is against the company. There is no need of my defending the Canadian Copper Company. It has proved itself well able to defend its own interests and those of its shareholders against the vindictive attacks of Mr. Ritchie. In his numerous suits against the company or its officers, he acknowledges constant defeat, but attributes it to the corruption of its Legislature and Courts, and then insults the House of Commons by talking of the influence of lobbyists. One of Mr. Ritchie's suits in Ohio, against the Canadian Copper Company, involved a claim of \$500,000, for services rendered it in *having the duty on nickel, in various forms, reduced, as well as for other services*. Now he takes the stand that the company is responsible for this action, and ought to be punished by the Canadian Government for having done it! To whomsoever the credit is due, should be given the thanks of Canadian ore producers for accomplishing a task so difficult and beneficial.

MAJOR LECKIE'S OPERATIONS AT SUDBURY.

That I am buying or securing options on nickel properties about Sudbury as stated by Mr. Ritchie, is untrue. Last December, I bought a mining lease and plant and had authority to invest a very considerable sum in mining property, but as soon as the *Globe* and other supposed ministerial organs, gave countenance to this unwise agitation for an export duty on nickel ore and matte, that authority was withdrawn and some of the capital invested elsewhere. I am now *en route* to Norway to examine some recent discoveries of pyrrhotite reputed to run high in nickel, and which, if confirmed, will absorb some of the capital which otherwise would have been invested in Canada. Mr. Ritchie's inaccuracies regarding my business about Sudbury may in some degree be excused, as he has been misled regarding the facts by a poor creature there, who in turn betrays Mr. Ritchie's confidence.

A year ago, I made a visit there in the interest and at the request of the Orford Copper Company, and have since then from time to time made other visits. Two new mines are being opened in that district under my direction, but neither of them show a trace of nickel nor were ever expected to. For the reasons already given the nickel mine will remain unworked so long as there is a prospect of its product being prohibited from finding a market.

LOW PRICE OF NICKEL.

The present production of nickel is quite up to the demand and no advance in price has been made. Canada is producing about one-third of this amount, but it is doubtful if this year's output will be as large as last. Mr. Ritchie refers to “the tremendous advance in the price of copper.” Now if Canada controls the nickel market of the world, why has the price of that metal not advanced likewise? Simply because the assumption is quite inaccurate. Its production has had a very great influence in depressing the price by aggressive competition, but this is a very different thing from controlling the market. It has had the power to reduce the price but not to increase it. Mr. Ritchie among endless other misstatements says: “The rise in the price of New Caledonia stock is owing to the contract with the Canadian Copper Company not to cut the price of nickel, &c.” This is quite untrue. If you refer to the well informed Paris correspondent of the *Engineering and Mining Journal*, you will find that he frankly states the cause of the rise to be the prospective withdrawal of Canadian competition owing to anticipated prohibitive export duty.

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Electric Transmission and Electric Drills for Mines.

F. HILL, M. E., Port Arthur, Ont.

(Read before The Canadian Mining Institute.)

When we see that in the neighborhood of a number of our mines the fuel supply for motive power is, or is nearing to become, a question of grave concern, and that this is heightened through the burning off of valuable timber by careless and unwise men, or through accidental igniting of the dry bush by the sparks of the locomotives, or even through lightning in the course of thunder storms, then we are very vividly reminded to look for another medium that can drive the machinery and apparatus in our mines. Now what can impress itself more quickly on us, than the numerous falls of our creeks and rivers whose roaring and thundering has become to many of us who roved around this country so often, a familiar music, and which has lulled us many a night into the arms of Morpheus. How often has that little dream god shown us these wild rushing waters harnessed into useful occupations, and how long will it be ere these dreams materialize, and we shall see every one of these at present useless spending powers utilized for the benefit of one or another of our industries? But before I proceed with this subject I take this opportunity of warning our people for this vandalic destruction of the forest by fire, or we shall experience the consequence, that in a few years most of the little creeks and rivers, and with them the lakes small and large, will dry up, and we would be deprived of the present very convenient way of travel and the cheap medium for power. One who has known this country for years has seen with regret the diminishing and disappearing of many of our water courses. Even Lake Superior is lower by nearly twenty-four inches since I first knew it, and this is principally caused by the burning off of the forest.

I mentioned above that we have numerous falls in our country from which we could derive motive power, and I do not exaggerate when I say that I know of nearly an hundred in the districts of Rainy River and Thunder Bay, some of considerable size and beauty. Many of them are right in our gold mining region, others in close proximity, and others again farther off, but many so conveniently situated that they would not cause a great outlay of capital in transmitting the electricity profitably to the mines. We all know that distance is nowadays no great obstacle any more since improved machines and a better insulation are at our disposal. Even as early as 1891, at the time of the Frankfurt electric exhibition, the first long-distance power transmission of 110 miles in length proved a success, for the loss was only 26 per cent., although different pressures from 65 to 28,000 volts were tried; and now we talk of distances of 500 miles and losses of only 10 to 15 per cent. Distance has to be considered only, then, when the consumption of power in a mine is small and it is within easy reach of cheap communication. The question will arise then, if it would not be more economical and convenient to use a different motive power, produced either with gasoline, or better yet, refined or crude petroleum, for instance with a Diesel motor.

The advantages of long-distance transmission are specially noticeable when high voltages are transmitted for large industrial centres, or for the distribution of power among a greater number of mines, situated in close proximity, or for a mine far off from the sources of fuel. But, as I said above, it is very questionable if it will be always advantageous for a single mine to go to the great expense of establishing water power and transmit it from afar to the workings. This has to be determined in every instance by closely figuring all the different conditions. We have, therefore, to consider transmission for greater distances, and such for electricity generated at the mine. Now let us suppose for instance we needed a larger amount of horse power for different machines, and wish to sell our surplus power to others, and know we can get this power from a rather distant waterfall. We take also for granted that the utili-

zation of this fall and the establishing of the primary motor—here the turbine or any other water wheel—causes no difficulty whatever; therefore, the next thing to be taken into account would be the dynamo, that is, has it to be a direct current, or an alternating current machine? Now we know we need a greater number of horse power, the distance is not inconsiderable, and we wish the current to do different work. In this case the only acceptable machine for us would be the alternating dynamo, because the direct current machine has a limited transmission of only about 2,000 volts, and this current cannot be divided in the manner we wish. This is different with the polyphase current which can easily be transformed into direct current of any strength which we might desire, or charged into as many motors as its pressure will permit us. I come now to the second question: the production of electricity by some other medium than water and directly at the mine. The building of dams, the laying of pipes, and the erecting of a power-house with all its machinery and other installations near a waterfall for the transmission of electricity over a long costly wire, is rather an expensive thing, and not every mine owner is in the fortunate position to indulge in such expensive enterprises. We conclude, therefore, to buy a Diesel Petroleum Motor which offers the most convenient and economic way to solve that problem. Also in this case the dynamo is a polyphase current machine, is coupled directly to the primary motor, and the generated electricity transmitted to the transformer and thence to the electric motors driving the various machines. This mode of generating electricity will prove in many instances more advantageous and economic than the first system, for, what we spent more in petroleum to run the motor, we save again in wages for attending to the different machines and line of wire, and also on interest of capital expended, and not less so on loss of time in repairing, in telephoning from the mine to the power house at the falls, and if I have a right to mention it, a saving of power in the shorter transmission. These are considerations of much importance which will, I have no doubt, decide in many instances the choice between the two systems of primary power, especially in places where railroad or water communications are near at hand and the freights reasonable.

A mine which is in the fortunate position of having electricity as motive power should make use of this advantage and drive with electric motors everyone of its machines or works. The great convenience which accrues out of such an installation is obvious when we consider the difficulty which we experience often in transmitting the power of the steam boilers and engines, be it steam, air, or rope transmission to our various mine workings. I might mention, however, that machines which need more than 50 h. p. would be better driven by a generator of their own, because the switching in and out of large motors would cause inconvenient differences of pressure in the main line and would affect the other motors to some extent. What advantage it is, but especially in large works, to disconnect or switch out any machine or apparatus at any moment without being obliged to shift belts over loose or friction pulleys, nor being able to stop the humming and buzzing noise of the overhead shafting with its tangle of belts which are a constant menace to everyone's dear existence, not to speak of the great convenience to convey the power with ease from place to place and from any machine above or below ground to another.

Now I wish to direct your attention to one of these machines which has, strange to say, found in this country very little or no attention, although it deserves it very fully. It is this, an Electric Drill of a very ingenious but simple construction and of great efficiency. The reason that we have heard and read but little of it in this country, and even in the States, is that we are too indifferent in acquainting ourselves with what other nations do in the various industries, and this is especially the case in the mining industry. We patronize in many cases the home industry too much to the disadvantage of our miners and mines. To

some extent it might also be attributed to the prejudice which seems to exist against electric drills on account of the poor success which the so-called Solenoid machines of Van Depoele and Marvin had. These machines were constructed after Werner Von Siemen's so-called electric hammer principle,* but soon abandoned by the latter. The principal fault of these machines was their inefficiency and weak return pull of the bit, although the consumption of energy was large, too large compared with the newer drills of Siemens and Halske. But even that earlier machine is surpassed in waste of power by the air drills so much in vogue at the present time. These earlier machines had the Solenoids—the motor—in the drill itself, which was a great disadvantage, considering the shocks which they received with every stroke of the piston; besides, it became soon hot and lost on account of this a large amount of energy, that is, efficiency. Different is this with the newer percussion drill of Siemens & Halske. The motor is here separated from the drill and is connected with it by a flexible shaft of about 8 ft. long. This arrangement enabled the inventors to construct a more compact solid machine, but at the same time a more simple mechanism. The axis of the piston could be placed near the one with which it is fastened to the upright or tripod, therefore a more rigid position was secured and a shaking when in operation was avoided. But to give the drill a still more steady working a fly wheel was fastened on the crank shaft of the machine, whose inertia would hinder the power-transmitting mechanism, especially the teeth of the cog-wheels, to clatter upon each other. Another good arrangement is connected with the machine—the piston rod for the drill steel is hollow throughout, therefore it is not necessary to change the position of the machine when a new bit has to be inserted. It can be done from the hind end by releasing the key with which it is fastened in its place. Further, the feed of the steel is on these machines either by hand or automatic, but always self-regulating according to the hardness of the material to be drilled. A jamming of the bit in the hole, which is with most percussion drills a very common occurrence, happens very rarely, for the return pull of the piston is so strong that on account of this and the powerful percussion the columns or stretcher bars had to be constructed especially strong, and instead of the common tripod, a quatripod, if you will permit me to give the four-legged stand (Fig. 2) that name, had to be provided for this percussion drill. In regard to the consumption of power this machine excels in economy every other percussion drill so far invented or in the market. A drill working with full capacity will use from 0.8 to 1.3 kilowatt, or six drills in operation will need 10 horse power of a steam or water engine, if the length of the transmission of power is not too great, and 12 horse power if it is great. It will drill a hole in the hardest rock from $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. wide and from 2 in. to 12 in. deep in one minute. For instance, in very hard granite 3 in. to 4 in. deep per minute. There is not one percussion drill, steam or air driven, which could show such results, combined with such economy. To make a comparison, only the largest size of air drill might be able to drill a hole of the same depth and in the same time above mentioned, but would need 6 to 8 times the power of one of the smaller electric drills. The vertical depth drilled with this machine is 61.2 ft., and the depth bored without changing bits is 16 in. with about 420 strokes per minute. The weight of the machine is about 240 pounds, and to raise and lower it on the stretcher bars with ease a small block and tackle is used for that purpose as seen in Figs. 1 to 3.

Besides the percussion drill the firm of Siemens & Halske manufacture also a "Rotary Drill." This machine, which is used for boring in rocks and fossils of a softer nature, is of simpler construction and lighter weight than the former. No fly wheel was necessary for this drill, because the drill barrel has only to follow the rotation of the flexible shaft, and the forward feed of the inner mechanism, which is

automatic and self-regulating according to the hardness of the material to be drilled. The consumption of energy is with this machine as with the former, about 800 Watt—to one horse power, and will bore in rock salt a hole $1\frac{1}{8}$ inches wide by 12 to 16 inches deep, or in saltclay, gypsum or oolitic iron ore, etc., 8 to 10 inches per minute. With two bit changes the machine can bore a hole of over 6 ft. Its weight is not more than 70 lbs., and breakage or parts showing wear and tear can be easily and quickly replaced by new ones. The construction of the stretcher bar or column can be seen in fig. 4 to be a very handy apparatus.

I have to say now a few words about the flexible shaft which connects the drills with the motor. This shaft consists of two parts; the outer protecting flexible tube is made of a steel wire spiral and surrounded with leather, while the inner, the real power transmitting part, is a very pliable apparatus made of a number of right and left wound conaxial steel wire spirals, provided on both ends with massive steel pins and couplings, with which they rest smoothly against the ends of the outer protecting tube, and connect firmly with the motor and machine. The whole shaft is very solidly made so that a rough handling in the workings will not injure it very easily.

The next part we have to deal with is the motor, which is enclosed in a strong wooden box covered on the outside with heavy sheet steel, of which is also made the cover, strong enough to allow of a stepping or standing on it. The lower corners of the box are bevelled to bear a pulling over the rough floor of the workings. Attached to it are two handles for a convenient carrying from place to place; also a lever for the starting or setting at rest the motor on whose sides the words "is going" and "is stopping" are marked, to avoid a mistake from the side of the drill men. There are further two openings on both ends of the box, one for the pin of the transmitting cable, and the other for the shaft to connect the motor with the drill. Fig. 5 represents the motor and schematic the inner part of the box, that is, the motor with its different parts in somewhat detailed form; this is a direct current motor, while Fig. 6 is the alternating motor with its schematic representation in the box. Both are one-horse power machines and have equal advantages; the efficiency is alike. Motor and box weigh only about 220 lbs., and are therefore easily carried by two men wherever they are wanted. It would go out of the scope of this paper to speak more in detail about these motors. I will only mention the transmission cable and the handy way it can be carried along in the workings. It is very heavily covered with rubber and strung along the roof or walls of the drifts or shafts, till it ends at a certain distance from the breast or bottom of the workings in a so-called connection box, Fig. 7. From the latter leads a shorter piece to a reel upon which about 300 ft. of cable can be wound, whose end connects with the motor. This reel is light and can be easily carried by one man.

Now when we consider with what ease all the different parts connected with these drills can be carried from place to place, and compare it with the work that is necessary and the difficulty which exists in carrying the air or steam along in a mine, we understand readily the saving of time, but also the saving of expenses, especially when we compare the much greater efficiency of these electric drills with those of steam or air. It is, therefore, surely not to be wondered at that we could not work with the two latter systems cheaper than by hand. Some might say: "But see the advantage of the air drill in furnishing constantly a certain amount of fresh air at the face of the workings." Permit me to reply, "that when we most need fresh air in these places, that is, after blasting, your fresh air is not there. If the air is so bad at these faces, provide in time for your air-ways, or lead a varnished tin tubing down to the workings and connect this overground with a fan or blower driven by a small electric motor. You have plenty of surplus power compared with the power consumption of the air drills." I ask you

* D. R. P. 9469, Oct. 22, 1879.

after what I have said above about the Siemens & Halske electric drills, in comparison with the other systems in vogue in this country, is a mine justified in using any other kind of drill than electric drill, if the motive power in that mine is electricity? I am sure every one of you gentlemen will answer negatively, because every one of you have the welfare and progress of our mining industry too much at heart not to sacrifice a certain predilection for a dear, old, but antiquated machine which stands not any more upon the height of the progress of our present time. These drills are not by any means something new, or unproved. Ever since the beginning of the nineties these machines have been in practical use and give complete satisfaction everywhere. Permit me to mention only a few places:

Rotary Drills—

- In the iron mines of Stumm Bros., near Diedenhofen, Germany.
- In the iron mines of the Société par Action des Usines, Luxembourg.
- In the salt and potash mines of New Stassfurt, of Sondershausen, Germany, and of Ischle, Styria.
- In the iron mines near Marcusfalva, Hungary.
- In the silver mines near Aranyidka, Hungary.
- In the construction of the Transbaikal R'y, Tiflis-Kars, Caucasus.
- In the construction of the Transbaikal R'y, Siberia.
- In the silver mines of Konsberg, Norway.
- In the iron mines of Gellivare, Sweden.
- In the gold mines of Island of Celebes, India.
- In the coal mines of Laurahütte, Silesia, Germany.
- In the lead mines of Silberg, Westphalia, Germany.
- In the coal mines of Colliery Courl near Dortmund, Germany.
- In the iron mines near Unterwellenborn, Thuringia, Germany.
- In the iron mines of Laurum, Greece.
- In the silver and gold mine of Silverton, Colorado.

These are only a few places where they are in operation, but as we see, they are already well known in different parts of the world. "Now let us go and do the same for our own and our country's advantage."

FIG. 1.

Percussive Rock Drill with Electro-Motor.—The percussive drill is also worked by an electro-motor and flexible shaft, the action being maintained by means of a crank, a fly-wheel, and strong springs. The feed is generally given by hand but it can also be arranged for automatic working. Bits of the different lengths required can be put in and taken out at the back of the machine, so that any hole can be completely bored without shifting the apparatus. The axle of the machine is hollowed out for the purpose and the bits are held tight by a key. The percussive drill is intended for the harder qualities of rock; with an expenditure of 1 H.P. it will bore a hole of 1¼ inch diameter and 3 to 4 inches deep in the hardest granite or quartz in one minute. The maximum depth of the holes which can be drilled is 6½ feet. The drill is fixed to an hydraulic stretcher-bar, and is raised or lowered most readily by means of a block and tackle. The separate parts of the machine, viz., the drill, with stretcher-bar, fly-wheel, flexible shaft, and motor-box can be easily carried by two men.

FIG. 2.

Percussive Drill with Electro-Motor.—The mode of supporting the drill on a stretcher-bar as shown on the preceding page is useful for driving work in the mine, whereas the four-legged stand shown above makes the machine suitable for over-ground work in quarries, and in connection with railway construction. The stand is so firm and rigid that the drill can be worked at any angle.

FIG. 3.

Percussive Drill at the Face, in use in the Ober-Gruna Mine near Freiberg (Saxony).—This sketch and the following one shows a percussive drill at work at the face of a drive. The drill is fixed to a hydraulic stretcher-bar with blocks of wood above and below the latter to secure the utmost rigidity.

FIG. 4.

Percussive Drill at the Face, in use in the Ober-Gruna Mine near Freiberg.—The rock-drill itself is more clearly seen than in the preceding sketch. The block and tackle for raising and lowering the drill on the stretcher-bar are also shown.

FIG. 5.

Rotary Rock Drill with Electro-Motor in use in the Salzburg Mine at New-Stassfurt.—The drill is fixed to the stretcher-bar in as simple a manner as

possible so as to suit the small space between the floor and crown of the drive. The apparatus is worked by two men.

FIG. 6.

Rotary Rock Drill with Electro-Motor in use in the Salzburg Mine at New-Stassfurt.—In order to bring the drill into position, a staging of wooden beams is used. The motor-box is on a trolley, so as to enable holes to be bored in the crown of the drive.

FIG. 7.

Cable Drum for Rock Drills with Electro-Motor.—The fixed conducting wires are connected with a joint-box secured to the wall near the place where the work of boring has to be done. A transportable drum holding about 65 yards of twin-conductor cable is put near the joint-box; the connection between the cable on the drum and the fixed wires is effected by means of a short length of double-conductor cable, having on its free end a union plug that fits into a corresponding socket on the flange of the drum. Before the shots are fired the cable can be wound back on the drum. As the work advances, the fixed conductors are lengthened and the joint-boxes fixed in a more forward position.

FIG. 8.

Joint-Box and Cable Drum for Electric-Drill as used in the Salzburg Mine at New-Stassfurt.—This sketch shows the mode of fixing the joint-box to the wall of the drive. The whole of the cable is unwound from the drum and led to the rock-drill, which is about 65 yards away.

FIG. 9.

Haulage by means of an Electric Locomotive in the Drive of the Salzburg Mine at New-Stassfurt.—The axles of the locomotive are driven by a direct current motor of 15 H.P. Conducting bars or rails leading from the generator are supported by insulators fixed into the crown of the drive, and the current is taken from these rails and led to the motor by means of two travelling contacts.

FIG. 10.

Rotary Rock Drill with Electro-Motor.—The drill which is carried by an adjustable screw stretcher-bar, is driven by means of a flexible shaft coupled to an electro-motor, the latter being enclosed in a stout box. The shaft can be readily uncoupled from the drill and motor. The motor-box can be easily carried by two men, whilst the drill with its stand and the flexible shaft form a load for one man. This drill is specially suitable for soft stone, such as salt, oolitic iron stone, &c. The feed is adjustable, automatic, and self-regulating. When two bits of different lengths are used, holes of more than six feet can be bored.

FIG. 11.

Chain Haulage Plant with Electro-Motor. In use in the Alkali Mine at Aschersleben.—The haulage machine is driven by an electro-motor of 35 H.P. The straining gear for the chain is in the same chamber with the machine. A shield of sheet iron is fixed above the motor to the crown of the gallery to ward off the drops of water.

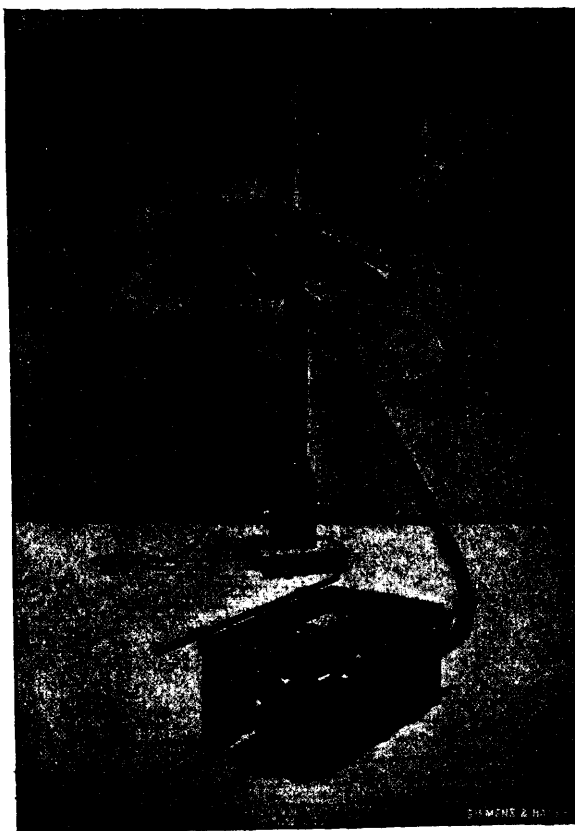
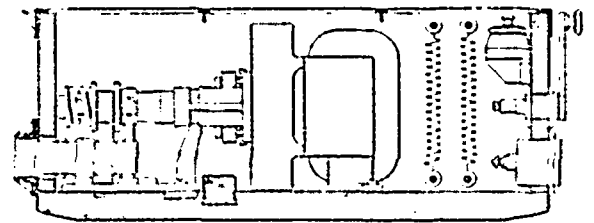
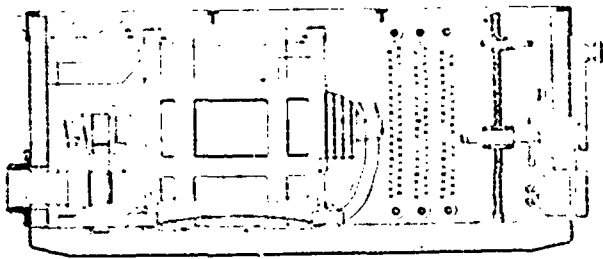
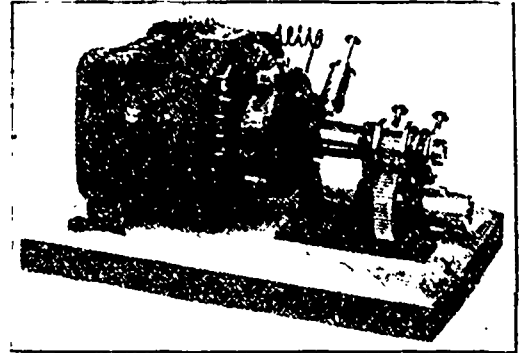
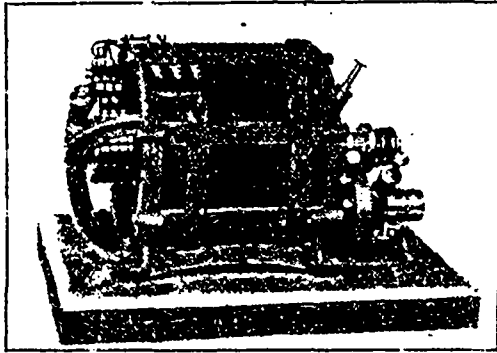


FIG. 1.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES.



DIRECT CURRENT MOTOR.



FIG. 2.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES.



FIG. 3.



FIG. 4.

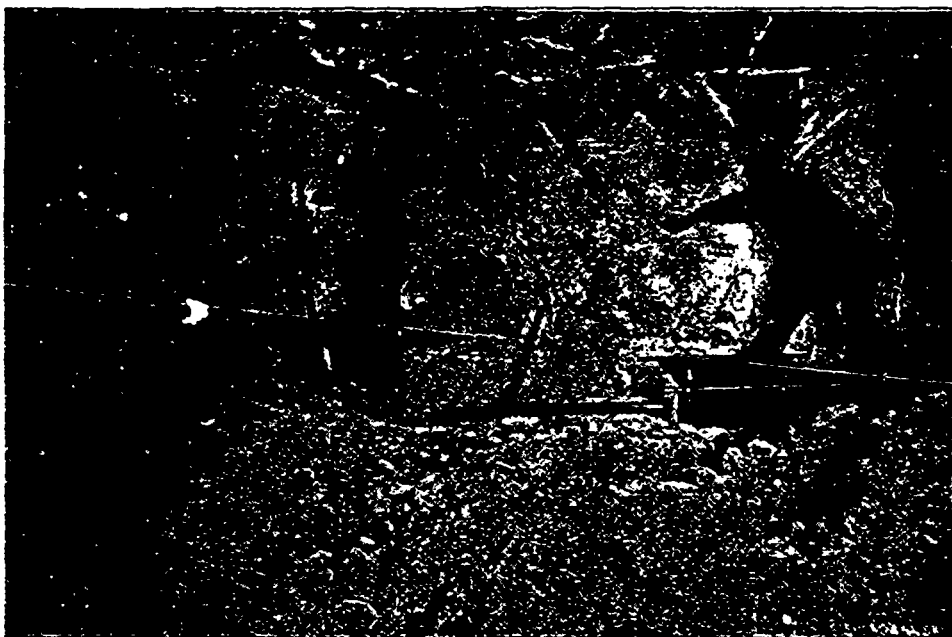


FIG. 5.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES.

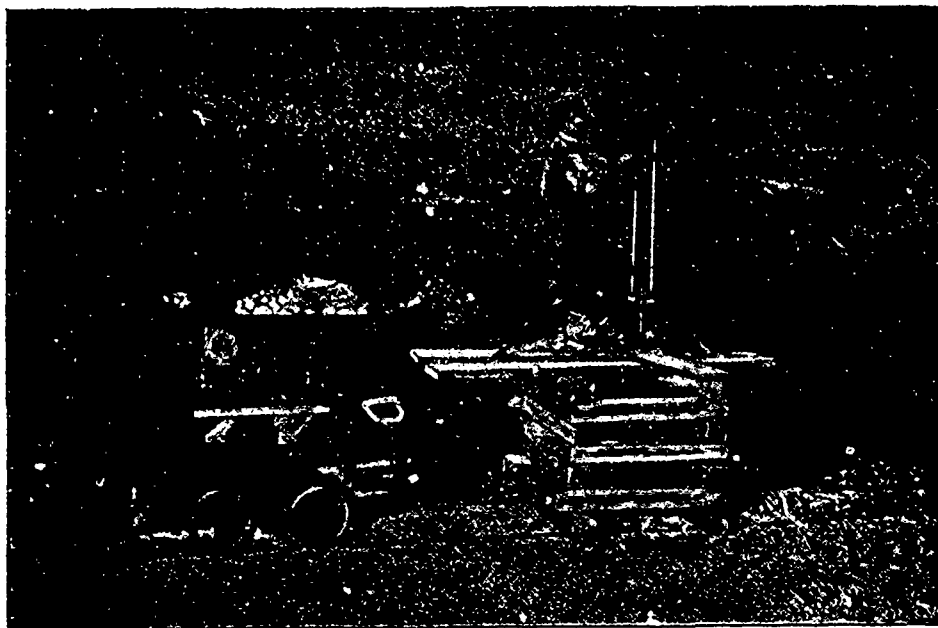


FIG. 6.

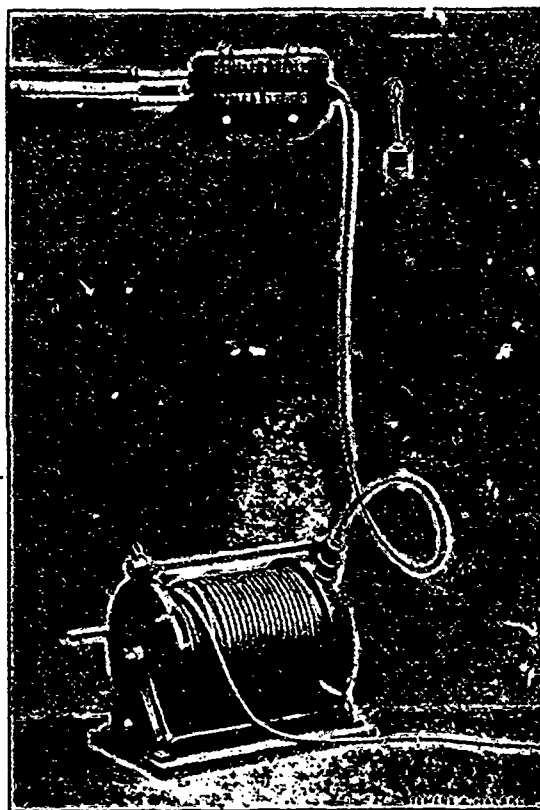


FIG. 7.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES.

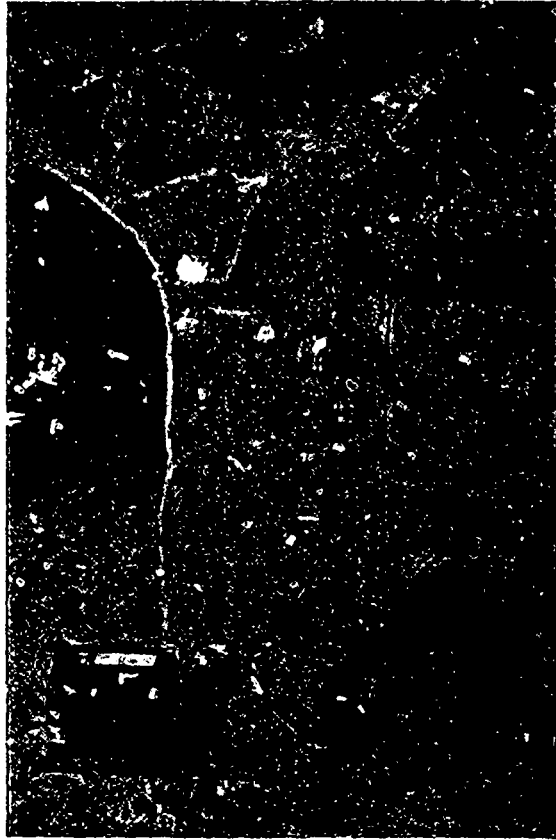


FIG. 8.

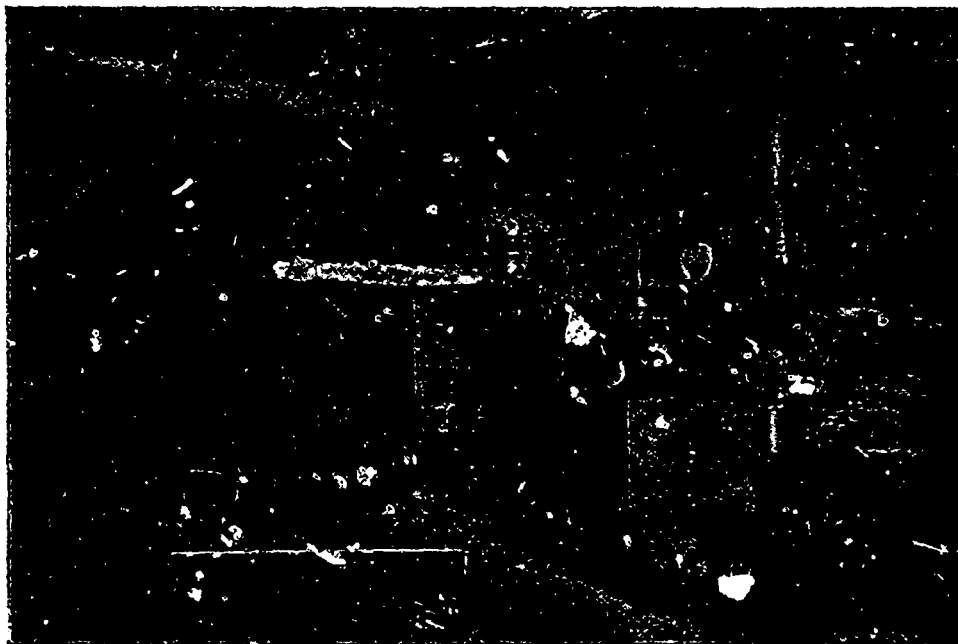


FIG. 9.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES.

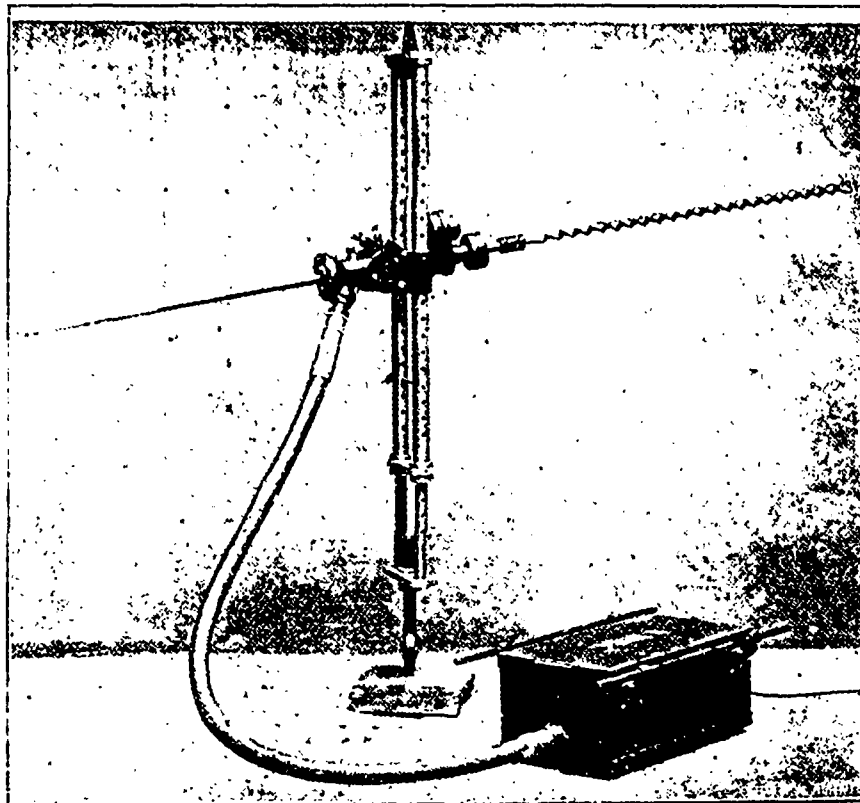


FIG. 10.

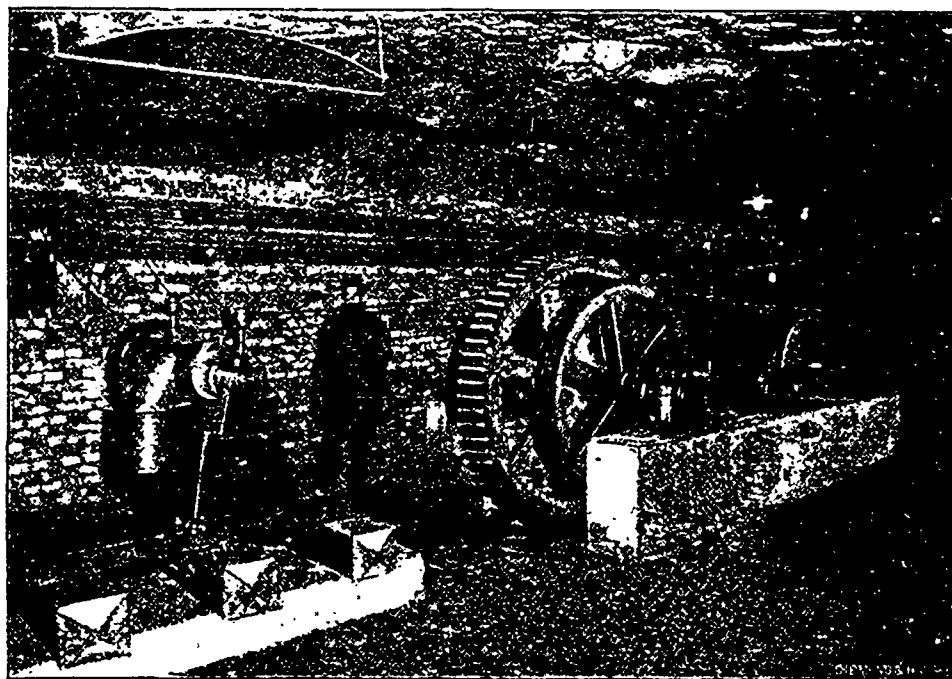
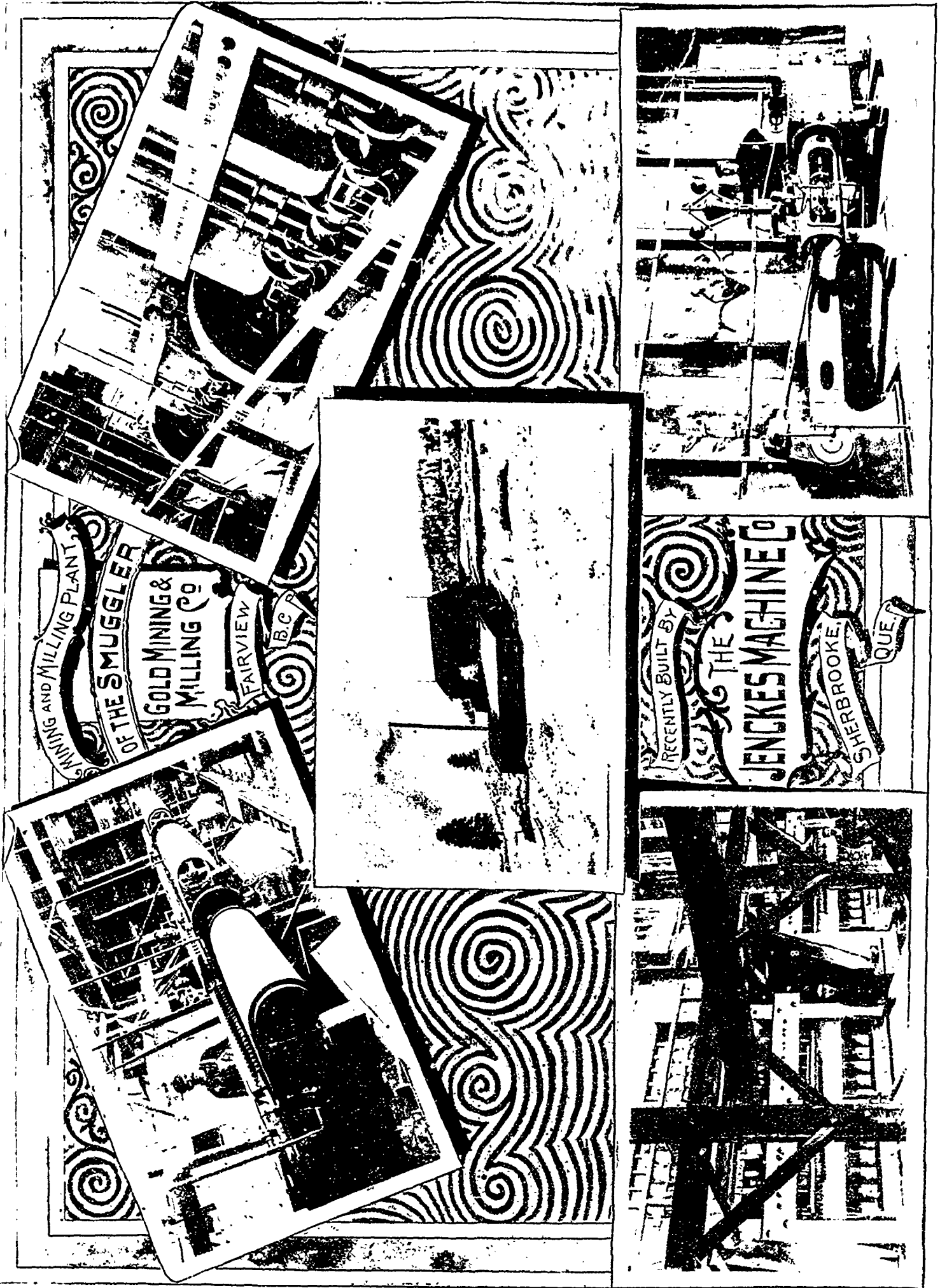


FIG. 11.



The Gold-Bearing Veins of Bag Bay Near Lake of the Woods.*

By PETER MACKELLAR, F.G.S., Fort William, Ontario, Canada.

INTRODUCTION.

The district around Bag Bay in Shoal lake, west of Lake of the Woods, in the Ontario Western gold-fields, is attracting considerable attention at the present time as a gold-producer. A large number of gold-bearing veins have been prospected and mined to a considerable extent in the locality. On the whole they make a fair showing, considering the work done; and some are undoubtedly rich—the Mikado, for instance. The principal mining companies that have been operating here are the Yum-Yum, Ontario Limited, Cornucopia, Engledue Concession, Tycoon, Toronto and Western and Mikado Cos. I will confine my remarks chiefly to the three companies last mentioned, as their developments, lying in the Bag bay granite (which is several square miles in extent), present the peculiar feature which this paper is intended to describe, namely, the smallness of the quartz-fissures as compared with the size of the ore-bearing lodes. Most of the operations of the other companies are within Huronian areas, and if the veins which they are working were formed under similar conditions, as I think they were, the peculiarity referred to is not so strongly marked.

THE GEOLOGICAL FORMATION.

The geology of the western gold-fields of Ontario has been fairly well established by the Canadian Geological Survey and the Ontario Bureau of Mines. Dr. Bell commenced the real work in the Thunder Bay District in 1869 and in the Wabigoon and Lake of the Woods Districts in 1881, and made the first geological map of these regions. He showed that the rocks belonged to the Archæan age, which comprises the Laurentian and Huronian systems. The gneisses and the principal acid eruptives were classed as Laurentian; while the green schists in general, and the basic eruptives, were provisionally included with the Huronian.

The work was ably continued by Messrs. A. C. Lawson, W. McInnis, W. H. Smith and others. Now the whole district from Thunder bay to the Manitoba boundary, a distance of more than 300 miles, is pretty thoroughly mapped out, so as to show the principal geological and topographical features. Through the gneisses and schists, granite, syenite, protogine, etc., have been erupted in great bosses and irregular areas. These again have been intersected by dikes and felsite, diorite, etc., and still later, by numerous fissure-veins, which, in many localities, are gold-bearing.

MINING DEVELOPMENTS.

The Mikado Mine—The well-known Mikado gold-mine is situated on the south side of Bag bay. It has been in successful operation with a 20-stamp mill during the last eighteen months. Three veins on the property, Nos. 1, 2 and 3, are worked. In the report of the Ontario Bureau of Mines for 1898, page 53, Mr. Briedenbach, the general manager of the company, reports as follows:

“On No. 3 vein the shaft has been sunk 45 feet and is being continued. It has enlarged from several inches at the top to 5 feet at the bottom, and the assays run from \$1 per ton at the surface to \$7 at the bottom, increasing gradually. No. 1 and 2 veins have been mined to a depth of about 250 feet each. No. 2 vein, at the surface is only 2 to 3 inches wide of quartz, but rich—\$100 to \$200 to the ton. At a depth of 100 feet the lode is 6 feet wide, of \$10 per ton ore.”

This ore is principally the green veinstone, mikadoite, to be described further on. At 240 feet deep the lode is larger, 6 to 12 feet wide and yields \$15 to \$20 to the ton.

I have confirmation of these particulars from reliable sources. No. 1 showed an unusually large outcrop of quartz for this class of veins. It was a high-grade ore, \$45 of ore to the ton

* New York Meeting, February, 1899, of the American Institute of Mining Engineers.

During the surface-developments, the ore was believed to be free-milling, and only amalgamated copper plates were used for saving the gold. About two months ago, the erection of a cyanide plant with a capacity of 50 to 60 tons per day was commenced. It was completed about the middle of November last. It has been installed by Mr. J. C. Pengilly, a gentleman of large experience in South Africa and other parts of the world. Now it seems that only about one-third of the gold is free-milling in the deeper workings of the mine. In answer to my inquiry, Mr Pengilly kindly informed me by letter that the first run of the cyanide process was very successful, 77 per cent of the gold-contents being recovered

I know no more convincing proof of the value of these veins than the statement of Mr. Breidenbach in the *Rat Portage News*, about six weeks ago, that there was a twenty-five years' supply of ore in sight in the mine, which has not been worked over two years, during eighteen months of which time a 20 stamp mill has been in operation. The value of the ore worked up to the present date, as near as I can find out, is \$15 to \$20 per ton. Very rich ore has been struck in the lower level which will average many thousand dollars to the ton. When last reported they had taken out several tons of it, and still the body was getting larger. I have handled samples of the ore which felt heavy with the gold, like the Calumet and Hecla ore, with its native copper.

The Toronto and Western Mines Development Co.—This company owns the Sirdar mine, on location “D 410,” adjoining the Mikado mine on the east; also several other contiguous locations, “D 411,” “D 412,” etc., all situated on the granitic area, and many other locations throughout the Ontario Western gold-fields. As Field Superintendent of this company, and also as connected with its development-work for the last two years, the writer has had many opportunities for examining the formation and veins.

The Sirdar and “D 411” properties are each one-half mile square. On the latter location several test-pits were sunk on different veins to a depth of 5 to 8 feet each and a 7 by 11-foot shaft was sunk to a depth of 57 feet. On the Sirdar several veins have been examined by sinking test-pits to a depth of 5 to 8 feet, and two shafts have been sunk, one on No. 1 vein to a depth of over 100 feet (now in progress of development with a steam hoist), and the other on No. 2 vein to a depth of 57 feet. The veins occur in groups, one of which appears on “D 411” and two on the Sirdar location. Of the latter, Fig. 1 shows the western one, Group A. These veins appear on the surface like stringers of quartz, rarely reaching a width of more than six inches. They are traced with difficulty for any great distance along the surface, yet when opened up by mining they generally show two, three, six or more feet in width of gold-bearing ore, a greenish veinstone which I will call mikadoite for convenience of description in this paper. This veinstone seems to be a talco-siliceous mineral resembling sericite. It appears to have been formed by the alteration of the granite. Its color is greenish-white to green; it is massive and slightly unctuous, and merges into the quartz as if they were one mineral. When light in color it is called quartz by the miners and others generally, but it is easily detected by its yielding readily to the knife and leaving a white powder. It first became conspicuously noticeable in the Mikado mine, and it forms the principal productive portion of the gold-veins in the Sirdar group. All these veins upon which work has been done are much alike in character, but they vary in size and richness.

Quartz, in irregular stringers, lenses and lumps, occurs throughout the mikadoite, more plentifully in some parts than in others. There are also occasional stringers of dark green chlorite, one-half to one inch wide. The mikadoite penetrates the granite in several places in the shaft which are not marked in the section, as only the outshoots, where I had taken measurements, are shown.

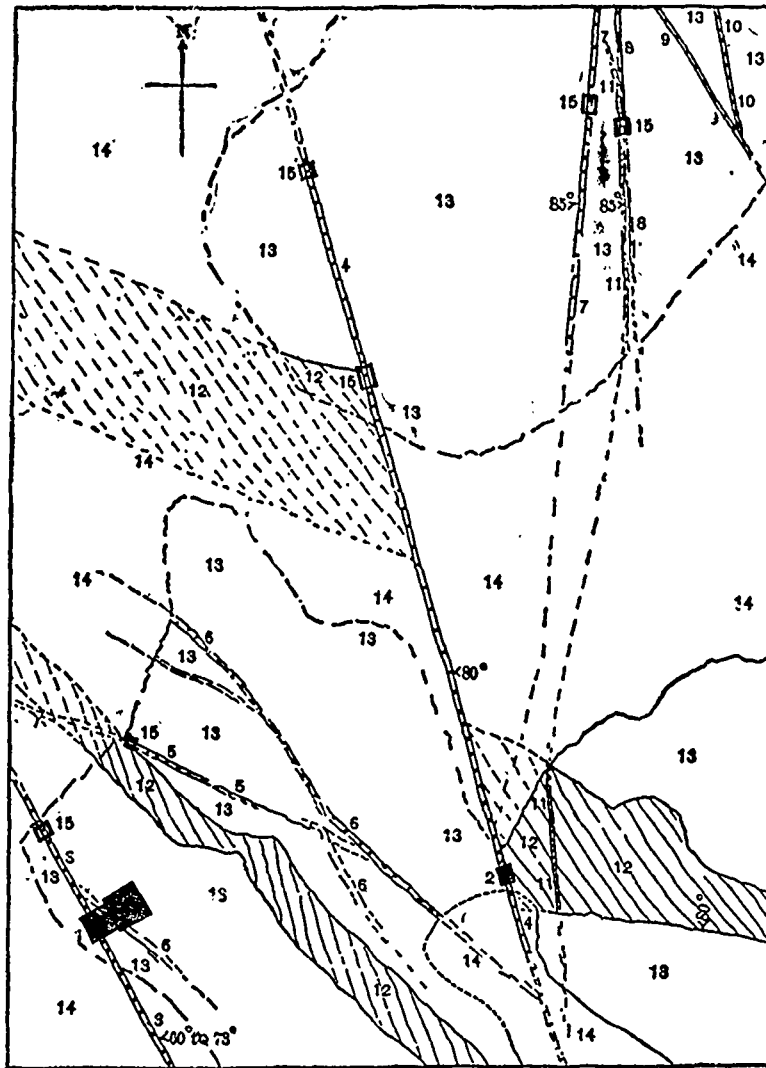


FIG. 1.

Group of Veins, Sirdar Gold Mine, Scale 1650, linear, to 1.

1. Shaft and shaft-house on No. 1 Vein. 2. Shaft on No. 2 Vein. Shows lateral throw of over 200 feet. 3. No. 1 Vein. 4. No. 2 Vein. 5. Veins, 3 in. quartz and 2 to 3 ft. mikadoite. 6. Quartz stringers with mikadoite. 7. Vein No. 3, Quartz 4 to 10 in. and mikadoite, 5 ft. 8. Vein, 3 to 4 in. quartz; 2 to 3 ft. mikadoite. 9, 10. Quartz veins, 4 to 5 in. wide. 11. Chloritic-diorite dike, 4 to 12 in. wide. 12. Felsite dikes. 13. Granite. 14. Covering of alluvial deposits. 15. Test-pits.

The shaft is now down to the 100-foot level. At the surface the principal sheet or vein of quartz was on the footwall, with the mikadoite above it. It continued on a straight line, at the dip of 73 deg., to a depth of 85 feet, with a strongly marked wall. At this point the mikadoite is below it, and more than seven feet wide. At 60 feet depth there was about 1 foot of mikadoite above and 3.5 feet below the quartz sheet or vein. The latter varies from a couple of inches to four or five inches in width. The amount of vein-quartz through the mikadoite is irregular and varies considerably.

The ore in bulk in the upper portion of the vein, chiefly mikadoite, average about \$4 per ton, as was shown by a test of about 45 tons treated at the Keewatin reduction works. Again, by sampling a pile of about 30 tons of the ore taken from a depth of 65 to 80 feet, and another pile of 25 tons from a depth of 80 to 90 feet, the yield on assay was found to be \$4 in the former and \$24.20 in the latter. The assays were made by Mr. Charles Brent, of the Rat Portage metallurgical works. I have made many pan-tests of the ore from this shaft, and have found the gold much coarser from the lower part than from the upper. It does not appear that there is much change in the richness of the pure quartz; but the mikadoite seems to improve very much in value below the depth of 70 to 100 feet. The work in the Sirdar and

Tycoon mines shows this, and I have reliable information that this mineral is much richer in the lower part (below the 100-foot level) than it is in the upper part of the Mikado No. 2 vein. I may also mention that samples of mikadoite from the Sirdar shaft, below 80 feet in depth, assayed in Toronto, gave more than \$300 to the ton.

Tycoon Mine—This property is a water-location of about 60 acres, enclosing three islands in Bag bay, immediately in front of Mikado and Sirdar mines. It lies across the strike of the veins of the Mikado and of those of group A of the Sirdar. On these islands three diamond-drill holes were sunk to vertical depths of 108, 128 and 152 feet respectively, and each intersected a group of veins. Mr. James Conmee, M.P.P., showed me the results of the borings, which confirm to a remarkable degree the impressions I had formed as to the principles governing the formation of these veins. The vein out-crops would be passed over as unworthy of notice even by mining prospectors, unless they had previous knowledge of this class of veins. Only small veins of pure quartz are shown; and the greenish veinstone, or mikadoite, which accompanies the quartz differs but slightly in appearance, on weathered surfaces, from the granite. The surface-samples I have panned showed very little gold; and yet, below the 100-foot depth, where the diamond-drill cut the veins, they are very rich, as will be seen by the description given below.

I expected a fair showing of gold at the depths where the drill would intersect the veins, by reason of the results of the developments obtained on shore, but I had no expectation of such a remarkable showing as the actual tests presented. The first bore-hole, at a depth below 120 feet, intersected a vein 11 feet wide, which assayed an average of \$19 per ton. It then passed through 24 feet of granite and intersected another vein-belt, 20 feet wide, that assayed an average of \$13 per ton. The second bore-hole was placed about 300 feet east, to intersect a second vein. This hole passed through two vein-belts separated by 46 feet of granite. The first belt is 60 feet wide, of siliceous schist, or mikadoite, assaying \$4 per ton. Within this schist are seven quartz-veins, each 1.5 to 4 feet thick, an aggregate of 19 feet of quartz, which yielded by assay an average of \$67.25 per ton. The whole width of the vein-belt, 60 feet, gives an average of \$24.10 per ton. After passing the granite a second vein-belt is reached. This is 20.5 feet wide, and gives an average assay of \$37.65 per ton. One branch of quartz in this belt, 4.5 feet wide, averaged \$.50 per ton; another, 6 feet wide, gave \$7 per ton, and the balance \$5.50 per ton.

The third hole reached a vertical depth of 108 feet. The first vein-belt intersected was 26 feet wide and assayed \$6.70 per ton; the second vein-belt, below the 100-foot level, was 6 feet wide, and assayed an average of \$16.50 per ton.

VEIN CHARACTERISTICS.

These veins consist of small quartz sheets with comparatively large quantities of the altered granite (mikadoite) which shows a schistose structure next to the quartz, and passes by gradual transition into massive granite. It is generally charged with fine iron pyrites amounting to 0.5 to 3 per cent., and carries more or less gold, in grains and not in leaves, as it is in the quartz in some places. Small quantities of the sulphides of copper, lead, zinc and bismuth are occasionally present, more particularly in the quartz, rarely in the mikadoite. The latter accompanies the quartz fissure-veins and spreads out irregularly to either side, apparently following lines of weakness or lines along which the granite is most numerously jointed, and thus forms great bodies of ore. The veins are shown to be true fissures by the faultings of the formations. Along No. 2 vein, Fig. 1, the felsite dike is displaced latterly over 200 feet. Again, they intersect alike the massive and stratified formations.

The felsite dikes are charged more or less with gold adjacent to the quartz-veins without being otherwise much altered, except that they have an increased percentage of iron pyrites. Samples taken at the surface from the felsite dike cut by Sirdar No. 2 vein yielded by assay over \$6 per ton, and pan-tests of the same at a depth of 50 feet were much richer; but this dike has not been tested with a view of finding how far the gold penetrates into it. Some of the smaller dikes that traverse the Huronian strata are gold-bearing also. Several of these, which intersect the diabase masses, are being mined with promising results. For instance, Inspector Bow, in the seventh report of the Ontario Bureau of Mines, says, in regard to the Ontario Limited mine, that No. 4 vein appears to be a felsite dike; that it has been traced for 500 feet, and shows in one place where it has been uncovered a width of 12 to 14 feet; also that a test-pit has been sunk 9 feet upon it, and a quantity of ore has been taken out for a mill-run. Again, in reference to the Grey Eagle mine, he says (p. 59) that the ore-bodies are large felsite dikes which contain a few stringers of quartz.

THE SOURCE OF THE GOLD.

It seems highly probable that the gold was derived from heated vapors and solutions that ascended through the fissures from great depths, presumably from the vicinity of the magmas, the source of the felsites and greenstones. The felsite dikes are generally present near the veins, and are usually more or less charged with the fine-grained

sulphide of iron that almost invariably accompanies the gold in the veins. They are also frequently auriferous, and especially so in the near vicinity of quartz veins. The felsite in many places loses its visible texture and passes into phonolite with the usual metallic ring. It is probable that this rock has some connection with the presence of the gold here, as I understand the phonolites of the famous Cripple Creek are admitted to have in that region. And, somewhat similarly, the trappean eruptions are connected with the presence of the Lake Superior native copper. For these reasons I have great confidence in the continuance and improved value in the depth of the auriferous veins just described.

PRINCIPLES OF THE VEIN-FORMATION.

In my examination of these veins I was for a long time unable to understand the nature of their formation, nor did I find the conditions presented to agree with the ordinary fissure-vein theories of which I had any knowledge. I came at last to the conclusion that, during the movements that caused these rents, a sufficient pressure was exerted to prevent such a separation of the walls as would leave an opening or gap for the reception of vein-matter. Therefore the opening must have been created afterwards. There can be no doubt that the rock masses which were involved in creating the fissures must have been enormous, and that the granulation and lamination of the walls would be a natural consequence. Subsequently the heated solutions that would surely percolate among the fissures and interstices would be likely to dissolve the more granulated portions for the reception of the silica or usual vein-quartz, while the other crushed portion would be metamorphosed, as is well represented by Professor C. R. Van Hise in his admirable paper on "Metamorphism of Rocks and Rock Flowage."

Again, Dr M. E. Wadsworth, President of the College of Mines, Houghton, Mich., says, in his pamphlet on the Lake Superior Copper Deposits, 1891:

"One of the latest phases of the formation of deposits of value has been the filling in of fissures by the water-deposited quartz and other vein-materials, or, in case no crack or fissure existed, by the removal of the country-rock along certain lines and their replacement by vein-matter."

I have noticed a great difference in the character of these gold fissure-veins of Archæan times, and those of later age, such as the silver-bearing veins of Thunder Bay. The latter show well-defined walls, frequently with brecciated extraneous matter enclosed in the quartz or sparry matrix, while the adjacent rocks are but slightly, if at all, laminated or metamorphosed. The veins in the Archæan rocks, on the other hand, rarely show two well-defined walls and seldom contain extraneous brecciated matter, and the adjacent country-rock is generally laminated and highly metamorphosed. The laminated portions are, in many places, an important factor in the gold-veins of the latter class, as shown by these of Bag bay. There may be veins of later age within the Archæan areas, but there cannot be any of Archæan age in the areas of newer rocks. I believe that the gold veins of the western Ontario gold-fields were formed in Archæan times, as I know of no place where they penetrate the later formations around the basin of Lake Superior. They occur in the Archæan areas on both sides of the lake, as at the Jackfish bay, at the Schreiber and on Shebandowan lake on the north side, and again at the Ropes gold-mine, north of Ishpeming on the south side, but not in the later rocks which lie between the last-mentioned and the others. Although it does not appear that there are gold-veins in the newer rocks (Cambrian and Silurian) in the Lake Superior country, it is in rocks of later age than the Archæan that gold is chiefly found in other parts of the world.

SAWBILL AND HAMMOND REEF.

I believe that many other localities throughout this vast area of gold-bearing rocks in the western Ontario gold-fields will be found to

be subject to similar geological conditions in regard to vein-formations. I will only refer to one locality which lies along the Seine river in the vicinity of Sawbill lake. I have spent considerable time in exploiting the gold-veins in that district. The rocks are somewhat similar to those at Bag bay, and consist of Huronian strata and eruptive rocks. The principal eruptive is an altered granite or protogine, in which chlorite takes the place of mica. I noticed in several of the quartz-veins here the same greenish siliceous veinstone (mikadoite) as that in the Bag bay veins; and it is also auriferous in many places.

It seems probable that the granitic rocks of these two localities were eruptive from the same or analogous magmas at about the same geological time. At both places they are intersected by similar dikes

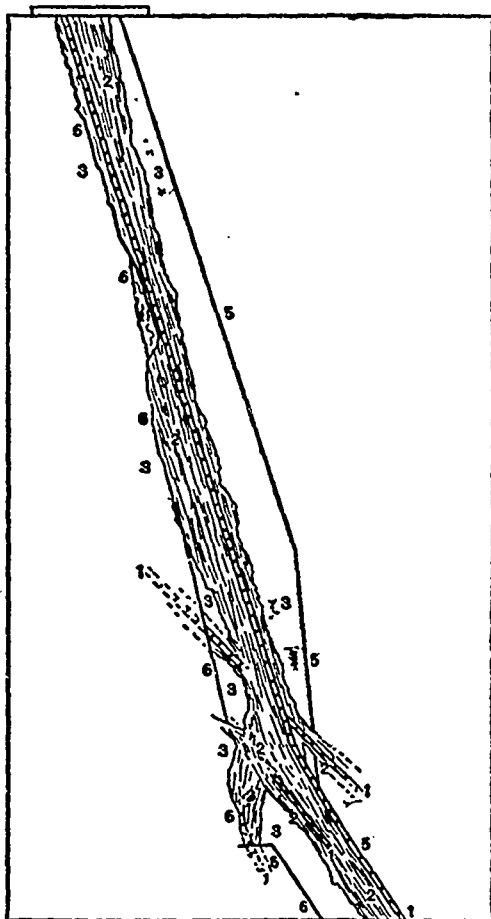


FIG. 2.

Vertical Section of Shaft on No. 1 Vein—Scale 240, linear, to 1.

1. Quartz vein. 2. Mikadoite. 3. Granite. 5. Hanging-wall of shaft.
6. Foot-wall.

of felsite and diorite. Out of many auriferous lodes here, I will refer only to one, the well-known Hammond Reef. This is a remarkable gold-bearing belt. It is 100 to 500 feet in width, and traverses the country for miles, separating into branches that diverge at considerable angles. The gold-bearing portions are largely mikadoite, with branches of quartz. It seems to have been formed under similar conditions to those of the Bag bay veins. Here there appears to be a series of nearly parallel fractures, close to each other. The mechanical forces that were in action were not equal to reducing the whole to a sufficiently crushed condition to be effectively acted upon by the heated solutions. Hence the unreduced portions appear as enclosed barren cores within the reef. According to the hypothesis explained above, the reefs or lodes should improve in depth.

PECULIARITIES OF THE ARCHÆAN.

As I have endeavored to point out, these Archæan metalliferous deposits are different from the general metalliferous formations of the world, and it appears to me that the gold-bearing fissure-veins are marked examples characteristic of the former.

Considering the early age of the Archæan rocks in the history of the globe, the crust at that time must have been thinner and weaker, the heat greater, the gaseous elements more powerful, and the shrinkage of the crust more rapid and intense, than in later times. Therefore, it might be expected to find the rock-formations greatly fractured, and the sides of the rents ground and laminated to a greater extent than in veins of later date. Although there may be veins of the open-spaced fissure-kind here, I think the majority are of the other variety, in which the space for the reception of the vein-matrix was created by solvents in the water circulating through the crushed material along the fractures. In the latter case, the size of the quartz-vein is not a fair standard of the strength, value or continuity of the lode, when judged by the principles of formation and filling of fissure-veins of later formation. The lamination of the walls is, I think, a guide by which to distinguish the two kinds of veins. I am strongly of the opinion that mining men and experts in general will be mistaken if they look for the general characteristics of the open fissure-vein among the Archæan rocks of the western gold-fields of Ontario.

In conclusion, I may say that the doubts which existed about the continuance downwards of the gold-deposits in these Archæan rocks have about vanished within the last two years. I think that, upon consideration of the showing made here, it will be conceded that the auriferous deposits of the western Ontario gold-fields promise to improve in depth—more, probably, than those of any other gold-mining country in the world. The deeper into the veins, the more effective should have been the crushing and granulating process; and proportionally, the quantity of both quartz and mikadoite ore should be greater also.

Notes on the Alleged Shortage of Cyanide Bullion.

By C. W. MERRILL, Assoc. Inst. M. M.*

The impression that the bullion returns from cyanide plants are, in spite of the observance of all possible precautions, uniformly less than the correct tonnage multiplied by the difference between the values per ton indicated by assays of the "charges" and "residues," seems to have become so general that it was thought that the accompanying plot, with a brief explanation as to how the figures therein were computed, would be of interest.

These figures are the results from the operations, from July, 1897, to November, 1898, of the tailings plant of the Montana Mining Company, Limited,† the capacity of which is 12,000 tons per month, which was installed and operated under the writer's supervision, and which has been working during all but the severest weather between the dates named, it being impossible to economically handle the store tailings in mid-winter,‡ the thermometer sometimes dropping as low as 50° below zero in this northern latitude, and the tailings freezing as hard as sandstone to a depth of several feet from the surface in consequence.

ESTIMATION OF OUTPUT BY DAILY ASSAYS OF CHARGE AND RESIDUE SAMPLES.

About 135 truck or car loads of tailings are hauled to the bins daily, each car containing approximately 3 tons of sand. From six to ten of these are weighed, and large samples are taken from each of the cars so weighed; the accumulation of these car moisture samples gives the daily average moisture sample. From the number of cars dumped, the average weight per load, and the moisture percentage determined from the average sample is figured the number of dry tons treated daily.

*Transactions of the Institution of Mining and Metallurgy.

†A description of the plant, which has since been enlarged, appears in the *Journal of the Association of Engineering Societies* (U.S.), May, 1898, vol. xx., pp. 324-326; also in the *Engineering and Mining Journal* of April 16, 1898; and *Mining and Scientific Press*, April 30, 1898.

‡The plant was, however, operated for a short period, during November, 1898, when the thermometer ranged from zero to 15° below.

The sand passes from the cars to the bins and is withdrawn by a 24-in. belt conveyor, one of which discharges into a rotary distributor over the centre of each sand vat. The stream of sand as it leaves the belt is sampled three times per hour during nine hours, which period is the average time consumed in filling a vat with 400 tons of tailings. The large "charge" assay sample so obtained is quartered down and 4 assay tons of the dried sample are taken for duplicate melts and weighings of gold and silver, care being taken that the lead buttons from each melt of 2 assay tons shall weigh approximately 30 grains. If the variation in the weights of gold obtained from these two melts of 2 assay tons each does not exceed $\frac{1}{16}$ milligram (equivalent to 20 cents per ton), the average is taken as representing the value per ton of the tailings charged that day; otherwise the assays are repeated in duplicate until such a concordance of weights is obtained.

After treatment the residue in the vat is sampled by removing 16 cores from top to bottom by means of the sampler (Fig. 1). The sample thus obtained, weighing several hundred pounds, is in turn cored with a small tryer, yielding about 20 lb. of residue, which is dried, mixed and quartered for the final assay sample. Of this, 8 assay tons are taken for assay, the doré buttons from each melt of two assay tons being weighed separately and parted in pairs so as to give duplicate gold weighings from 4 assay tons each. If these weighings differ by more than $\frac{1}{16}$ milligram (equivalent to 10 cents per ton) the assays are repeated. All gold weighings are made on an Oertling 12A balance, sensitised to $\frac{1}{100}$ milligram.

The monthly outputs calculated on the basis of the preceding determinations are shown in the upper line of the accompanying plot, the gold being plotted to the right of the datum line and the silver to the left.

ESTIMATION BY DAILY SOLUTION ASSAYS.

The total amount of unprecipitated or pregnant solution flowing from the sand vats daily is measured, sampled and assayed, as is also the corresponding precipitated or barren solution.

Of the unprecipitated solution from 4 to 8 assay tons are measured and evaporated to small bulk in ordinary saucers standing on a hot plate. Each saucer holds 5 or 6 assay tons; if larger volumes require to be taken a corresponding number of saucers are used and the contents, when sufficiently reduced, are poured into one. A mixture of litharge, silica and charcoal is then added and the whole heated till dry, when the contents of the saucers, after cooling, are mixed with sodium carbonate and charged into a crucible. Any residue adhering to the saucers is moistened with dilute nitric acid and taken up by a small piece of filter paper which is then sprinkled with litharge and added to the crucible. The mixture is then melted, the resulting lead button cupelled and gold and silver determined. Duplicate solution assays are not usually made, but when so made the results almost invariably agree very closely. The sodium carbonate is not added to the solution with the rest of the flux, because it would cake on the inner surface of the dish and make the mixture difficult to remove. Of the precipitated solution, from 8 to 24 assay tons are similarly prepared for the furnace, as many as 40 assay tons being occasionally taken.

These solution assays are of great practical utility, not only as guides to the efficiency of the precipitation, but also as giving warning of the presence of reducing material in any charge several days before the residue from such a charge is available for assay, and they are made primarily for these reasons.

The estimation of the values recovered monthly on the basis of these solution assays is shown on the lower line of the plot.

MONTHLY BULLION ASSAYS.

The monthly bullion assays are made with the usual precautions, including determination of the cupel absorption, check for volatilization

of silver, etc.; the results are shown in the centre line of the plot. The shortage of bullion in the first clean-up is usual in cyanide plants, the deficiency being made up in the succeeding months.

COMPARISON.

The output of gold determined by daily assays of charge and residue is seen to be \$276,499.70, while the gold in the bullion obtained was \$284,856.35 or 3.02 per cent. greater. The silver called for by daily assays was \$51,596.51, while that obtained in the bullion was \$52,572.27 or 1.85 per cent. more. Comparing the total values we find \$328,096.21 called for by daily assays, and \$337,428.62 obtained in bullion, or an excess of 2.84 per cent. over the estimate, a highly satisfactory concordance.

The estimates of precipitation have also averaged somewhat less than the gold and silver obtained, the value of the gold being slightly greater than that called for by daily assays of charge and residue, and that of silver materially less. The deficiency in silver is partly due to the fact that the lead buttons from the solution assays, which are made primarily as guides to the efficiency of solution and precipitation, are placed in the rear row of the muffle during cupellation.

The bases of values, \$20.30 per fine oz. of gold and \$0.50 per fine oz. of silver, were taken for reasons of convenience in computation, their values not affecting the comparison.

The ton referred to is the United States ton of 2,000 lb., and the assay ton contains 29.166 grams, or the same number of milligrams as the ton contains of Troy ounces.

The Longest Mine Haulage.

By F. Z. SCHELLENBERG, Pittsburg, Pa.*

A recent visit with the engineering students of the Western University of Pennsylvania to the Keeling coal-mine on the south side of Pittsburgh, furnished interesting matter to communicate, as may be the case, however, with regard to the striking features of any of our well-arranged larger collieries; for every mine surely appears unique as a whole, though description fails to give that impression, except in particulars.

In the first place, the deliveries of the product at the terminal are on a paved street of the city, and not to railroad cars, or to river boats, as they might be, from such a gravity-plane as the mine cars descend, coming from the old drift mouth at the outcrop of the coal seam, fully 350 feet above the river level. The dumping is into road waggons that travel the streets. A total of about 200,000 tons is handled in a year.

Standing where the cars emerge on the hillside, we see the smokestacks in the valley occasionally giving out great black clouds; and while we know that this means a loss of only 1 per cent. of the fresh fuel, we feel annoyed at the thought of the discomfort to the inhabitants that could be avoided if the users would obey very simple rules of applied science, using, for example, heating furnaces of adequate capacity, that would not require pushing, but only steady, small dosing of fuel. This reform would require in many cases the increase of the steam boiler plant. When we turn to think of the waste in the ground, we would invoke some power against individual wantonness.

But whatever may have been the loose method of mining in these front hills, the Keeling mine is now worked to get all the good coal of the seam.

We take passage in the train of 60 mine cars and ride through three hills and over short intervening ravines, drawn by a 16 ton steam locomotive, for 2 miles. The enlarged tunnel, so-called, is 10 feet in bottom width, 8 feet top, and 9½ feet high, where it is timbered. The track rails weigh 60 pounds to the yard.

*Transactions of the American Institute of Mining Engineers.

Here, at Spiketown, stands a rope hauling plant, idle since last October. The 8 miles of rope were wound up on the drums when the electric trolley line displaced their work, with a promise also of a farther reach than the nearly 3 miles of ropes, of which the trebled length had often called for a mile's renewal at a time.

At Spiketown, too, is Dr. Slocum's experimental gas plant for furnishing a substitute for natural gas, when this product of our day shall have reached its time of displacement, or rather replacement; for in this case it cannot be displaced by an article superior to that which came so easily from nature's store to our lavish hands.

The electric locomotive seems to have come to stay. Two of these are employed, each making its trip in an hour (at the rate of 8 miles per hour while running), and bringing a distance of $3\frac{1}{2}$ miles a train of 30 cars against a grade of 1 per cent. maximum. Each car with its load weighs 2 tons. The gauge of the track is 39 inches. One locomotive runs in and the other out at the same time, the trains passing inside.

In the next ravine stands the new power plant; two Westinghouse direct-current, compound-wound, multipolar, belt-driven generators of 100 K.W. each, at 250 to 300 volts. The two prime motors are Fischer steam engines.

Westinghouse-Baldwin locomotives are used, each equipped with two 50 h. p. motors and weighing about 25,000 pounds. With that weight on the drivers 15 per cent is expected to appear as pull on the draw-bar; and 10 pounds pull to the ton for the locomotive, with 18 to 20 pounds per ton for the mine cars, are required on the level on the well-laid track. With inferior road-bed and superstructure, and common mine cars in bad repair, 40 pounds pull per ton on level track would be the initial rating, before considering the effect of grade. At Keeling's, therefore, there is 1. more power called for up the 1 per cent. grade than would be required under common conditions without grade.

The Westinghouse Electric and Manufacturing Co. declare that, "except at the instant of starting, the draw-bar pull is practically the same for all speeds up to 12 or 15 miles per hour, uniform speed. When the train is accelerating an additional draw-bar pull is necessary to overcome the inertia."

The track in the mine is partly laid with 40 pound rails.

The 7 miles of nearly all underground mine car haulage, including the gathering by mules in the mine itself, it is almost needless to say, is in good alignment, the result of proper surveys. The entries are $8\frac{1}{2}$ feet wide by $5\frac{1}{2}$ feet high.

The electric current is utilized to advantage for incandescent lamps at the parting and in the waiting-rooms (for such they have here, cleanly, and fitted with benches to sit on); and it may soon find further uses, as a trial is being made with two under-cutting machines, of two makes of endless chain cutters, that do the kerfing in the upper half of the lower bottom of the coal seam, which bottom it was not advisable to work by hand as the whole of it would be taken, and would put an inferior product among the lump-coal. The full 5 feet of breast—above the lower bottom beared in—is thus now all making lump-coal.

In this mine the pillars between rooms—the ribs—will not be robbed and left then to waste, as is done too much now in "machine mines" in the harder coal, and always was in the softer coal. Everybody ought to know that the pillars can all be consecutively safely mined as easy work by hand, and that leaving ribs, whether purposely to waste or in postponement, jeopardizes the open work and threatens it with ruin by squeeze.

On Lick Run, shipping on the Wheeling branch of the Baltimore and Ohio Railroad, is another Keeling mine, which is working northward; and there may be in a few years 10 miles of open main entry, through the junction of the two fronts.

Near that farther front are other railroad coal mines; and the "First Pool coal" comes from that rear country, where the hills round about rise more than 500 feet above the river-level.

Geological Survey.

ANNUAL SUMMARY OF WORK DONE BY THE STAFF IN OUR MINING FIELDS.

The Summary Report of the Geological and Natural History Survey of Canada is one of the most interesting and servicable publications published by this most useful and deserving branch of the public service.

The volume covering the work done in 1898, now before us, gives in abstract form, an account of the explorations and surveys completed or in progress, together with a record of the investigations conducted in the offices at Ottawa, publications, additions to the collections, organization, changes in the staff and other matters relating to the Department. The following extracts will give those of our readers who have not yet received this report, an idea of the important work being done for the country by the Survey:—

MARKETS FOR FELSPAR, MOLYBDENITE AND OTHER MINERALS.

Dr. Dawson, in the opening pages calls attention to the commercial importance of a number of our minerals, such as Felspar and Molybdenite. He says:—

"Some trouble has been taken, for instance, to obtain representative specimens of Canadian felspars from deposits capable of yielding this mineral in large quantity, and some of these have been experimentally fused in the kilns of the Ottawa Carbon and Porcelain Company and forwarded in that condition, together with the crude material. Felspar is extensively employed in the manufacture of pottery and porcelain, and if it can be laid down at the works in England, at a satisfactory price, although the percentage of profit to be anticipated is small, there is no reason why the industry may not assume very large proportions, the Canadian material being apparently quite equal to that produced in Scandinavia. Considerable shipments have already occurred to potteries in the United States.

Molybdenite is another mineral for which a considerable and growing demand appears to have been established, particularly in connection with the employment of molybdenum in alloys of iron and steel. Mr. Willmott was instructed in July to visit and report upon some of the best known and most accessible occurrences of this mineral, and specimens of the more important of these deposits were sent to the Imperial Institute. As a result of this, prices were quoted for the mineral, in England, that appear to afford a good margin of profit for the working of some at least of these deposits.

In connection with the above and other mineral substances which Canada is capable of producing and supplying to new markets, I may add that the greatest difficulty has been found in inducing the owners of deposits of the kind, not previously worked, to make even trial shipments of their products. Many proprietors are ready to sell undeveloped properties at good prices, but are either unable or unwilling to put the matter on a commercial basis. The inquiries received are not, as a rule, directed to the acquirement of deposits, but to the practical question—at what price and in what quantity can a given mineral be delivered at a stated market. The acquisition and locking up of mineral deposits for purposes of speculation only, has, in fact, become a serious deterrent to the development of Canadian mining, to which the attention of the proper authorities in the several provinces might, it is believed, be usefully directed.

Among the minerals for which special inquiries have been received during the year, the following may be mentioned. Some of these have not yet been found in Canada, or not in quantities that appear to be of commercial importance, but most of them may be looked for in different parts of the Dominion, with prospects of success, while others are already well known.

Asbestos, Antimony ores, Bismuthenite, Corundum, Chromic Iron, Felspars, Fire Clays in British Columbia and the North-west Territories, Fluorspar, Graphite, Gypsum, Iron-pyrites, Iron Ores (Bessemer and titaniferous), Limestone (pure, for manufacture of calcium carbide and dolomitic or magnesian limestone for use in connection with wood-pulp manufacture), Molybdenite, Mispickel in Ontario, Mica, Marble for ornamental purposes, Magnesite, Natural Gas in Quebec, Nickel, Osmium, Platinum, Pottery-clay in the North-west, Peat, Phosphate or Apatite, "Quartz" for pavers of grinding pans, Sand for glass-making and for "sand-blasting," Steatite or Soap-stone, Talc, Tungsten ores (wolframite or scheelite), Zinc ores.

Nearly all the substances above noted were required for purchase or immediate utilization in connection with different industries, and a large proportion of the inquiries came from Great Britain, the United States and the continent of Europe. Whenever possible, the inquirers have been either placed in correspondence with persons working or owning the minerals asked for, or have been informed of the localities and under what conditions these minerals are known to occur.

MINERAL COLLECTIONS FOR SCHOOLS.

During the past year, twenty-five collections, comprising an aggregate number of over 2000 specimens, have been prepared and presented gratuitously to approved educational institutions in various parts of Canada. The number of such collections that can be made up being necessarily limited, while the demand for them appears to be a continually growing one, more care is now necessarily taken than in former years to ascertain that the institutions supplied are of such a grade that specimens of the kind can be beneficially employed in them. In the case of schools in which natural science forms no part of the curriculum, it would appear that but little use can be made of such collections, the cost of which to the Department is considerable, in time and work, as well as in the expenditure annually necessary to procure suitable material.

A NEW BUILDING URGENTLY REQUIRED.

While it is necessary in this report to again allude to the ever-present danger of the loss by fire of the valuable collections and records of the Survey, still housed in the old and inadequate building on Sussex Street that has been occupied since the removal from Montreal, it may be added that there now appears to be some prospect of the early erection of a new and spacious fire-proof building. It should be fully recognized that the loss of the collection, with its numerous "type" specimens, resulting from the work of the staff for more than fifty years, would not only be a national calamity, but one which would be deplored by scientific workers the world over. The rapidly increasing importance of mining in Canada, alone, should ensure the immediate provision of suitable quarters for the museum and staff of the Survey, in which it may be possible to afford something like an adequate presentation of the mineral resources of the country to all visitors to the capital.

In connection with the value of type specimens, of whatever kind, the following observations by Professor O. C. March, being part of a communication made by him

to the International Congress of Zoology at Cambridge, England, in August last, may be quoted here, as the importance of such specimens is not so generally understood as it should be:—

"The careful preservation of their own type specimens is a sacred duty on the part of all original investigators, and hardly less so of those who are the custodians of such invaluable evidences of the progress of natural science. * * * For the preservation of type specimens, fire-proof buildings are indispensable. I recall no less than five Museums of Natural History, in America, that have either been destroyed, or their contents consumed, or seriously damaged by fire, since I became actively interested in natural science."

GOLD DREDGING ON THE SASKATCHEWAN.

The North Saskatchewan has hitherto been by far the most important stream upon which gold mining operations have been carried on, and is the only one which has offered a continuous and somewhat considerable output of gold. The length of the river upon which work has been found to pay, under favourable conditions, is, as already defined, about 120 miles; Edmonton being situated almost in the centre of this length of the river. Up to the present time, gold washing has been prosecuted almost entirely by hand or with the aid only of very rude mechanical appliances for lifting small quantities of gravel from the submerged bars and bed of the river. The prosecution of this work has been desultory, being practically limited to the low-water stages of the river, and even then conducted by a number of men who, generally, wish to devote only a part of their time to such work; influenced largely by the inducements offered by employment in other directions. It must be added, however, that experience here, as elsewhere in regard to river-bar mining, shows that the best returns are obtained from the first working of such bars, and that, although more or less re-arrangement of material and renewal of accessible gold is brought about each year when the river is in flood, the naturally exposed bars rapidly deteriorate in their yield. For this reason, except at unusually low water, a number of the miners now devote themselves to the working of layers of gravel covered by lighter sandy deposits along the banks of the river, and that these often carry a considerable amount of gold, is shown by the fact that some men were engaged, with profit, during the past year (1898) in removing from five to eight feet of sand, shovelling underlying gravel from the pit thus formed, wheeling it thirty or forty yards to the edge of the river and washing it there by hand with an ordinary "grizzly."

The steam dredge constructed in 1895, and to which allusion has already been made, was at the time of my visit to Edmonton last autumn, laid up some way up the river, and no favourable accounts were received of the results so far attained. I was able, however, to visit the other steam dredges on this part of the Saskatchewan, beginning with that of the Star Mining Company of South Edmonton.

This was found at work about two miles above Big Island (or thirteen miles above Edmonton). It has a twelve horse-power engine and is capable of raising gravel from a depth of about ten feet. Three men and a boy were employed, and the returns were stated to amount to from \$25 to \$40 worth of gold per diem. The gravel is said to average about 40 cents worth of gold to the cubic yard, without the very fine gold, which is known to be lost because of the comparatively imperfect construction of this small dredge. This dredge is stated to be paying well.

A much larger dredge, belonging to Loveland Brothers, was found at work in the channel south of Big Island. This is a well-constructed machine, with two twenty horse-power engines, one to actuate the bucket, the other to pump water for washing the gravels raised. It had just been completed, and some of the appliances were of a temporary character, and no records of work were available. About two miles above Edmonton, a small dredge belonging to Dr. Bowers was visited, but was not at work. Like those above described, it is a dipper dredge, but is provided with a truck drawn upon inclined rails to the stern, where the gravel is screened in a revolving perforated drum before washing.

Another dredge belonging to Mr. Braithwaite, was lying at the bank of the river near Edmonton. This is provided with a small engine for pumping water. It has two longitudinal wells in the hull, in each of which a bucket or scoop attached to a beam is operated. Another dredge, belonging to Mr. Brindley, lay not far from the last, but is still simpler in construction. It is said to produce about \$10 worth of gold a day when at work, but had lately been employed in connection with the foundations of the piers of the bridge under construction. There are also several small hand dredges of primitive construction employed by miners at various places along the river, not specially noted.

All the dredges above referred to are dipper dredges of varying construction. On the south side of the river, at Edmonton, a large new dredge, the first of several which it is intended to build, was approaching completion. This belongs to the Saskatchewan Gold and Platinum Proprietary, (limited), Mr. A. E. Hogue, general manager, and is in every way a great advance upon any dredge heretofore placed upon the river. It is to be provided with four engines, one to actuate an endless chain of buckets, one for the winches by means of which the dredge will be moved from place to place, and a couple to pump water to wash the gravel. It is intended to raise the gravel to a height of twenty-five feet above the deck, where, after the removal of the larger stones by a grizzly, it will be screened in revolving drums and the finer residue treated on blanket-covered Frue vanners placed on the after-part of the deck. This dredge was completed late in the autumn, but not in time to practically test it. Its working capacity is stated to be 3,100 cubic yards of gravel in twenty-four hours.

There appears to be no reason to doubt that satisfactory results, comparable with those achieved in a number of cases in New Zealand, may be obtained on several rivers in the North-West, and more particularly on the North Saskatchewan. Properly constructed dredges of adequate size and capacity will permit work to be carried on continuously during about half the year. It is to be remembered that such dredges enable the working not only of the bars and bed of the river, but also of the adjacent river-flats, where these do not possess a greater and more permanent value for agricultural occupation. Many of these flats are known to be underlain by auriferous gravels which have never yet been touched.

CROW'S NEST PASS COAL FIELDS.

Fernie Station, on the Crow Nest Pass Railway, is situated in the Elk River valley where Coal Creek enters this valley from the east. A range of 100 coking ovens of approved type was in construction here at the time of my visit, early in September, and since then fifty of these ovens have been completed and the actual manufacture of coke has commenced by the Crow Nest Pass Company (limited). Houses for the miners have also been constructed at Fernie, and a town-site has been laid out. From Fernie, a spur line has been built up the valley of Coal Creek for about five miles, to the place at which the actual mining operations are in progress. Although bounded on both sides by mountains several thousand feet in height, the valley here opens out considerably, affording ample room for a large loading yard, as

well as for the construction of the necessary bins, screens and other appliances for handling the coal. Work upon these appliances was actively in progress when seen.

Here, under the immediate superintendence of W. Blakemore, the outcrops of the coal-seams have been uncovered and drifts have been run in on both the north and south sides of the valley. The beds here belong to the west side of the coal-basin and have an easterly dip at an angle of about twenty degrees. The principal seam opened on the north side of the valley, according to Mr. Blakemore, yields 5 feet 6 inches of workable coal, while that on the south side is about 6 feet thick. The relative stratigraphical position of these two seams has not been accurately determined, owing to landslides at the base of the mountain slopes, but it is believed that the seam on the south side (known as No. 2) is from 80 to 100 feet above the other, the intervening rocks being chiefly sandstones, but possibly, in accordance with Mr. Fernie's views, including a third and much thicker coal-seam. It is proposed to decide this point, at an early date, by further work.

The great value of this remarkable field is, in fact, now in a fair way to be realized, and from this time onward, continuous shipments of excellent coke will, no doubt, be made from it to the smelters and metalliferous mines of West and East Kootenay.

GOLD MINING IN THE KLONDIKE.

The following is from the notes of Messrs. R. G. McConnell and J. B. Tyrrell, who spent last summer in the Yukon:—

"The productive part of the Klondike Gold District, as at present known, covers an area of 1000 square miles, and is situated between the Klondike and Indian rivers, tributaries of the Yukon, and east of the latter river. The region is traversed by a multitude of streams, flowing for the most part in deep trough-like valleys, among the most important of which are Bonanza Creek, (with its rich tributary Eldorado), Bear, Hunker, Too Much Gold, and All Gold creeks, flowing into the Klondike; and Dominion, Sulphur and Quartz creeks, branches of Indian River. The larger creeks are separated by long ridges gashed by the smaller streams and terminating upwards in even slopes or lines of rounded hills. The general aspect of the district, viewed from one of the higher elevations, is hilly, owing to the fact that the main ridges and creeks radiate out in a general way from a central point known as the Dome. The main ridges rise above the valley from 1200 to 1500 feet, and in places are somewhat higher. The Dome, a name given to the prominent hill surmounting the ridge separating the tributaries of Indian River from the Klondike, and one of the highest points in the region, has an elevation above the Yukon River of about 3000 feet. East of the hilly region centring in the Dome, at a distance of eight to ten miles, is a wide plain drained by a branch of the Klondike, beyond which, and closing in the horizon, runs a high range of rugged peaks. The district, with the exception of the higher peaks and ridges and occasional flats along the streams, is covered with a fairly heavy forest growth, consisting principally of the white and black spruce, with some birch and poplar.

The approximate area of 1000 square miles, given above as the probable extent of the known gold-field, refers to the district traversed by the gold-bearing creeks, and not to the actual area of pay gravels. The latter are confined to the bottoms of a few of the valleys and the lower slopes of the adjoining ridges, and occupy a much smaller area. The rich creeks, so far, are only four in number, viz.: Eldorado, Bonanza, Hunker and Dominion, and by far the greater proportion of the remarkable yield of the last two years has come from Eldorado and Bonanza. The proved portions of the four producing creeks have an aggregate length of about thirty miles. A number of tributaries of the producing creeks, and other streams such as Bear, Sulphur, Too Much Gold, All Gold and many more, have yielded small amounts, and it is confidently expected that the prospecting work now in progress will result in large additions to the producing area.

The gold occurs in the gravels flooring the bottoms of the valleys, in stream-terraces lining the lower slopes of the valleys and in a remarkable moraine or glacial deposit that occurs along the southern slopes of Eldorado and Bonanza creeks for some miles, and was also found north of the latter creek for some distance above its junction with Eldorado.

The stream-terraces are very uniform in character throughout the district. They consist mainly of flattened sub-angular schist pebbles, ranging in size from small scales up to rounded or elliptical plates a foot or more in width, coarse round pebbles and boulders of quartz and occasional layers of clayey vegetable mould. The gravels rest on a slightly irregular floor of decomposed mica-schist and quartz-schist. They have a thickness of from two to eight feet and a width along the most productive portions of Eldorado and Bonanza creeks of from one hundred to four hundred feet. They extend across the valley-bottoms and increase in width with the gradual enlargement of the latter towards their mouths.

"The gravels are overlain in all cases by a layer of black argillaceous vegetable matter of three feet or more in thickness.

"The gravels are everywhere more or less auriferous, but, as in other placer camps, the concentration is very irregular, and the gold increases in quantity towards the bottom of the section, the greater part of the pay being found usually within eighteen inches or two feet of bed-rock. A considerable portion of the gold is also found in the soft decomposed and shattered country-rock on which the gravels rest, into which it has sunk often to a depth of two feet. The pay-streaks range in width from a few feet to a hundred feet or more. They are interrupted along the length of the creek by comparatively barren stretches, and in places more than one pay-streak is found in prospecting across the rocky bottom. The minimum richness of the gravels considered as 'pay' by the miners, on an average claim, is given at about \$5 to the cubic yard, but varied according to different informants from \$4 to \$7.

"The bench-terraces are of less importance than the stream-terraces and so far are only worked to an inconsiderable extent along Bonanza and the lower part of Eldorado Creek. The benches only occur at intervals along the sides of the valley and as a rule are rock-cut and not built up by stream deposits. They are found at varying heights up to an elevation of seventy-five feet or more above the bottom of the valley.

"In ascending Bonanza Creek the first bench claims were found opposite No. 60, below Discovery, on the south side of the valley. The bench has an elevation of seventy-five feet above the bottom of the valley and consists of sixty-seven feet of schists of various kinds terminating upwards in a flat surface and overlain by eight feet of gravels. The bench is wide, as it occurs on a projecting point, but does not extend far along the valley. The gravels are mixed with sand and consist of flat and sub-angular pebbles of schist often a foot or more across and rounder quartz pebbles. The gold is fine, but nuggets up to a value of a \$1.35 are reported to have been found. The average yield of the gravels is stated to vary from 5 cents to 20 cents to the pan. Several bench claims similar in character to the one just described, but at lower elevations, were being worked further up on Bonanza Creek and on the lower part of Eldorado. On Hunker Creek, only one claim of the kind was being worked at the time of our visit, and on Dominion Creek none were in operation.

"Hill claims, situated on the moraines mentioned above as occurring along Bonanza and Eldorado creeks, are being extensively worked and in some cases have proved extremely rich. The moraines are situated at an elevation of from 150 to 200 feet above the bottom of the valley, have a width of from 200 to 300 feet or more and a thickness in the centre of 50 feet or more. The most productive claims occur along the lowest edge of the deposit and are worked by open cuts. The gravels are washed in rockers as the water supply is insufficient for sluicing. The morainic material is auriferous throughout, but the greater part of the gold is found at or near the sloping surface of the bed-rock at the bottom of a bed of coarse gravel, which consists of rock-flour, sand, pebbles and boulders. The gold, which is often in large nuggets, usually includes much quartz, and is rough and unrounded.

"Conditions of working.—As stated above, the stream deposits consist of beds of gravel varying from two or three to fifteen or twenty feet in thickness, overlain by a mass of vegetable material, locally known as 'muck,' from four to eight feet or more in thickness. This muck is chiefly sphagnum bog, or peat, which has suffered little decay since it grew where it now rests. Both the peat and the gravel are permanently frozen, and as the peat is an excellent non-conductor of heat, the gravel continues frozen as long as it remains covered by even a thin coating of peat.

"After the prospector has found indications favourable enough to induce him to stake off a claim, he can readily prospect it thoroughly in winter by building a fire on the surface, removing the thawed earth, building another fire on the same spot, again removing the ground that has been thawed, and so on down to bed-rock. The sides of the shaft so sunk remain firm and solid. In summer, however, it is difficult to sink a shaft in this way, as the sides are likely to cave in, so that prospectors then build a fire upon the open ground, heat stones very hot and throw them down the shaft, covering them with brush or anything else that will prevent the heat from ascending. These stones will, in a night, thaw the ground to a depth of from 6 to 9 inches. This thawed ground is taken out, and the process is repeated until bed-rock is reached. If pay gravel is struck it may be thawed and removed from around the bottom of the shaft until a large circular 'room' is formed in the gravel. The gravel raised is afterwards sluiced, and the gold extracted from it.

"The most economic method of working creek claims is by open cuts. The barren muck overlying the gravels is got rid of early in the season by the simple device of damming up the stream and leading it by several channels across the claim. The frozen muck dissolves readily and is usually completely removed by the stream in the course of a few weeks. The underlying auriferous gravels, as they become gradually thawed out and loosened by the sun and the various atmospheric agencies are shovelled into sluice boxes and washed in the ordinary way. When the surface is kept clean thawing proceeds at the rate of from two to four inches a day and bed rock is reached before the season closes.

"On the dry benches in the northern part of the Yukon district, the ground was found not to be frozen in summer, and probably some of the drier and more open tracks in the Klondike district are not permanently frozen.

"On the hill-sides, as well as in the bottoms of many of the valleys, there are large quantities of earth and gravel that are too poor to admit of being worked by the ordinary method of sluicing or rocking now in use, and to yield good results will require to be worked on a larger scale and by more economical methods.

"The clays and gravels when exposed in summer in the creek beds and on the hill-sides, thaw very quickly leaving them loose and friable and in a favourable condition to be acted on by water. The available water in the Klondike creeks is however too limited for work on a large scale and the problem of obtaining a supply from other sources has not yet been solved. The grade of the Klondike River is fairly steep and it is possible that water might be flumed from it. This could only be done at a great cost, as the river would have to be tapped far up. The gravels are, however, exceptionally rich even in many portions of the creeks too lean to pay by present methods of working and would justify a heavy expenditure in their exploitation.

"To install extensive plants either for hydraulicing and sluicing blocks of ground, large sum of money will be needed, and in order to encourage the influx of this capital into the country it will be necessary to offer every facility to investors. It should thus be not only possible but reasonably easy for them to consolidate groups of claims or to obtain blocks of land of sufficient size to make it probable that they would receive a fair return for their investment, especially in the case of lands not sufficiently rich to be profitably worked by hand.

MINING IN THE SLOCAN.

Mr. R. W. Brock, writes:—

"The past year has proved to be a prosperous one in the Slocan district, contrary to expectations in the early part of the season, when the Klondike excitement, together with depressed markets, threatened to retard its development. Increases in the prices of silver and lead had a stimulating effect, so that at the time of my visit, substantial if unostentatious progress was steadily being made. The development work, both in the prospects and mines, has proved very encouraging. That in the lower workings of the large mines has been particularly reassuring to those who entertained misgivings as to the permanency of the Slocan leads, for the depth gained on the Payne, Last Chance and other properties has exposed large bodies of high-grade ore, and has demonstrated the continuancy of the ore-bodies. This permanency was to be expected, such producers as the Ruth, Slocan Star and others, at comparatively low altitudes, showing that mineralization on a grand scale extended to horizons well down towards the bottoms of the valleys. That the majority of the best known mines should be located near the crests of the mountains, is to be accounted for by the fact that prospecting is there remarkably facilitated by the absence of superficial deposits and forest vegetation.

"The Payne has maintained or increased its large and steady shipments of ore, and its payment of excellent dividends. The lowest workings are now 700 or 800 feet below the upper tunnel, and the longest tunnel is about 1200 feet. The Ruth, which passed last year into the control of an English company, has, under the new management, taken a place second only to the Payne as a producer. The Slocan Star is working steadily, maintaining its reputation as a dividend payer. Concentrating ore was being taken out at the time of my visit, but a large quantity of clean ore was blocked out ready for mining during the winter months, when lack of water makes it advisable to shut down the concentrator.

"At the Last Chance, some shipping was in progress, but until the tramway shall be completed, development work is that which is chiefly receiving attention. Large quantities of high-grade ore are ready to be taken out, and it is expected that as soon as the facilities for shipping are perfected this mine will rank with the heaviest producers.

"On the Noble Five, under the new management, attention has also been turned to development. This appears to be progressing favourably, and it may be expected that regular shipments from this property will soon be resumed. The Wonderful,

Sovereign, Treasure Vault, Ajax and numerous other properties in the vicinity of Sandon have also produced more or less ore.

"In the Idaho Basin, the larger mines are working vigorously. The Queen Bess, now owned by the Queen Bess Proprietary Company, England, has become one of the heavy shippers. The Idaho-Alamo group continues to turn out large quantities of ore. Very high grade ore is being mined in the Idaho, some of it containing a large percentage of native silver.

"Other mines besides these mentioned, in this and other parts of the district, are making favourable progress. The development work on a number of the prospects makes it probable that additions will be made to the list of shipping mines, and a number of new locations of considerable promise are recorded, so that, at present, the mining status of the Slocan is regarded as more satisfactory than at any previous time in its history."

GALENA AND NICKEL MINING IN QUEBEC.

Dr. R. W. Ells reports:—

"The most important mining developments along the lower Ottawa, at present, are on Calumet Island. Here the old workings on the Lawn property, near the east end of the island, on blende and galena deposits, have been extended, and development work is now carried on over three lots on range IV. The containing rocks are largely dioritic, with some reddish granite, and these masses are intrusive through the grey gneiss and limestones. These latter are well exposed along the Roche Fenéu channel of the Ottawa on the south side of this island. The principal workings at present are on what is known as the Bowie property, where a large open cut has been made on an ore-body in the diorite, that carries both blende and galena. The ore-body is of considerable extent, but is pockety in its character, and no well-defined hanging or foot walls were seen, though the mass sends off spurs into the enclosing diorite. Over 1,000 tons of ore was mined at this place during the past summer, and the ore finds a ready sale in the European market. On the west part of the area a shaft has been sunk to a depth of nearly 130 feet, in order to cross-cut and intersect several masses of ore that appear at the surface in this vicinity, but work on this location was suspended during the season in order to fill orders from the Bowie pit. There is evidently a large quantity of mixed blende and galena ores in the intrusive rocks of this district, but in none of the openings examined was any well-defined vein structure noted, the ore everywhere appearing rather in pockety masses, though some of these are of large extent.

"About three miles to the north-west of this mining area, on lots 11 and 12, range IX., another interesting deposit of mineral has recently been opened on the property of Mr. E. P. Cowan. The ore here is different from that on the eastern end of the island, being mostly a pyrrhotite, which carries both nickel and cobalt. The associated rocks are diorites that cut a series of gray and rusty gneisses and crystalline limestones. A large knoll of the diorite rises to the south of the ore-bed, which has a thickness of about twelve feet, and between it and the diorite mass is a band of crystalline limestone. The ore itself is associated with another band of diorite that apparently traverses gray gneiss, the latter being seen beneath or to the north of the ore deposit. On the river a short distance to the south of this mine, the formation is mostly a crystalline limestone, and the intrusions of diorite and granite in this rock can be readily seen. The bed of pyrrhotite at the Cowan mine dips to the south at an angle of about 50°. A shaft has been sunk to a depth of about 40 feet and cross-cuts have been made to test the thickness of the deposit.

"Between this place and the Lawn property, there are several points at which mineral indications have been noted, but little attempt has as yet been made to ascertain their value.

EXTENSION OF THE SPRINGHILL COAL FIELD.

Mr. Hugh Fletcher who spent the most of the season in the Springhill coal field in the study of the faults and folds affecting the coal measures there succeeded in tracing, by means of bore holes and trial pits, the lowest seams worked at Springhill to a distance of more than two miles and a half beyond the point to which they had been proved by the late Mr. Scott Barlow and Mr. John Anderson.

IRON-ORE IN CAPE BRETON.

Mr. Fletcher also briefly describes the developments in an iron ore property at Whycocomagh, worked last season under direction of Mr. C. A. Meissner:

A tunnel driven into the west bank, high above the stream, cuts quartz and quartzite, succeeded by about seven feet of hard red hæmatite and rock in layers of from two to four inches in thickness, after which comes nine feet of ore, partly specular iron and partly hæmatite, with an occasional admixture of fine-grained magnetite. The average of this nine-foot band is said to be fifty per cent. of metallic iron. It contains about five-tenths per cent. of phosphorus, ten to fourteen per cent. of silica, and a variable quantity of sulphur. In the front of the vein a good deal of pyrite was found, while the back part which contains the solid ore has little sulphur. Another tunnel, eighty feet below the first, went through twenty feet of limestone, dark-green slaty rock eighty feet, then ten feet of dark quartzite; but, at last accounts had not cut the ore.

Other openings have been made in this mountain which exposed iron ores more or less promising.

GOLD MEASURES OF NOVA SCOTIA.

Mr. E. R. Faribault, as usual, contributes many interesting facts gathered from his study of the structural geology of the gold-bearing belt lying east of Halifax:—

"Waverley Gold District.—Three weeks were spent surveying this interesting and important district, and a plan on the scale of 250 feet to one inch was plotted in the field. The auriferous quartz veins, which have been worked from time to time since the first discovery of gold in 1861, are all interbedded between layers of 'whin' and slate on the crown of a huge anticlinal fold. The general course of the fold is N 80° E (mag.),* and its axis pitches westward at an angle varying from 10° to 35° from the horizon, while one length dips south, angle 25°, and the other north, angle 70°. Extensive denudation has worn away and truncated this enormous fold to a depth of over 12,000 feet, exposing a horizontal section of strata and intercalated auriferous veins which were formed 7000 feet below the base of the black slate group. The veins conforming with the strata, their outcrops have also a semi-elliptical shape, pointing westward and dipping north, west and south, like the saddle of the fold.

"The fault referred to above as following the Waverley chain of lakes, has greatly disturbed this anticlinal fold. The main dislocation runs up Lake William and Lake Thomas and passes immediately west of the short run uniting these two lakes. It causes a horizontal displacement of some 800 feet to the south on the east

* The magnetic variation in this part of Nova Scotia is about 21° 30' E.

side of the fault. The west fault runs up by the railway station and through Muddy Pond, and has been ascertained by Mr. A. A. Hayward, in the underground developments of the Lake View Mine, to give a shove of 118 feet to the south on the east side, and to dip east at the angle of 40°. Another line of disturbance was also located by surface trenching on the same property at the south-west cove of Lake Thomas, but the displacement does not appear to be extensive.

"The high dip at the north side of the fold being more favourable to the formation of large and permanent auriferous veins than the low dip of the south side, all the most valuable veins are found on that side. As far as present operations indicate, the pay-zone attains its maximum development immediately north of the anticline on the West Waverley and Lake View properties, where it is over 600 feet wide, and has been worked for a length of 7000 feet. Several leads have been operated along this pay-zone, to depths varying between 200 and 350 feet, on the above properties, and most of them have given good returns to that depth, while a few, especially the most northerly, were found to decrease in size and value. A shaft sunk 628 feet on the dip of the Dominion lead, showed the vein to decrease from fifteen inches on the surface to a mere film of quartz with small lenticular pockets at the depth of 500 feet. A close study of the structure of the anticlinal fold shows that this diminution of the veins in size and value is attained when the northern limit of the pay-zone is reached. In this district the axis-plane of the fold forms the southern limit of the pay-zone and it dips south at an angle of 69° from the horizon, while the interbedded veins dip to the north at an angle averaging 70°, giving a diverging angle of 41° between the two planes; so that a cross-cut driven south from the bottom of the 628 foot shaft on the Dominion lead would reach the anticlinal axis at some 650 feet and should develop a large belt of veins in the auriferous zone, many of which do not crop at the surface. A cross-tunnel driven south from the 360 foot shaft on No. 6 lead, on the Lake View property, would likewise develop a belt of auriferous veins in the richest part of the pay-zone. On the West Waverley property, at the depth of 225 feet, a cross-tunnel was driven south 641 feet from the Brody lead to the anticline, cutting ten leads, two of which do not crop at the present surface.

"A considerable length of this auriferous-zone is still undeveloped, between the Lake View mine and the Laidlaw Hill property at the east end of the district, the disturbed condition of the strata having hindered, to some degree, any important operations.

"A valuable and interesting 'barrel-quartz' vein was worked extensively some years ago around the crown of the anticlinal dome on Laidlaw Hill. It was operated as deep as could possibly be expected from individual effort, and gave very good returns. A company has lately consolidated these small properties, has driven a tunnel 670 feet long, from the level of Lake Charles, cutting the barrel-quartz vein at the apex of the saddle, along which levels have been driven around the dome, 434 feet on its north dip and 238 feet on its south dip. The present developments prove the auriferous value of the vein to that level and for some distance lower, and show that the pay-zone at the extreme east end of the district is confined to the arch-core of the fold, upon which other auriferous veins certainly occur to much greater depth.

"The total yield of the Waverley gold district, taken from Dr. Gilpin's report on the 'Ores of Nova Scotia,' published this year by the Department of Mines of the province, is, up to date, 61,308 ounces, from 122,346 tons of quartz, valued at \$1,200,000, or an average of \$9.81 per ton.

"*Montague Gold District.*—Two weeks were spent in a survey of this important district, and a plan on the scale of 250 feet to an inch was partly completed in the field. All the veins operated in the district follow the stratification in the same manner as at Waverley, and are situated along an anticlinal fold that runs N. 78° E., and pitches east at an angle of 8°, on area 781 of the original block, and to the west at a very low angle, at the north end of area 951 in the same block, forming a long and narrow elliptical dome. The strata lie at a low angle for some distance on both sides of the saddle, the dip increasing gradually till it meets the perpendicular 1000 feet south of the axis, and reaches 70° at a distance of 1250 feet to the north of it, the axis-plane of the fold dipping north at an angle of about 80°.

"As far as present developments indicate, all the more important veins are found on the south dip, where they form, at the middle of the district, a pay-zone about 600 feet wide, the northern limit of which is about 500 feet south of the axis. The plan of the district is not sufficiently completed yet to report conclusively on it. A few words, however, may be said of the important pay-streaks which have been worked so extensively on the Lawson lead to a depth of 313 feet, on the Annand lead 250 feet with a trial-shaft 400 feet deep, on the Twin lead 150 feet, and on the Rose lead to a depth of 270 feet with a shaft 388 feet deep. These rich pay-streaks are situated along an imaginary line running almost parallel with the anticlinal axis and they are characterised by enlargements and enrichments of the veins dipping to the west at low angles. Although there is reason to believe that the limit of the pay-zone has not been reached on the above-mentioned leads, at the depths to which they have been worked, it is probable that in some of them the limit of the high-grade ore is near at hand. For the zone of rich streaks appears to be narrow, and as it is parallel with the axis-plane, it dips to the north at an angle of 80°, whereas the dip of the veins is to the south, angle about 80°, so that the two planes would give a diverging angle of 20°, and so limiting the length of the pay-streaks on individual veins. Thus, to keep in the pay-zone it becomes necessary to cross-cut north when the limit of the pay-streaks has been reached, and new veins will in this way be developed which might be barren or wanting on the surface.

"The Golden Group Company has lately acquired the Lawson, DeWolf and Rose properties; the plant and mill have been remodelled to handle with economy large quantities of ore; and, if the developments are carried on in the direction outlined above and the auriferous zone is systematically blocked out, there is every reason to believe that the large returns obtained in former years will again be realized, and a new system will be inaugurated which may do much to solve the problem of deep and permanent gold mining in Nova Scotia.

"Important leads are also being operated on the old Symonds-Kaye property at the south-west end of the district, which is characterized by angular veins intersecting the interstratified veins and giving rise to rich pay-chutes at their junctions. The undeveloped ground on the northern part of this property and immediately west of the Lawson, is certainly promising, and should be prospected.

"A few veins have been opened on the north side of the anticline, but developments have not yet been sufficient to locate the pay-zone; the field is, however, promising.

"No fault of any importance has disturbed the structure of the fold. One cutting the strata at right angle on the south dip, opposite the middle of the dome, gives a maximum displacement of forty feet, measured horizontally at the Lawson lead, and a few parallel slide-faults have been met with in the workings of the Skerry, Rose and other leads. The outcrops almost coincide with that of the strata, and they dip south at low angles, the top part having moved upward and northward.

"The total yield of the district to date is 39,071 ounces, valued at \$742,349, from 22,652 tons of quartz, or an average of \$32.77 per ton, the highest average of any district in the province.

"*Lawrencetown Gold District.*—Two weeks were employed surveying this district, and a plan on the scale of 500 feet to one inch was partly completed in the field. All the auriferous quartz veins developed some years ago, but not worked lately, belong, as in the above two districts, to the interbedded class and are included in an area nearly half a mile wide and over one mile long. The remarkable width of auriferous ground is due to the presence of two anticlinal folds, converging as they approach this district from the east. The immense strain and pressure accompanying the meeting of these two folds have developed, as at the Moose River district, fissures along the bedding planes which have eventually been filled by segregations, producing the auriferous veins which have been brought to view afterwards by extensive denudation and are now being worked.

"The anticlinal folds have a general east-and-west course and are 1800 feet apart at the foot of Echo Lake. The most northerly crosses the lake 1600 feet north of the Mill stream outlet and the other crosses that stream 200 feet below the outlet. The syncline between these two anticlines runs down Echo River to the dam, coalescing towards the west with the southern anticline and terminating on the Shanghai property. All the openings on the east bank of Partridge River are situated on the opposite sides of this syncline, while on the Shanghai property they are on the north limb of the syncline, with the exception of those at the western end of the Bennett lead, which are on the south dip of the southern anticline. The operations along this double fold have established the presence of a rich pay-zone, which will certainly prove valuable when systematically developed with a proper knowledge of the structure of the strata. As depth is attained on the Wadlow belt, cross-cutting north will have to be done, to keep to the north of the synclinal trough and new veins will then be developed in a promising part of the pay-zone.

"Several veins have also been worked for a distance of 2,000 feet to the south of the double fold, some of which have given streaks of very high-grade ore; but none of them have been worked to any depth.

"A few small veins have also been tested on the north side of the north anticline, but heavy drift has prevented prospecting along this promising axis.

"One main fault has been located running down Partridge River in a south-east direction to the Lawrencetown Lake, with a horizontal shove to the south of some 200 feet, on the east side of the line; and two other right-hand faults were established to the west, parallel with it, with displacements of about 90 and 17 feet respectively.

"*Lake Catcha Gold District.*—Two weeks were devoted to a detailed survey of this district, discovered some twenty years ago, and a plan on the scale of 250 feet to an inch is in progress. All the more important veins operated belong to the interbedded class of fissure-veins and are situated on the north side of a broad anticlinal fold. The general course of the fold is N. 74° E. (*mag.*) It pitches to the east at an angle of 25° and to the west at a low angle, forming a long elliptical dome. The strata on the south side of the axis dip south at a low angle, increasing gradually to 45° at a distance of 500 feet to the south of it. The structure on the south dip does not appear to be favourable for the development of quartz veins. On the north side the dip increases more rapidly and reaches 80° at a distance of 500 feet. In the folding, the strata have been subjected to greater pressure on the north dip, producing fault-fissures along the bedding planes into which important auriferous veins have been segregated. Some of these veins, like the Coleman, Mill and Iron leads, have been traced for a length of over one mile. The greatest depth yet attained in the workings is 225 feet on the Mill lead at the Oxford mine. Rich streaks have, however, been worked on several veins along their outcrops, notably on the Coleman, Mill and Battery leads on the Oxford property, and on the Lake and Sheba leads on the John H. Anderson property. The late J. M. Reid, while in charge of the Oxford mine, kept many records and plans of the underground workings which should prove very valuable in directing further developments. He established three well defined rolls or pay-streaks in the works of the Coleman lead, lying under one another in undulations dipping at low angles in the plane of the vein. Some of these have not yet been worked out, and it would be desirable to sink deeper to find out if other rolls exist beneath.

"In looking over the plan of the district, we find that most of the best streaks on the Coleman, Mill, Battery, Lake and Sheba leads are situated along a well-defined zone. This zone leaves the anticlinal axis at the west end of the district, where rich drift has been discovered north-west of the Petite Mare bridge, on the Cogswell areas, and from there it runs N. 60° E. It therefore intersects the veins at an angle of 14°, until at the east end of the district it is found 1400 feet to the north of the axis. Much good ground is still undeveloped on the surface along this zone, on the Oxford, Anderson and Cogswell properties. In pushing the development work to greater depth, the dip of the pay-zone must be taken into consideration. The axis-plane of the fold dips to the south at an angle of 75°, and it is most probable that the pay-zone has the same dip to the south, so that cross-cutting south has to be done in this district, as depth is attained.

"Two interesting auriferous fissure-veins are being developed in the district; one, the Cooper vein, occurs 3000 feet north of the anticline at the north-west end of the district and cuts the stratification in a north-east direction in the manner of an 'angular,' following a layer of slate for a short distance eastward, then cuts across a certain thickness of strata to another layer of slate which it follows to leave it again, and so on. It varies much in size, reaching four feet in places, and appears to show gold and sulphides more freely along certain belts of slate. The other fissure-vein, the Cogswell 'angular,' also cuts the stratification in a north-east direction, at the east end of the pay-zone, and it is more auriferous at its intersections with interbedded veins.

"Several faults cut across the stratification and produce important displacements of the veins, often interfering with the progress of operations, but most of them have been accurately established by skilful developments. The most important is a right-hand fault on the Anderson property, running north-west and dipping south-west at an angle of 20°. The others are all high-angle breaks under forty feet, the eastern ones being left-hand breaks and the western ones right-hand breaks. However, there appears to be another prominent right-hand fault at the west end of the district, following La Petite Mare brook, the course of which is about N. 25° E., not yet exactly established, but important on account of the rich drift found on the undeveloped areas lying to the west of it. Total yield to October, 1898, is 23,153 oz. of gold from 21,140 tons of quartz.

"*Tangier Gold District.*—Eighteen days were devoted to a survey of this district, one of the first discovered and most important in the Province, and a plan on the scale of 200 feet to an inch is in course of preparation. All the veins operated belong to the interbedded class of fissure veins, and occur along the axis of the anticlinal fold furtherest south on the Atlantic coast. This fold is the western prolonga-

tion of that passing through the gold districts of Harrigan Cove, Moosehead and Ecum Secum; it has a general east-and-west (*mag.*) course, forms a long narrow elliptical dome and pitches to the east and west at angles under 15°. It dips to the north and south at angles reaching 70° on both sides, giving a perpendicular dip to the axis-plane.

"Auriferous veins have been developed extensively for a length of over two miles along this fold, the most important operations being confined to the veins on the south dip, along a narrow and well-defined pay-zone. This pay-zone touches the anticlinal axis at the centre of the dome, a couple of areas east of the original Free-claim area, where it has a width of some 200 feet, comprising the rich pay-streaks worked on the Big-south, Little-south, and Nugget leads to depths of 100 to 150 feet. From the centre of the dome the pay-zone runs east and west, keeping a few degrees to the south of the course of the anticlinal axis, and intersects the various leads at a slight angle, creating enlargements and richments on the veins which have successively been worked towards the west on the Nigger, Butler, Blue, Leary, Lake, Tennant, Field and Bingay leads, and towards the east on the Little-south, Nugget or Kent, Twin or Dunbrack, Forrest and Wallace leads.

"A few of these leads have been worked along their outcrops for nearly half a mile, but the greatest depths attained so far, are, only 240 feet on the Forrest, 160 feet on the Nuggett and Leary, 140 feet on the Big-south, and 130 feet on the Little-south and Field leads. Most of these veins can certainly be successfully worked to greater depths. Still the pay-zone does not appear to have a great width, being only 200 feet wide at the centre and not much wider to the east and west, and, as its dip is about vertical and the veins dip between 55° and 65° to the south, the southern limit of the pay-ground will be reached at no great depth, especially on the southerly veins. Cross-cutting north will then have to be done to keep in the pay-zone, and new veins will thus be developed at their richest parts to great depths.

"Most of the district was formerly held in small areas and operated by private individuals with limited means, but it has recently been consolidated under the management of one company, and we may look now for larger and more permanent operations. The attention of this company might be directed to the desirability of making developments by cross-cutting north from the deeper shafts on the Big-south, Little-south and Nugget leads in the vicinity of the Free-claim area. Likewise, cross-cutting north should be done from the deeper shafts on the Forrest lead on Strawberry Hill property. The Free-claim area may be mentioned as one of the most promising locations for a deep vertical shaft with a system of cross-cuts and levels, as it would develop veins which do not crop to the surface, in one of the richest part of the pay-zone.

"Very rich drift found south of the Essex mill has not yet been traced to its source. It should be looked for along the pay-zone to the north of the Dunbrack-lead.

"Only a few veins have so far been opened on the north dip, and none to any extent, but those immediately north of the axis at the centre of the dome, near the Free claim area, are certainly very promising.

"The structure of the anticlinal fold of this district has been more disturbed than that of any other in the province, by two important series of small faults which have a general north-west and south-east direction, and all dip at high angles. The eastern dislocation occurs on Strawberry Hill and is composed of a series of right-hand faults with horizontal shoves ranging from 76 feet down to a few feet, giving a total displacement of some 280 feet. The extensive operations made on the Forrest lead, have determined exactly the horizontal thrusts of every one of these breaks; but many rich pay-chutes, dipping west at angles of about 45°, have been lost by these faults and might yet be recovered by determining the extent of the upthrows.

"The western dislocation is composed of a series of left-hand faults beginning at the Essex mill, with horizontal displacements along a north-west and south-east course varying from a few feet up to 150 feet, and giving a total displacement of 470 feet. All these faults have been exactly determined by the important surface developments made by John Murphy and the late A. M. Barton, in their endeavour to locate leads to the west of the Essex mill, the drift of which was found very rich along the main road. The block of strata comprised between these two main dislocations has been thrust to the north by lateral pressure and contains the above mentioned promising veins not yet developed, which should be looked for along the pay-zone passing north of the Dunbrack lead.

"A dyke of diorite, 40 feet wide, the only one known in the gold districts of the province, cuts the strata and auriferous veins at right angles on Strawberry Hill and has been traced in a straight line for two miles to Grum Point on the sea-shore. The dyke does not affect the richness or size of the veins and does not appear to be auriferous. It has, however, altered the adjacent rock for a short distance on each side of it.

"The total returns of the district, including the Mooseland mines situated on the next anticline to the north, are, up to date 20,491 ounces, valued at \$721,183, from 43,092 tons of quartz.

"Cow Bay Gold District.—A hurried survey of this district has been made, but the plan has not yet been plotted.

"All the veins developed here are true fissure-veins running north-and-south and cutting the stratification at right angles with a vertical dip. A great number of them have already been opened, for a width of nearly four miles across the point of land stretching between the Eastern Passage of Halifax Harbour and Cole Harbour, and a few have been traced for over one thousand feet along their course, but none have yet been worked to any extent. The present developments prove that all these fissure-veins are more auriferous along a certain part of their course, corresponding with the crossing of a highly mineralized belt of gray felspathic quartzite about 100 feet wide, situated at the contact of the upper-slate group with the underlying whin group. Some layers are so heavily charged with specks of magnetic pyrites as to affect the needle of the compass. The strata of this mineralized belt dip to the south at an angle of 35° from the horizon, and the pay-chutes of the veins will necessarily dip to the south at the same low angle and ought to be developed on that incline to great depth. No doubt many of the failures met with in the present operations are due to the ignorance of this important fact."

Mining in Rossland Camp, 1898.

(FROM THE REPORT OF MR. JOHN KIRKUP, GOLD COMMISSIONER.)

LE ROI.

Superintendent, N. Tregar. Average number of men employed, 250. Shipments, 66,000 tons. Power plant—A 40-drill Rand air compressor, with three 100 h.p. boilers; a 300 h.p. two-drum, direct acting, steam hoist. Work done—150 feet shaft sinking; 2,350 feet drifts and cross-cuts; 280 feet raises and winzes.

This property passed into the control of the British America Corporation, November 22nd, when shipments were temporarily cut down from 400 to 200 tons per day, to permit of more development work being done and to get well in advance of stopping or ore extraction.

The mine is worked through an incline shaft, 850 feet deep, with two hoisting compartments, and now 200, 350, 500, 600 and 700-foot levels are being extended westward. The main ore chute is over 400 feet long, and 6 to 30 feet wide, and on the 700-foot level a large body of ore, 35 to 40 feet wide, and already shown to be 200 feet long, is being worked. Here on the hanging and foot-walls are wide bands of good grade ore, while nearly all the intervening material, although of lower grade, is sent to the smelter. The present shaft is being sunk to the 900-foot level, but at the west end of the property, or 1,000 feet from the inclined shaft, it is proposed to shortly begin the sinking of a large vertical shaft, equipped with heavy hoisting plant.

This Company possesses an excellent smelter plant, situated at Northport, capacity, 450 tons per day, which capacity may soon be doubled.

COLUMBIA AND KOOTENAY.

D. J. Macdonald, Superintendent. Number of men employed, 50. On this property about 4,700 feet of work, comprising drifts, cross-cuts, raises and winzes, has been done, of which, 3,200 feet is new work this year. There are now five tunnels, running into the mountain along the ledge, of which Nos. 3, 4, 5 and 6 are at present being advanced, the lower, or No. 6, being about 700 feet below the crest of the mountain and 400 feet above the bottom.

In these tunnels the vein is found to be very straight or with very few dislocations, and to vary in width from a few inches to over 30 feet of nearly solid pyrrhotite. Tunnels 3, 4, 5 and 6 are respectively 1,200, 800, 700 and 150 feet long, and are being connected by raises for ventilating and exploring purposes. Many cross-cuts are also being run, exposing large bodies of ore of varying value.

At the mine good and commodious buildings have been erected, and everything is now in excellent condition for work.

The twenty-drill Ingersoll-Sergeant air compressor supplies abundant power through a six-inch main, running up the hillside past the tunnels.

No shipments were made during the year.

GREAT WESTERN AND NICKEL PLATE.

Superintendent, W. S. Haskins. Number of men employed, 45. On the *Great Western* a two compartment shaft was sunk 230 feet, and drifting has been in progress along the vein at the 200-foot level. However, sinking has been resumed and the 300-foot level will be run out when that point is reached.

Since pumping out the *Nickel Plate* in April, work has been confined to the 200-foot level, where nearly 2,000 feet of drifting and cross-cutting has been done, disclosing two veins, 300 feet apart, 6 to 30 inches wide, of chalcopyrite-pyrrhotite ore, assaying from \$2 to \$22 in gold, and 3% to 12% copper.

A 10-drill Ingersoll-Sergeant with two 60 h.p. boilers, water jet condenser, etc., supplies compressed air for these two properties when 5 to 7 drills are working.

JOSIE AND NO. ONE.

Superintendent, Jno. M. Long. Number of men employed, 50. On the *Josie* work has been confined to extending the 300-foot level and its cross-cuts, and 1,250 feet of work is the result. To the east end a chute of good grade ore, as yet 50 feet long and 2 to 7 feet wide, is now being explored by a raise to the 100-foot level. In the west, two veins have been found by cross-cutting, and drifts are now being run along these.

On the *Number One* only two or three shallow pits had been sunk. A tunnel was begun and driven 450 feet, disclosing one ore chute nearly 200 feet long, 2 to 7 feet wide, of quartzose ore carrying gold, silver and copper, with values varying from \$6 to \$25 per ton. East of this point a vertical two-compartment shaft was sunk 220 feet, and at the 200-foot level a drift has just disclosed a wide ledge running east and west, with a good width of ore near the hanging wall. The west drift will be pushed under the ore chute found in the tunnel, and sinking will be at once resumed.

Power for these two properties is got from a four-inch main from the Le Roi compressor, and a steam hoisting plant is at each mine, where, eventually, electric hoists will probably be installed. Six drills have been at work, but soon ten to twelve will be running.

Total amount of work done—*Josie*, 1,250 feet; *Number One*, 700 feet; *Great Western*, 950; *Nickel Plate*, 2,400 feet; *Columbia and Kootenay*, 4,700.

WAR EAGLE.

J. B. Hastings, Superintendent and Engineer. Average number of men employed daily, 175. Shipments in 1898, 42,779 tons. Net value of same, \$496,395.71.

CENTRE STAR.

This mine was extensively developed under its previous owners. It was purchased by Messrs. Gooderham and Blackstock from the old owners for \$2,000,000 cash. The plant comprises a 7-drill compressor, with pumps, etc.

The management, since October 1st, has been in the hands of Mr. J. B. Hastings, of the *War Eagle*. A new shaft is being sunk on the south face of Red Mountain on the property. Seventy-two men were employed daily since October 1st to December 31st. The mine is to be supplied with a first-class, up-to-date plant, and thoroughly worked under Mr. Hastings' direction. About 2,600 tons of ore were shipped from the mine under the old management.

ENGLISH-CANADIAN COMPANY, LIMITED.

This Company, which has recently purchased the properties of the Fourteen Gold Mines Consolidated Company, consisting of a block of twenty-one claims, situated in the south belt, about two miles south of Rossland, has done development work to the extent of 90 feet of shafting on two of its properties, namely, the *Edna* and *J. & J.*, under the superintendency of Mr. M. A. Green.

BIG THREE GOLD MINING COMPANY.

William Yolen Williams, Superintendent. The property of this Company comprises the *Mascot*, *Southern Bell* and *Snow Shoe*. The *Mascot* is situated on Columbia Mountain, adjoining the *Columbia and Kootenay* mine. The *Southern Bell* and the *Snow Shoe* are situated on the north-eastern slope of Red Mountain. Development work on the *Mascot* comprises 575 feet of tunnelling and 300 feet of shafting and winzes.

The *Southern Bell* and *Snow Shoe* are being developed jointly. About 650 feet of tunnelling and 160 feet of sinking have been done. Number of men employed, 7. No ore has been shipped, though a considerable quantity has been mined. The pay streaks are small, but carry good values.

Heretofore, hand power has been used. Recently, machinery has been introduced, and comprises one standard, class B. belted Ingersoll-Sergeant 7-drill air compressor, supplied by James Cooper Manufacturing Co., Montreal; one 3-phase synchronous motor, 75 K.W., 900 revolutions, with a voltage of 2,080, furnished by the Canadian General Electric Company, of Toronto. The West Kootenay Power and Light Company furnishes the power.

Twelve men have been employed, but this is to be increased to twenty. Montreal capital is chiefly interested.

CANADIAN GOLD FIELDS, LIMITED.

J. C. Drewry, Managing Director. This group comprises the *Sunset No. 2*, *Gold Hunter* and *Alabama*. All are Crown-granted claims. From January 1st to November 30th, the average number of men employed was 21. The plant comprises a 7-drill Ingersoll-Sergeant air compressor, an 80 h.p. boiler, hoist, complement of pumps, etc.

Since the beginning of the year the development work done was tunnelling, 103 feet; sinking, 280 feet; drifting, 380 feet; cross-cutting, 360 feet; and other work making a total of 1,268 feet of underground work, in addition to a large amount of surface work. Pay ore has been struck on the 300 and 350-foot levels, and the chute is in course of development.

IRON MASK.

J. F. Herrick, Manager. Number of tons of ore shipped for 1898, 3,370. Net cash received from smelters, \$72,600. Power used, compressed air. Average number of daily employees, 32.

VIRGINIA.

The shaft is down 400 feet; drifts, 816 feet; total, 1,216 feet.

One ore-body 25 feet wide. Number of men employed, 24. Plant comprises one 35 h.p. hoist; two No. 5 Cameron pumps. Power is supplied by *Monte Christo* compressor. No ore shipments have been made.

MONTE CRISTO.

Development work comprises 2,160 feet of tunnelling, 300 feet of shafting, 190 feet of raising, 2,400 feet of drifting; total, 5,050 feet. One ore chute 7 feet wide.

The plant comprises one 15 h.p. hoist; one No. 6 Cameron pump; one 80 h.p. boiler, and one 7-drill compressor. Work is at present suspended.

IRON HORSE.

Development work consists of a double compartment shaft 4½ by 9 feet in the clear, and sunk perpendicularly to a depth of 50 feet. It is the intention of the management to sink to the 300-foot level, and a 7-drill air compressor has been installed for this purpose. A new shaft-house has been erected, 30 by 60 feet, and a blacksmith shop and powder-house; also a compressor building, 30 by 50 feet. About 24 men are on the pay roll.

IRON COLT.

J. Ferguson McCrae, Secretary-Treasurer. Development work consists of 1 shaft, 75 feet; No. 1 tunnel, 65 feet; No. 2 tunnel, which includes the right-of-way through the *Alberta* tunnel for 354 feet; making a total of 1,068 feet. There are four open cuts, from 10 to 30 feet long, and 5 to 10 feet deep. The drifts from No. 2 tunnel are 136 feet west, 27½ feet east, and No. 2, west 29 feet.

Ore-body in No. 1, west drift, from 3 to 35 feet wide. Eight to ten men were employed. Power is supplied by a 5-drill air compressor plant. Shaft-house, 20 by 40, with 26 feet gallows. Work was suspended since January 15th, 1898.

EVENING STAR.

The amount of development for the year 1898 consists of 260 feet of drifting, 85 feet in the upper tunnel and 175 feet in the lower tunnel. Two shifts, of two men each, are employed, working by hand. A new ore-body, about 4 feet wide and 20 feet long, as far as drifted on, was encountered in the upper tunnel; the ore averaged some \$24 per ton in gold. After encountering this ore-body, drifting was begun in lower tunnel some 60 feet below to cut the same ore-body, which it is expected to do very shortly, as the present face is nearing the calculated position of the ore-body as met with in the upper tunnel. This work is being carried on under the superintendency of Roy H. Clarke.

ATLANTIC CABLE.

Development work comprises 27½ feet of a shaft, well timbered; 55 feet of shaft straightened and re-timbered; total, 82½ feet. Also 122 feet of cross-cuts and drifts driven at the 100 and 200-foot levels. The power is supplied by a California horse whim. An average of 4 men has been the working force, but work was suspended at the date of the report.

DEER PARK.

Roy H. Clarke, Engineer-in-charge. The amount of development on this property for the year 1898 consists of 112 feet of sinking, making the vertical shaft 305 feet deep, and 300 feet of drifting, as follows:—173 feet on the 200-foot level (including a winze 22 feet deep), 97 feet on the 100-foot level, and 20 feet on the 150-foot level.

The shaft was sunk in ledge matter the entire distance, encountering in the year's development two pay-ore bodies, the first 5 feet wide and the second 2 feet wide, below the 200-foot level. Drifting on the 200-foot level showed considerable low grade ore, but was important chiefly as determining the course of the ledge.

The most important work was begun about November 1st, after the installation of a 7-drill compressor plant, 80 h.p. boiler, and two air drills, costing \$6,500. The ore-body on the 100-foot level, already opened up by a cross-cut 35 feet long, was further opened up by a drift to the north, 40 feet long, and the cross-cut was continued 35 feet west. The ore-body on this level was found to be about 20 feet wide, with high grade streaks in this body 2 feet wide, and extended north about 30 feet, and southerly to an extent as yet unknown, the whole averaging about \$18 per ton. The same ore-body is now being encountered on the 150-foot level. The mine employs 15 men.

GOOD FRIDAY.

During the year 1898, the following work was done:—Tunnel No. 1, 238 feet; tunnel No. 2, 245 feet; tunnel No. 3, 98 feet; tunnel No. 4, 160 feet; tunnel No.

5, 37 feet; tunnel No. 6, 28 feet; total, 806 feet. Shaft No. 1, 18 feet; shaft No. 2, 31 feet; shaft No. 3, 35 feet; total, 84 feet.

There are 950 feet of surface cross-cuts, three-quarters of a mile of trail, and two log buildings. Number of employees, from 25 to 45. Large ore-bodies of varying grades have been encountered on the surface. Neither tunnel is far enough advanced to reach the ore-bodies or cross-cut the leads at the depth. Average cost of tunnelling, \$16 per foot; sinking shaft, \$22.

GREEN MOUNTAIN CLAIMS.

This property has been opened up by cross-cuts in seven or eight different places across the entire length of the claims. Development work comprises one tunnel, 35 feet; 1 tunnel, 65 feet; 1 shaft, 80 feet deep. A steam plant has been installed and a good machinery and shaft-house erected, also a good cook and bunk-house, 60 by 20.

GIANT.

This property is situated on the west flank of Red Mountain. Development work comprises No. 1 shaft, 65 feet; No. 2 shaft, 115 feet; and tunnel, 125 feet. The ore showing is good. There are at least two distinct leads on the property. During the past summer 114 tons of ore were shipped from the *Giant*, which averaged \$17 per ton. Up to November 30th, 15 men were employed. Operations are suspended for the winter.

NOVELTY.

This property adjoins the *Giant* on the east. The shaft is down 40 feet. Tunnel No. 1 is in 45 feet, and tunnel No. 2, 160 feet. The ledge is 35 feet wide. A shallow cross-cut has been made. Six men were at work at the date of the report.

ABE LINCOLN.

W. T. McDonald, Superintendent. The shaft is down 197½ feet, with a cross-cut of 18 feet. Five stringers of pay ore have been encountered in the workings. Number of men employed, 7. The power is supplied by a horse whim.

GRAND PRIZE.

Two shafts of 25 and 38 feet, respectively, have been sunk on this property. Number of men employed, 3. It is intended to use a horse whim in deepening.

LILY MAY.

W. J. Harris, Manager. Work was begun November 1st. Up to the date of the report, the shaft was deepened 20 feet. It is now down 125 feet and in ore all the way. The report states that the bottom of the shaft is now looking better than at any time during the history of the mine. The ownership will be transferred to the new English-Canadian Company, on February 1st, 1899, and the necessary capital for the steady development of the mine is being furnished.

The plant comprises an 80 h.p. boiler, a 5-drill compressor, two machine drills, a blacksmith shop, shaft-house, machine-shop, boarding and bunk-house. No. of men employed, 9. Total amount of development work, 485 feet.

HOMESTAKE.

T. H. Bain, superintendent. This property is situated on the east side of Trail Creek, and is contiguous to the *Sunset No. 2*. Area, 21.3 acres. The main shaft is 10 x 6, 160 feet deep. The prospecting drift, 4 x 5, is 50 feet deep. The drift which connects the shaft is 75 feet long. A number of surface cuts have been made, and the ledge is exposed for 700 feet. Number of men employed, 13. The plant comprises a 5-drill compressor, 80 h.p. boiler and hoist.

COMMANDER.

W. J. Harris, manager. Development work was commenced in August, 1898, and since then the shaft has been sunk 100 feet without encountering solid ore. The shaft, however, runs through mixed ore, and is down 280 feet, but no shipments of ore have been made. The power is supplied by a 60 h.p. boiler, and there are one 3-drill compressor, 2 power machines, a blacksmith shop, a shaft-house, bunk-house and boarding-house, and lodging-house, etc. The total work done is 875 feet. Drifting will begin at the 300-foot level. Number of men employed, 13.

VELVET.

John L. Morrish, manager. Development work comprises 4 drives, 4 winzes, shaft and tunnel. The north drive, at the 100-foot level, is driven 222 feet; the south drive, at the same level, 145 feet. The north drive, at the 160-foot level, is driven 151 feet; the south is driven 160 feet at the 70-foot level. No. 1 winze, at the south of the shaft, is sunk from the surface 100 feet; No. 2 winze, north of shaft, is down from the surface 100 feet; No. 3 winze, north of shaft, is down 60 feet from the 100-foot level; No. 4 winze, north of the shaft, is sunk from the 100-foot level 60 feet. Depth of shaft, 210 feet. The distance driven in tunnel is 54 feet. The shaft was sunk through ore from the surface to the 160-foot level. Ore was also encountered in the drives and winzes. Number of men employed, 28. Plant comprises 25 h.p. boiler and hoist. No market shipments of ore have yet been made.

SANTA ROSA GROUP.

Development work comprises:—1 cross-cut tunnel, 406 feet; 1 drift, 35 feet; 1 open cut, 16 feet; 1 open cut, 12 feet; 1 shaft and open cut, 20 feet; 1 open cut, 4 feet; 1 open cut, 6 feet; 1 shaft and open cut, 6 feet; 1 open cut, 10 feet.

No. 1 tunnel cuts the outcrop of a considerable lead about 40 feet wide, consisting of magnetic iron and copper pyrites, and is cut through almost its entire length, and is heavily mineralized. No. 2 tunnel is driven on a lead of decomposed ore, near a syenite and porphyry contact. Tunnels Nos. 3 and 4 open on the lead at a depth of 290 feet. Tunnel No. 6 opens on quartz syenite, and is free milling. No. 7 opens up a lead of galena, with carbonates. Nos. 8 and 9 are similar to 4 and 5. No. 10 tunnel opens up a lead 4 feet wide of magnetic iron, with solid pyrites and well defined. Number of men employed, 6. No plant in use.

WANETA AND TRAIL CREEK GOLD MINING COMPANY.

This group comprises the *Copper Bell*, *Copper*, and *Copper Glance*. Area, 140 acres, all Crown-granted. Development consists of one tunnel 25 feet, one winze 20 feet, one shaft 28 feet. The vein contains copper and galena. No machinery in use.

FROM THE SLOCAN.

Like a bolt from the blue came the announcement that the Provincial Government had decided to enforce the eight-hour law with respect to underground workers on the 12th of June. While no definite understanding had previously been reached, it was generally considered that the opposition to the amendment was so strong, that it would be quietly dropped at the first convenient opportunity. Now all this is changed, and unless the miners or their representatives can be brought to view the matter in the light of reason, the prospects for a disastrous and protracted labour struggle are not to be envied. On the principle of "let well alone" the action of the Legislature is universally condemned by those who desire to see the country live up to the growing reputation which it is acquiring in the financial centres of the world. One result, detrimental alike to all, has already been attained in the continued non-operation of several properties which would otherwise be employing large forces, and unless some amicable arrangement is come to whereby the men agree to accept a decrease in wages commensurate with that in the hours of labour, serious trouble is threatened; as the mine-owners are a unit in their determination to close the mines rather than submit to dictation at the hands of the union. This very drastic amendment, which was brought in by the member for Rossland and passed almost without comment, appears to have met with little opposition in that district, but in Nelson and the Slocan where conditions are essentially different it is extremely unpopular and is being vigorously opposed by capital of all kinds and the better class of labour, who would rather work ten hours for \$3.50 than run the risk of getting only \$3.00 for an eight hour shift. What the ultimate outcome will be it is impossible to predict. The mine-owners and managers are firm in their conviction not to pay more than the latter sum, while the majority of the miners have expressed themselves through their union as equally determined not to recede from the position which they have assumed in the matter. We shall know more definitely of course next month, but in the meantime it may not be out of place to remind the union that whatever happens *Cœur D'Alene* tactics will not be allowed to prevail in West Kootenay.

To the self-respecting resident of these parts, the report of the Minister of Mines for 1898 does not make any too congenial reading. That the Slocan still retains its position at the head of producing districts, being still \$150,000 in advance of its nearest rival, is doubtless cause for congratulation, but a falling off of over \$600,000 from the amount reached in 1897 cannot be attributed wholly to the lower price for silver which prevailed and the increase in the lead duty, although a large proportion of the shrinkage in values must obviously be due to these two factors, the average grade of the ore being well maintained in the neighbourhood of a hundred ounces in silver and fifty per cent. lead, showing that it is not yet possible to mine and ship lower grade ore at a profit except in the form of concentrates. Statistics however go to show that there was actually three thousand tons less produced than in the preceding year, a falling off in tonnage of ten per cent. To what then must we attribute this? To the giving out of the ore-bodies? Certainly not, because they are showing up better and stronger in almost every instance and never presented such a healthy appearance as they do to-day. No; the real explanation why the Slocan did not show a gain in place of a decrease last year was owing to the unnatural excitement in the Klondyke, which completely paralysed the efforts of promoters and diverted to the frozen north much of the capital originally intended for West Kootenay.

We are only now beginning to reap the benefits of the reaction which afterward set in, and barring unforeseen circumstances such as the possibilities of a calamitous strike, we are safe in predicting a substantial increase in the total for 1899.

Montreal capitalists appear to be getting quite active, as they have recently taken hold of the Sovereign in addition to the Payne, and from all indications intend to push it at once to the front rank.

Another prominent property, the Enterprise, so long inactive has found a purchaser in the London and B.C. Gold Fields, renowned for conservative management and the adoption of thorough business methods. I am not saying too much I hope in expressing the belief that they will here repeat the story of success which has been theirs in the past. One thing is certain, and that is that operations will not commence until a settlement is effected with regard to the conditions which shall govern the miners' eight-hour day, as this company, while one of the strongest financially and most successful in its operations, was foremost in its opposition to the passage of the eight hour law.

The oft-boomed project of a sampler at Rosebery, a really admirable site in its way, has received its death blow by the erection of a similar plant at Nelson, which will be fully capable of handling such of the Slocan ore as does not find its way to Kaslo. The many advantages which works of this nature offer, more especially to small shippers, whose number is now on the increase, are thoroughly understood and need no recapitulation, it is enough to remark that the plant in question will be ready for operation, all being well, early next month, sufficient ore having already been acquired to keep it going for some time.

Coming after an unusually severe winter, this is by all odds the most backward spring experienced in these parts for many years, the result being that work is delayed on many properties which ought by this time to be in full swing. The snow disappears very slowly, and in a few weeks of really hot weather may have a disastrous effect on the condition of the creeks and waterways, a repetition of the floods of 1894 being quite within the bounds of possibility. The most serious aspect of the situation however, is the short time which will be available for prospecting, as the higher altitudes will hardly under present conditions be free of snow until well on in July, leaving three months only for surface investigation and the completion of assessments; a time manifestly insufficient.

The Arlington, erst-while prominent on account of the quantities of native silver disseminated through the vein, occasionally in the form of slabs of considerable size, is to be re-started under new management as soon as the condition of the ground will admit of operations being carried on. All interested in the dry-ore belt are confident that this property needs only a fair opportunity to demonstrate its capabilities, in order to rank among the really first class mines of the Province. This then is evidently its chance to prove its worth and redeem its past record at the same time.

It has been a source of satisfaction as well as profit to mine-owners here to observe the recent increase in the price of silver. It would hardly be correct to say that it is regarded in the light of a fore-taste of better things to come, although this might have been true at one time; now however, it is generally recognized that the limit is about reached when the price climbs to sixty-three or four. The cause of the upward movement is unknown, but is generally attributed to the formation of the powerful smelting trust on the other side.

The Slocan is commencing to show up in a new light. According to the Minister of Mines Report, there were some sixty ounces of gold credited to this district last year, the bulk of which I presume came from the Monitor Mine at Three Forks, which is the only wet proposition showing returns of this nature; the remainder, and I am inclined to think a good deal beside which is not recorded in the statistics, coming

from the quartz leads. Next year it will likely be in order to include the value of zinc production along with the others. The Bosun—more as an experiment than anything else—recently shipped twenty tons of fifty per cent. ore direct to London, the supposition being that it would be treated directly for the extraction of the zinc, as being the more valuable constituent, the residue consisting of oxides of iron and insoluble matter being afterwards smelted for the silver which it contained. With the existing price for the former metal the idea appears more than feasible, and some practical result is fully anticipated. Only pure blends will of course prove amenable to this method of treatment, as even a small percentage of lead renders the zinc product of poor quality. This class of ore can however be readily furnished by many of the concentrators, and should a satisfactory market be opened up it will mean a valuable addition to the resources of several of the leading mines. H. W.

SLOCAN ORE SHIPMENTS IN 1898.

The following table is excerpted from the report of Mr. Alexander Sproat, Gold Commissioner, to the Hon. the Minister of Mines, covering the year 1898:—

Name of Mine.	Number of men employed.	Tons of ore reported as shipped in 1898.	Ore, Development, &c.
Payne	130	14,000	Galena and carbonate ore.
Slocan Star....	110	2,862	Good ore at 900 ft. depth; has a mill and tramway; has done 2,500 ft. tunnelling, 1,500 ft. upraises and winzes. Ore, galena and concentrates
Ruth.....	45	3,250	Ore, galena and carbonates. Has done 3,200 ft. of tunnelling, 2,000 ft. upraises and winzes. It is contemplated to put in mill and tramway.
Noble 5 Group.	35	.....	Is supplied with a fine mill and tramway, and is doing steady development work preparatory to shipping.
Last Chance...	45	1,700	Ore, galena and carbonates. Is developing large ore bodies; an aerial tramway is about completed.
Sovereign	10	160	1,000 ft. of tunnelling.
Ajax	14	.....	Galena and zinc ore. 1,500 ft. of tunnelling.
Reco	28	480	Rich galena and carbonates. 1,500 ft. of tunnelling and 500 ft. of raises, etc. A tramway and mill site have been surveyed.
R. E. Lee	8	.....	Has run 740 ft. of tunnel, which is expected to cut the lead soon, gaining a depth of 1,600 ft.
Goodenough....	6	.....	600 ft. of tunnelling.
Blue Bird	8	60	Ore, galena. 600 ft. of tunnelling.
Trade Dollar.	6	.....	Ore, galena. 100 ft. of tunnelling.
Queen Bess Co.	65	1,700	Ore, galena and carbonates. Has done 5000 ft of tunnelling, raises, etc.; also built extensive buildings during the year.
Idaho Mines...	45	4,000	Ore, galena. Paying dividends.
Ivanhoe .....	.....	.....	Has been doing development work for 18 months; has large amount milling ore blocked out; contemplates erection of a mill in spring—difficulty of approach has been obstacle.
Treasury Vault.	25	20	Ore, galena and carbonates.
Miller Creek Co.	6	40	Ore, galena and zinc.
Dardanelles ..	14	75	Ore, galena; has 2 ft. of ore at a depth of 500 ft.
Rambler.....	25	580	Ore, galena.
Antoine	30	350	Ore, clean galena.
Washington...}	12	.....	Just commenced work under new management.
Slocan Boy...}	.....	.....	.....
Great Western.	6	.....	Ore, concentrating. 300 ft. of tunnelling.
Madison Group.	4	20	A "dry ore," some of very high grade. 175 ft. of tunnelling.
Minnehaha	7	.....	300 ft. of tunnelling.
Red Fox .....	.....	.....	Closed for winter, owing to difficulty of working.
Wakefield	45	.....	Ore, galena and carbonates. 2,000 ft. of tunnelling done this year; developing all summer, preparatory to shipping over rawhide trail to waggon road.
Conistock	60	.....	600 ft. of raises, 700 ft. of tunnelling; developing all summer; now constructing concentrator on Finnell Creek.
Vancouver	35	300	Developing all summer a large body of rich galena ore.
Galena Mines ..	12	.....	Developing all summer; has a large body of concentrating ore; well equipped with modern hoisting plant.
Bartlett Group.	.....	.....	175 ft. of tunnelling. No shipments, owing to difficulty of access.
Condor Group.	8	.....	300 ft. of tunnelling.
Essex	5	.....	Engaged in development.
Edinburgh...}	.....	.....	.....
Bosun	27	420	Ore, galena. 2 cross-cut tunnels to cut vein, and a 75 ft. shaft sunk in ore. First assessment work on this property was done last May.
California	15	40	230 feet of tunnelling this summer; shut down for winter.
Marion.....	11	.....	.....
Enterprise....	.....	.....	Ore, galena, high in zinc. Developing only; 450 ft. of raises and 280 ft. of tunnelling; large amount of ore blocked out.
Evening Star..	13	.....	Developing, with promising results. A steam hoist has been erected.
Golden Wedge.	30	.....	Developing.
Springer Creek.	.....	.....	The ore is mostly "dry silicious." 5 carloads have been shipped.
Other Claims..	.....	.....	About 8 other claims on Lemon Creek are being developed, but have not shipped.

NELSON DISTRICT, B.C.

The very late spring here is causing much delay to the prospectors, who, even at this date, find two much snow on the hills to follow their hazardous, if occasionally remunerative business. Old timers predict trouble with high water, as when the snow does actually disappear it is likely to do so very rapidly, so that the lake outlet will be taxed to dispose of the sudden influx in its usual time and manner; still, as the possibility of floods is recognised, extra precautions will of course be taken, and the experience gained in 1894 will be of great service.

It is gratifying to record that the Hall Mines Co. are still actively developing the Silver King, and that the quantity of ore shipped down to the smelter has been considerably increased. The big blast furnace made a very successful run lately, and as the small one is running steadily on Slocan lead ores, which appear to be handled without any difficulty, it is to be hoped that the magic word "Dividend" may be heard again shortly in connection with this very extensive concern. Quite possibly some minor alterations in the general arrangements may take place, but the directors intend to follow out their present system of steady development, and not to change the main policy of the company.

Several properties on Morning Mountain have been bonded or otherwise passed into fresh hands during the last month or two, notably perhaps the Venus, which adjoins the Athabasca, and on which a very important strike has recently been made of free-milling quartz—one assay from which is said to have yielded values of over \$100 per ton. It is always prudent to receive these reports of extraordinary assays with some little reserve, especially in the case of gold quartz—it is such a very easy, and very human thing to do, to pick out the best and call it a sample of the vein, when it is really a specimen only, and does not indicate the true value of the property.

Of the Athabasca nothing but good can be said. The mine is being extensively developed, and the management claim now to have very large bodies of ore ready for stoping. It is not necessary to recapitulate the amount of money that has been expended on the mine and machinery, but there is no doubt whatever that the property is well worth the expense incurred. During April the value of the bullion actually obtained is officially given at \$7,500.00, while there was in addition a large quantity of concentrates carrying a value of some \$2,200.00 more, which must be regarded as highly satisfactory.

The Exchequer, too, which is not far from the last-named group, is looking very well just now, the management reporting some 4½ feet of good ore between well-defined walls. Much steady work in sinking and tunnelling has been done, and the owners are well satisfied with the appearance of the vein. Some people consider this may be the same lead as the Athabasca, time alone will show that, but the two properties are separated by a very deep gully, and it seems hardly likely that one is the same as the other.

The group of claims on Eagle Creek (west of Nelson) known as the Duncan Mines seem in a very prosperous condition, and as the result of some 50 men having been working there all the winter, the company have taken up the bond of some \$80,000.00 on the Royal Canadian and Granite and made the final payment on it. So satisfactory have the assays turned out, that it is intended to erect a 20-stamp mill for the treatment of that part of the ore that proves to be free-milling, of which there seems to be a good deal. The vein is white quartz, carrying some copper and iron pyrites, together with free gold, and averages something over \$25.00 per ton of values actually caught on the plates. If this holds out, the owners may well be congratulated on their possessions, more particularly as they have ample water and timber for all purposes.

As a further proof of the interest shown lately in developed properties, a strong English syndicate has bonded some 20 claims on Toad Mountain, all more or less opened up, especially the Dandy, which adjoins the Silver King. Although there is as yet far too much snow on the hill to render it easy, or even in some cases possible, to approach these claims, yet as soon as ever the season will permit a very large force of men will be employed, and systematic exploration carried on.

Probably the Dandy will attract attention first, as it has had far more work done than any of the others, and has in addition some hundreds of tons of ore on the dump. This mine has hung fire for several years now, and while some people condemned it, the owner has stood by it all the time, and it is to be hoped he will now reap his reward.

The Last Chance Mine, belonging to Messrs. Wilson Bros., will shortly be working again, the deep snow last fall rendering access so difficult and dangerous that work had to be suspended during the winter, and in this case also the owners well deserve success for the perseverance they have shown under much discouragement.

The Fern, a little farther south than the Last Chance, is reported all ready for another start; winter weather having caused some inconvenience in connection with the machinery, which is now remedied.

A matter that is likely to cause considerable trouble in all the mining districts is the new and very hastily considered Eight Hours Bill, which provides that no miner shall work more than eight hours in twenty-four. As there was no demand for this measure (except possibly from two or three sore heads who think they own all Kootenay), and as the men were all contented and peacefully working ten hours, it does seem that much more consideration should have been given before passing such a sweeping measure. No one appears to have known anything about it, or to have known even that it was going to be proposed. Of course the mine owners say they will only pay eight hours wages, but the men generally say they want ten hours wages for eight hours work, and it seems probable that there will be friction in many of the camps caused by this too hasty legislation.

Another important Bill has been passed, namely, that all Assayers practising in B.C. must either undergo an examination or prove that they have done so at some recognized institution. This is perfectly right and proper, but it seems very hard on a man to have to pay \$15.00 for a new certificate. Surely a nominal sum, say \$5.00, would be ample. However, the Act will not come into force for nearly two years, and there may be a chance of having that clause amended. The places where the

examinations will be held will be determined by the number of men offering themselves, which seems to meet the difficulty and expense of long journeys fairly well. The examiners appointed are the Government Assayer and the Government Mineralogist, both of whom are well qualified for the work, but probably others will be appointed in different districts in addition.

Nelson itself is apparently anxious to emulate much older and larger cities; we are likely to have a gas and coke works in the near future, and a complete service of electric trams is also being arranged, both of which installations will be of great benefit to the inhabitants in this hilly though prettily situated town.

May 15, 1899.

A. H. H.

LAKE OF THE WOODS.

Navigation opened on Lake of the Woods on May 10th, and the steamer *Shamrock* has been placed on the route from Rat Portage to Camp Bay, calling at Regina Mine, Whitefish Portage, &c., making three round trips per week. This will be a great convenience for mining men and others travelling in that direction, affording as it does cheap and rapid transit to and from Rat Portage. Captain Johnston of Norman, has brought the steamer *Telphyr* up from Port Arthur, and is fitting her up as an addition to the Lake of the Woods fleet.

This promises to be the best season we have ever had as regards actual mine development. Nearly all, if not all, the prospects being worked are giving encouragement to the operators, whilst our three old "stand bys" are at least sustaining their reputation for wealth. Quite a few mining men of capital are here, and more are coming; evidence that an interest in this mining region is on the increase amongst capitalists outside.

MIKADO.

Manager McMillan came to town this week with \$15,000.00 of gold bricks. The output for 1898 was \$69,435.00; this year they hope to run it up to \$100,000.00. The chairman of the company, Mr. James Reed of London, Eng., is visiting the mine at present.

REGINA.

Manager Maiville brought in \$6,000.00 worth of gold bricks last Saturday. The shaft is now down 474 feet, and the 500 foot will soon be reached. At this depth there is 6 feet of quartz that will mill \$8.00. The mill has been shut down for a while, and a full force of miners are sinking and drifting.

SULTANA.

Mr. J. F. Caldwell, the owner, is at present in England, where he is supposed to be putting through a deal on his celebrated mine.

SIRDAR.

The main shaft is now down 200 feet. The vein at the bottom is 3½ feet wide, with ore that will mill over \$12.00. Alongside the vein of quartz is a dyke of some 2½ feet in width, that will mill about \$6.00. Sinking is also being done on four other veins on three different locations, belonging to the same company, viz., the Toronto and Western, all of which have shafts of from 40 feet to 50 feet. All are showing up well as regards strength of vein and richness of gangue.

SCRAMBLE.

The main shaft is down 84 feet, and at that depth cross-cutting is being done, and the ore taken out is said to be richer than in the upper portions of the deposit. The crew at present consists of eight men, but it is expected that the force will be increased shortly.

THE CHEMICAL MINE.

Manager Humphrey went out recently with a crew of six men to build camps to receive the force of miners that is to be sent in shortly. It will be remembered that this mining proposition is situated between the Stella and Triggs mines.

CAMP BAY.

Captain Proudlock is in town from 575 where he is sinking a shaft on contract for the Sentinel Gold Mining Company, which has an option on the property from the Coronado Company. The shaft is now down 40 feet and the vein looking well.

The Combined Mines Company are resuming operations, and are making preparations for the erection of a stamp mill.

There is a crew at the Bully Boy, unwatering the shaft, and getting it ready for the inspection of parties *en route* to examine it.

THE CZAR MINE.

Mr. Wm. Bull and two miners have spent the winter developing this property, which is owned by Bull and Captain Brydges. A shaft 35 feet deep has been sunk on the main vein, and a pit 25 feet deep on another. A quantity of the ore will be tested at the Keewatin Reduction Works.

THUNDER BAY DISTRICT.

In the Township of Blake, about 25 miles southwest of Port Arthur, the Standard Oil Company has an option on a native copper property, from Messrs. Brimson *et al*, Port Arthur. About 3,000 acres of land is involved, and the option is for \$60,000.00, a portion of which was paid down, and the remainder to be paid in two other instalments. The metal occurs as shot copper in amygdaloidal trap. The lead has been traced for a considerable distance. Mr. John Hardman, S.B., M.E., amongst others, reported upon this property.

About six miles from the above-mentioned property is another native copper deposit which is being opened up by Mr. Harry Wiley, of Port Arthur. Some parties from the East are shortly to visit it, with a view to a deal.

Work at the Rabbit Mountain has again been stopped. There is said to be a splendid vein, wide and well defined, but too poor in silver at the point now reached, to be profitably worked, at least, that appears to be the opinion of the owners.

Work is going ahead at both East and West Silver Mountain.

ZENITH ZINC MINE.

This property is situated about 12 miles north, and a little east of Rosspoint Station on the C.P. R'y., on the north shore of Lake Superior. There is a canoe route from the mine out to the shore of Lake Superior, which it reaches in the vicinity of Maggot River. A sleigh road was constructed along the canoe route—across lakes and the portages between them, and over this road 1,200 tons of the zinc ore were hauled during the past winter, the teams making daily trips, and some loads

containing as much as three tons. The ore is sewed up in bags, each of which contains on an average 120 lbs. of ore. An attempt to find a waggon road is to be made this summer. This promises to be somewhat of a difficult undertaking, as the surface is almost entirely occupied by steep and high hills, the only level land being in the swamps, which are not very numerous. The ore was shipped via New York to Belgium, where, I believe, it fetched \$48.00 per ton. The cost of carriage from Maggot River to Belgium was \$8.00 per ton.

The property consists of 160 acres, and belongs to H. J. Beemer, Esq., the well known contractor of Ottawa and Quebec. The deal by which he came into possession was consummated last December, and I understand that the price was \$20,000.00. Mr. William Caldwell, the well-known mining man, of Rat Portage, was in charge during the winter, but he has been superseded by Mr. J. E. Hoolihan, as Superintendent, with Mr. W. H. Walsh, as foreman. A large number of men were employed during the sleighing season, but in the end of April there were only about ten persons left, and on May 3rd, these were reduced to four, by the departure of the others for the front. The force is, however, to be greatly increased shortly, and active mining resumed. Comfortable camps have been built and a steam plant consisting of hoist and pump brought upon the ground. At the time of the writer's visit in the first week of May, there were about 300 tons of ore on the dumps and in bags.

The ore is the sulphide of zinc, or zinc blende as it is called, being the "Black Jack" of the miners, and is black with the usual metallic lustre of that mineral; it is of course easily drilled and can be mined very cheaply, especially where a vein is of sufficient width to obviate the necessity of breaking down any of the wall rock. I should think single hand drilling would be very applicable here.

The deposit itself occurs in diorite, and the principal exposure is along the face of a bluff close to the shore of a small lake. A succession of veins or seams are seen to traverse the face of the bluff at various heights, from a strong one at the very base, to one 60 feet higher up. These appear to have a general strike of about 5.70 E., and dip northerly or towards the heart of the mountain. At the foot of a ravine intersecting the range of bluffs, is a deposit of ore showing a fall of 15 feet of ore, but it was not quite apparent at what angle this section ran with respect to the axis of the mass. The ore hitherto taken out may justly be said to have been the product of mere surface work, although some came from a shaft some thirty feet deep. There is evidently a large deposit of ore in this mountain, and the property must be a very valuable one. The ore already taken out must have been sufficient to pay for the property and meet all expenses up to date. The ore yields about 50 per cent. metallic zinc.

The diorite appears to extend some two miles southeasterly from the mine, but not so far on the north and northeast, where it soon gives way to a somewhat fissile rock; in some places the lamination or foliation is quite pronounced, whilst in others, the rock is massive or nearly so. The dip is to the north and the strike about 5.70 E. Outside of these greenstone areas is the old Laurentian gneissoid granites, on the south and east at least.

This deposit of zinc was discovered by an Indian some 20 years ago, who sold it to Captain Pritchard, then of Port Hope, but now of Rat Portage. Pritchard associated with him Mr. Donald McKellar, of Fort William, and later on, Mr. Peter McKellar became a partner. Zinc in those days was so low in price that they failed to find a purchaser for the property, although the late Mr. Keefer, barrister, of Port Arthur, took an option on it and did some testing work. He threw it up, however, and nothing more was done until the present owner closed a deal on it last December, as already stated.

RAT PORTAGE, May 19th, 1899.

JOHN MCAREE.

The Trail Smelting Works.

On March 1st, 1898, the Canadian Pacific Railway Company took over the smelter at Trail from F. A. Heinze, and since that time it has been operated under the Railway Company's management. Some \$200,000 has been expended in rebuilding and improving the copper plant and in adding lead furnaces. To-day it is the largest lead copper reduction works in Canada, and in the matter of modern improvements and cheap methods of handling material, compares favorably with the most modern plants in the United States.

The total daily capacity of these works is close to 1,000 tons; the copper blast furnace being capable of smelting close to 800 tons, while the lead furnace can smelt over 150 tons per day.

The plant can be operated by three different powers, first: steam; second: water power developed from neighboring streams; and third: by the power of the West Kootenay Power Company, whose power plant is at Bonnington Falls.

The plant consists of the following:—Two complete automatic sampling mills, one for crushing and sampling Rosslund gold copper ores and the other for crushing and sampling the high grade lead silver ores from the Slocan and East Kootenay districts; three large copper blast furnaces, one 150 ton lead blast furnace, one large reverberatory, two automatic O'Harra roasters, six Bruckner roasters, four hand roasters, 24 roasting stalls, one briquetting plant, and two lime kilns. There is also a copper refinery and it is intended that a lead refinery will be built within the next year or two.

There are the usual offices, assay office and laboratory, warehouse, a complete machine shop and quarters for the employees of the works.

The management of the plant comes under Mr. T. G. Shaughnessy, vice president of the Canadian Pacific Railway. The local officers at Trail are: W. H. Aldridge, manager; A. L. Dean, superintendent; Jules Le Barthe, engineer; J. C. Welsh, chief chemist and assayer; T. W. Bingey, accountant; and D. W. Moore, ore buyer.

Gold Mining in Nova Scotia.

40 STAMPS FOR GUFFEY-JENNINGS MINE.

The development work at the "Guffey Jennings" mine, district of Caribou, in the past few weeks has been of the most satisfactory character, such as, in a large measure, to remove any doubt which may have heretofore existed, regarding the question of deep mining. The present owners of this mine purchased it some eighteen months ago, for the sum, it was stated at the time, of \$40,000, after a careful examination by a competent mining engineer and expert. The plant consisted of a ten stamp mill, and inferior hoisting and pumping machinery, entirely inadequate to work the mine to advantage. The new owners, after completion of the purchase, at once installed a modern hoisting, pumping, and sinking plant, some ten hundred feet west of the old working shaft, and have sunk a vertical shaft through country rock to a depth of over

500 feet and have been rewarded by cutting a lode, at this depth, of four feet in thickness. The quartz taken from the lode at the bottom of the shaft has yielded, by mill test, \$7.00 per ton in free gold. A drift was then made west on the lode, and a distance forty feet from the shaft the lode has increased to eight feet in thickness, and is very rich in free gold, both fine and coarse, some pieces as large as hazel nuts, besides being rich in minerals such as iron and copper pyrites, galena and zinc blende. It is estimated that the ore taken from the drift will yield several ounces to the ton. The character of the ore and the vein walls give unmistakable evidence of continuity to great depths.

After a careful examination the Company are fully convinced of the correctness of their initial opinion of the value of the property, and of a prosperous future; therefore they have determined to erect a modern milling plant with forty stamps. Much of the material is already on the ground.

Whether the lode cut in the new shaft is a continuity of the one previously worked is as yet conjectured; if a new one, it adds greater value to the property.

The results of this development work by the Guffey-Jennings Company has established two facts, viz., the assurance of profitable deep mining and the necessity of capital for the successful working of Nova Scotia mines. The lode formerly worked on this property was discovered some 20 years ago. It varied from a few inches to two feet wide at the out-crop on the surface, and yielded from \$2.00 to \$20.00 to the ton. It has been worked in a desultory manner by various small companies without sufficient capital to properly equip it and yet it has yielded probably \$175,000 worth of gold.

THE ELK MINE.

The Elk Mine, in this district, after doing only development work for several months past, which was not very encouraging, has now at a depth of 400 feet encountered very good ore which is steadily improving as the work progresses. It is said the Guffey-Jennings people are about taking this property over.

HETHERINGTON MINE TO BE REOPENED.

Preparations are also in progress by Mr. J. B. Neily, of Boston, to re-open the Hetherington property, also the Truro Mine. The latter at one time yielded 200 ozs. to the ton of ore from a six inch vein.

GUYSBORO' COUNTY, GOLDENVILLE.

The Blue Nose Company, at Goldenville, returned for the month of April 440 ozs of gold from 1,250 tons of ore. Geo. A. Hirschfeld, whose lease has expired on the Stuart-Hardman property, has succeeded in leasing the New Glasgow Company's Mine. Mr. Hirschfeld has been very successful as a tributor. Mr. J. B. Neily has recently visited this rich district, with an expert, it is understood for the purpose of examining several of the old famous producing mines, including the Palmerston, Dominion, Wellington, Dewar, Boulder, Hayden, and Derby, with a view to consolidating the whole. The Guysboro Gold Mining Company of Wine Harbor, have returned 267 ozs. of gold from 224 tons of rock crushed.

HANTS COUNTY.

The McNaughton Mine, Rawden District, has recently been sold to Worcester, Mass., people for the sum of \$40,000. Mr. Archibald G. McDonald and John H. Johnson are said to be the representatives of the Company here. This mine has a very good record in the past, late returns showing from two to five ounces to the ton.

HALIFAX COUNTY.

The "Tunnel" Mine at Waverly is being put in shape for extensive working. The power will be brought from the Fall River Lakes, one and a half miles distant; it has not yet been determined whether the power will be conveyed by electricity or compressed air. It is now understood the purchase price of this large property is \$148,000, and the chief owner is Mrs. Hirsch, widow of the late Mr. Hirsch, one of the owners of the famous Anaconda Mine.

QUEEN'S COUNTY.

W. H. Cashen Mine, Leipsigat District, has returned 101½ ozs. from 305 tons of quartz for April.

The Colonial Mining Company of Moose River, has recently lost their new 20 stamp mill by fire. The loss is heavy being only partially insured.

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COMPANIES.

B.C. and New Find.—The First Annual General Meeting of the British Columbia and New Find Gold Fields Corporation, Limited, was held this month in London.

The Chairman said:—The Company was registered in August, 1897, and therefore, our accounts and report are for a period of one year and five months. Our capital being limited in amount, the Directors decided that we must be very careful in what business we undertook, and in commencing the work, we looked into numerous properties on the coast and islands of British Columbia. Some appeared very promising, and we took up options on one or two of them; but we found that opening up a new field such as this would be, was beyond our capabilities, and we thought we had better confine ourselves to one of the tried fields, such as the Kootenay District, where there are many mines paying very large dividends, and where the method of treatment and the character of the ore were well known. We appointed a Manager, Mr. Nelson Fell, who had been connected for some years with the St. John del Rey Mine. On several occasions we had put before us the question of the Athabasca Mine as one of the most promising. It was owned by Canadians, registered out there as a Company, which had not sufficient capital to develop it. We sent our Manager to report on the mine, and his report being very favourable, we undertook the financing of it on terms. As a result, the Athabasca Gold Mines was registered in London, in April last. Our Manager took possession of the property in May, and at the statutory meeting, held in September or October, we reported to the shareholders that the battery was running and that the electric installation and tramway were complete. We considered that it was quite unique in the history of mining that we should take possession of a mine without any machinery, and by the time of the statutory meeting be able to report that the battery was running. Since then it has been running continuously. In October, which was a broken month, it crushed 400 tons, of the value of \$1,961, or \$4.90 per ton. That we considered disappointing. The next month's crushing was 728 tons, which produced \$7,560, or an average of \$10.39 per ton. In December it crushed 695 tons, which produced \$6,400, or \$9.22 per ton. In January it crushed 713 tons, which produced \$5,190, or \$7.29 per ton. In February the Manager pursued a different method. The ore was getting so very

much richer than he put more Frue vanners on, and ran the battery more slowly. 424 tons were crushed, and produced \$7,988, or \$18.93 per ton. In March 465 tons were crushed, which produced \$9,650, or over \$20.75 per ton. For practical purposes you can take these dollars as representing pennyweights; so that in October the crushing yielded 4.9 dwt., then in the following months 10 dwt., 9 dwt., 7 dwt. In February it jumped up to 18 dwt., and in March to 20.75 dwt. per ton. This ore is not what you would call free-milling ore. It is heavily charged with other metals. If you pick it up you can tell at once by the weight that it is full of metal, and in nearly all the mines is considered smelting ore. There are only three batteries running in British Columbia, where the ore is treated by crushing—the Ymir Mine, the Athabasca and the Cariboo. Although we are only getting 20.75 dwt. per ton, the ore is really running somewhere about 2 oz., and it is manifest that the balance is lost in the tailings. We have had specimens taken every day for a month, and these have been shipped to Vancouver, where they will be tested with cyanide, and we are awaiting the opinions of experts there as to whether the cyanide plant would be the best method of extracting the 1 oz. lost in the tailings. Another plan is to put up four more vanners and collect a larger amount of concentrates and send them to the Hall Mine Smelting Works, which are quite near. Of course, we shall wait on the report of the cyanide plant before we decide what course is to be adopted.

With regard to how the mine is opening up, on March 2nd the Manager wrote:—"I may say that nothing could be more favourable than the development of the last six weeks. The ground has improved, the vein is running unbroken into the hill, so that at the face of the tunnel we must have between 450 feet and 500 feet of backs above us; and it has straightened up markedly, which is a most important factor in the cost of extraction. As to its values, they are very high. The samples which I sent you yesterday show the character of the rock, and free, coarse gold can be found at any point along the vein for last 75 feet (since it passed through the slip into the softer ground). The assay value of \$111 per ton was from a sample taken across the ledge on February 27. The ore there was 20 inches wide. It varies from this down to 6 inches." On March 15, he writes:—"Everything in the mine is as satisfactory as possible. The tunnel continues in ore without a break. Our weekly assay from this point on the 13th is as follows:—\$46.21, 13 inches wide. The above is, again, a producer of ore, and the sample from this point ran \$147.58, width 10 inches." On March 22, he wrote:—"I would recommend waiting till the snow and frost are gone before attempting any heavy construction works. By that time, moreover, we should be in receipt of Mr. Pellev. Harvey's report, and must come to some further decision about more machinery to treat the ore with. We are delighted with the results of the new vanner, and I wish we had four more running. Speaking generally, the results at present seem to indicate that when we are running the mill slowly on light concentrating ore (chiefly the vein) four vanners will do good work, and our tailings will not be heavy; but with heavy base ore (even at 17 tons per diem) the capacity of the vanners is insufficient to make either clean concentrates or light tailings. In the mine everything continues to be satisfactory. We encountered another slip in the main tunnel, but we soon caught the ledge again. We took the regular weekly sample on Monday beyond the slip, and the result was: vein 10 inches broad, value \$93.84 in gold." The latest news I can give is to March 29:—"I believe our clean-up for March will be fairly satisfactory." We have the results by cable:—"The more the mine is opened up the more numerous will become the points of attack, and the less dependent should we be upon each particular point. Regarding the water supply, the continued cold weather has been annoying, and the supply has been short, but we adapt our machinery from time to time to changing conditions, and so far we have not lost no time this month." Of course, with the vein 10 inches wide we have to take out three times that width, so that roughly speaking, the ore sent to the mill is about 2 oz. to the ton. We are getting with our present battery about 1 oz., and with 500 tons a month you see what a difference it makes. Five hundred tons would produce £2,000 a month, and we are losing another £2,000. That we must stop, for it will make a difference between paying very handsome and very moderate profits. The New Find Company has 50,100 shares in the Athabasca, and they are put down at cost price, £7,571, but they are quoted in the papers at 1 to 1-16, and have been pretty steady at that price for some weeks. We are not driven to realize, because we believe it will improve steadily; but we can realize portions from time to time, and having other very good business before us we will do so when occasion arises in the course of the next summer. We have offered us in the same neighbourhood a large undeveloped property which we can develop on very easy terms, and having our own Manager on the spot, it may very well suit us to take it up. One of the shareholders has expressed disappointment that no dividend is to be paid this year. If the market is such that you can float, then you can realize and pay a dividend; but failing such a market, you cannot do so the first year. At the statutory meeting of the Athabasca Company we congratulated the Manager on having erected the battery so quickly; we now have to congratulate him on keeping it running through the abnormal cold spell this winter. The mill-house was hung on all sides with icicles, feet or yards long, and looked like an ice palace; but, notwithstanding that, the battery ran thirty days eight hours, out of thirty-one days. Of course, in such intense frost you can only keep it going by moving the water very rapidly. If there was the slightest hitch it would all freeze solid; but since October the battery has been running without cessation. I now move the adoption of the report and accounts.

New Vancouver Coal Mining and Land Company.—The annual meeting of the New Vancouver Coal Mining and Land Company, Limited, was held this month in London.

The Chairman said: You will observe from the report that our output last year was a very considerable one; in fact, with one exception, it is the largest since the formation of the company. (Hear, hear.) In the present half-year, indeed, I certainly think we shall beat the record. Our output last half-year was 233,000 tons, and for the half year ended with the previous June it was 216,000 tons, making for the year a total 450,000 tons. That is a very large output indeed, and if the price had sprung up a little we should have made a very considerable profit. As it is, owing to the prices having remained pretty much as they were, the profits, though fair, can scarcely be considered commensurate. They amount to £17,000 for the half-year. That figure, however, has been enhanced by the profit on the sale of the "Peter Jebesen," which was fortunately disposed of in the time of war, when tonnage was very much required by the Government, at an advantageous price by our agents, to whom our thanks are due for the ready zeal which they displayed in taking advantage of the fortuitous occurrence which enabled them to make that profit. The profit we have made, incommensurate as I consider it on so large an output, would have been less—perhaps, indeed, none at all—if the old system had prevailed which prevailed some years ago with regard to tonnage. At that time, when sailing vessels took our tonnage, those vessels carried on an average 2,000 or 3,000 tons, and each voyage occupied about a month, whereas now steamships take away on the average some 4,000 tons, and by the new arrangements that have been made do not occupy more

than a fortnight. The facilities thus afforded for shipping the coal are enormous, and this enables our output to be satisfactory. Great credit is due to our superintendent for having brought about this change, enabling us to deal satisfactorily with so large an output; but for that our profit would have been very much smaller than it is, because so large an output, and dealing with it in that satisfactory manner, has enabled us to make the profit we have made. Again we have to thank our agents for the way in which they have been getting rid of the large output, for the contracts they have made for the large quantities of coal we have produced under these contracts have enabled us to keep down the cost of production. That cost, however, is, in my opinion, still too high, and we are impressing upon our superintendent the necessity of doing all he can—as I have no doubt he does—to keep the cost down. (Hear, hear.) If you turn to the balance-sheet, I think you will find that the company was never in so good a financial position as at present, for, instead of being in want of working capital, as we formerly were when we had to go to our agents for it, and to pay a heavy interest—7 per cent.—we now have working capital of our own sufficient to carry on our work without being subject to that interest. (Hear, hear.)

Another matter is the reduction of the debenture capital. This debenture capital was in 1890 as much as £70,000, last year it stood at £53,000, and this year we have paid off debentures falling due during the year, with the effect that this debenture capital is now reduced to £40,000. (Applause.) Inasmuch as the debentures carried 6 per cent. interest, that is another item in favour of the company, and tends to increase the profit divisible, among the shareholders. (Hear, hear.) Now, I want to say a word or two on the subject of the present position of the company with regard to the price of its shares in the market. (Hear, hear.) I don't care as a rule to refer to this matter, but I think under the circumstances, as we are paying this year 5½ per cent., and inasmuch as since the formation of the company we have paid an average of 4¾ per cent., I am justified in saying that, with our shares standing as they do at between 10 and 15s.—say 12s. per share—that is too low a price. (Hear, hear.) I think shareholders ought to know that they ought not to part with their shares unless they are absolutely compelled to do so at the price now prevailing. The board has always a med. and will continue to aim, at putting the company in a position to pay a regular dividend, and their aim will be in the future, as it has been in the past—and there is every probability now of their succeeding—to keep the company as a dividend-paying company of at least 5 per cent.—(hear, hear)—and I hope it will be more. Therefore it is quite clear that the present market price of the shares of a company which has paid nearly 5 per cent., and which may in future certainly be depended upon to pay 5 per cent., is not commensurate. (Hear, hear.) There is only one thing more I need refer to, and that is the accident which occurred in our colliery last November. There was an explosion in No. 1 level No. 1 shaft, by which two men were killed and six injured. One of those killed was our manager, Mr. McGregor, an excellent servant, who had been with us many years. We felt his loss, and so did Mr. Robins, very much. The board instructed the superintendent to do what was proper to aid the widows, and that has been done, and the directors expressed their great regret at the loss the company has sustained. A new manager has been appointed—Mr. Russell—who is well known to Mr. Robins, and so far he seems likely to take the place of Mr. McGregor with satisfaction to the board and to the shareholders. (Hear, hear.) I now beg to move that the report and accounts, as presented, be received and adopted.

Mr. Briviant said that he found that 1890 the chairman estimated the value of the company's assets at £422,000, when the output was only 280,000 tons. It was only right to say that if the property was still of that value and the output was 450,000 tons, while the capital of the company, including the debentures, was only £258,000, they were in a very strong position, and had ample means at their back. If the public were put in possession of these facts, he was confident the shares would soon stand at a better price in the market.

The Chairman said of course the value of the property of the company depended largely on whether it was regarded as a going concern or as a break-up price. Assuming, as he did in 1890, that the property were to be sold as a going concern, he was prepared to say that the value now was greater than in 1890. On the same basis as in 1890, he valued the company's assets now at £449,000, against £422,000 in 1890, though they did not appear in the balance-sheet at that figure, because a good deal had been written off.

Velvet Mine, Ltd.—The latest news of the Velvet is that the ore body in the mine is 273 feet in length, 160 feet in depth, and from 10 feet to 20 feet in width; while the shaft, which is to be deepened, has been sunk down to 240 feet from the surface. Two steam drills are now in active operation with a view to ensuring more rapid development than could hitherto be achieved by the hand-drilling apparatus. It is also announced that the 60 horse-power boiler has been duly placed in position, and is in good working order.

In a letter recently received, the Local Manager writes:—"I have had two rounds of holes drilled by the machine in the south cross-cut, and up to the time I left yesterday we were still in ore. We have cut through at least 35 feet of ore." The lode is from 10 feet to 20 feet, as stated, in width, though in the cross-cut at the 160 foot level it is as much as 48 feet wide, and many thousand tons are already in sight available for extraction and treatment. An arrangement has been in force for some time, under which the proprietors of the Velvet mine could obtain an extension of the railway to the property. Lately, however, the Manager of the Red Mountain Railway, whose line is five miles distant, gave a definite promise to Mr. J. Morrish, the Company's engineer, that as soon as the Velvet is in a position to guarantee a continuous output of not less than 50 tons per day, he would construct a branch line to the property. Mr. Morrish hopes in the near future to be able to give this guarantee, and it would thus seem that the Velvet Mine has reached the advanced stage of development which leaves but a short interval to be covered before arriving at production.

Samples of ore taken from ten different points in the 160 foot level yielded by assay as follows:—

(1)—1.08 oz. gold	2.00 per cent. copper
(2)—1.22 "	6.00 "
(3)—0.96 "	16.00 "
(4)—4.00 "	" "
(5)—0.81 "	15.00 "
(6)—1.40 "	7.56 "
(7)—1.12 "	5.90 "
(8)—1.18 "	8.30 "
(9)—2.20 "	8.25 "
(10)—1.40 "	4.90 "

The capital of the Velvet is only £100,000, and of this, £20,000 was appropriated for working capital. Its capabilities, on the other hand, measured by the quality of the ore body it contains, and the facilities it commands for profitable working, must be accounted considerable.

The Cariboo Consolidated Limited, has been formed in London with a capital of £350,000, in £1 shares, to acquire 19 mining properties in British Columbia. The purchase price has been fixed by Gold Lands Corporation, Limited, who are the vendors, at £250,000, payable as to £60,000 in cash and as to £190,000 in fully-paid shares of the company, or partly in cash and partly in fully-paid shares. Provision is made in the agreement of sale for a proportionate reduction of the purchase consideration, in case the company should not take over any particular properties. There are now offered for subscription at par 200,000 shares, of which 80,000 are for the provision of working capital.

The properties proposed to be acquired are:—

Name.	Approximate Acreage.
Lightning Creek	320
Lowhee Creek	240
Cunningham Creek	320
1 1/2 mile, North Fork, Quesnelle River	3 leases of 5 miles each, equal to about
Keithley Bar	
Pine Creek Bar	
Goose Creek Bar	
Harvey Creek Bar	
Duck Creek Bar	
Swamp River, 1 mile	
Quesnelle Forks—Government Reserve	9,600
Cedar Creek Bar	240
French Creek	300
San Juan and Boyces	320
Cariboo Creek (Champion Gulch)	160
Eureka Gulch	80
Chinese Hill (Ah Quay)	160
British Empire	80
	240
	12,060
Fraser River and Cayuse Creek	5 miles dredging rights.

Newfoundland Copper.—The company has chartered the s. s. "Regulus," 1,367 tons, to load at Little Bay, Newfoundland, a cargo of copper ore for shipment to the United Kingdom.

Ymir (British Columbia).—Cablegram dated May 10:—"During the entire month of April 40 stamps running 16 days crushed 1,700 tons; yield of retorted gold (bullion), 855 oz.; net estimated value, \$9,700. Stock of concentrates is, say, 110 tons; net estimated value, \$2,750." An office note says the engineer advises that the new plates absorbed a large quantity of the gold amalgam, also that only low-grade ore is treated in the mill.

North-West Mining Syndicate.—Bosun Mine—Cablegram from the manager reports: "60 tons lead ore, 20 tons zinc, shipped in April. Shipments reduced pending development in No. 2 and No. 3 tunnels."

Le Roi.—The following semi-monthly return has been received from the manager at Rossland:—"Returns from 6,500 tons shipped: 3,680 oz. fine gold, 7,600 oz. fine silver, 266,000 lb. copper. Gross estimated value, \$100,000. The gross estimated value for the first half of April was \$80,000."

Newfoundland Petroleum Company, Limited.—Registered on May 1, by Burn and Berridge, 11, Old Broad-street, London, E.C., with a capital of £35,000 in £1 shares. Object, to acquire, develop, and turn to account certain oil wells and properties in Parson's Pond, Newfoundland, and to enter into an agreement with H. C. Parkes. Registered without articles of association. Registered office: 9, St. Mildred's-court, Poultry, E.C.

Chaplean Gold Mining Syndicate, Limited.—Registered on May 1, by Jordan and Sons, Limited, 120, Chancery-lane, London, W.C., with a capital of £2,000 in £1 shares. Object, to acquire, develop, and turn to account any mines, claims, and rights in British Columbia or elsewhere. Registered without articles of association. Registered office: 179, Palmerston-buildings, Old Broad-street, E.C.

British Columbia Trust and Exploration Company, Limited.—Registered on May 3, by F. Henman, 2, Crown-Court, Milton-street, London, E.C., with a capital of £25,000 in £1 shares. Object, to carry on a financial agency business in Canada or elsewhere, and to prospect and explore mines and ground supposed to contain minerals or precious stones.

Bell's Asbestos Company, Limited.—The following is excerpted from the Report of the Bell's Asbestos Company, Limited, for the year ended 31st December, 1898:—

The result of the year's operations is a net profit of ..	£5,033 18 2
To which has to be added the amount brought forward ..	2,339 13 5
Leaving for Appropriation	£7,373 11 7

The Directors recommend:—1.—The payment on the 29th of May of a dividend at the rate of 4 per cent. per annum, free of Income Tax. 2.—To place to Machinery Reserve Fund £500. 3.—To carry forward £2,073 11s. 7d.

Granby Consolidated Mining and Smelting Co., Limited.—At a meeting of this Company, held during the month at Montreal, the following officers were elected:—S. H. C. Miner, President; J. P. Graves, Vice-President; C. E. Gault, Sec.-Treas.; G. W. Wooster, Treasurer. The Company will construct immediately a smelting plant at Grand Forks, B.C.

Estate, Finance and Mines Corporation.—The following cablegram has been received from the Manager of the Fairfield Exploration Syndicate, Limited, in Vancouver, dated May 14:—"Dorotha Morton Mine—Output for the month ended April 30, 1,670 oz. bullion; gold, 397 oz.; silver, 765 oz.; total value, £1,695 10s.; 867 tons treated; assay value, gold, 31s.; silver, 3s.; calculated extraction, gold, 80 per cent.; silver, 73 per cent. Ten stamps ran 18 days 18 hours; crushed 984 tons."

Mikado Gold Mining Co.—Clean-up to April 30, for 25 days:—Crushed 893 tons, yielding 334 oz. of gold, and from cyanide 509 tons, yielding 142 oz. bullion.

Whitewater (British Columbia).—The following information has been received by cable:—"During last month 3,317 tons have been milled, producing 214 tons of concentrates; have shipped 200 tons; there has been a great deal of waste milled, apparently, so as to avoid any stoppage of production, pending completion of arrangements to commence stoping this week in the lower levels."

White Bear Mining and Milling Co.—This Company has been reorganized. The capital stock has been changed from \$2,000,000 \$1 shares, into 3,000,000 10 cent shares. This gives the Company 1,000,000 10 cent shares for development purposes. Some of these treasury shares have already been sold, and there is money in the treasury for the prosecution of work. It has been decided to resume operations on the 1st of June, and the intention is to spend at least \$50,000 for development work, if it is found necessary to do so.

Velvet.—This Company recently disposed of its assets in the Velvet Mines, to the New Gold Fields of British Columbia, the parent Company, for £90,000. Sir Charles Tupper is President of the New Gold Fields, which has a capital of £250,000. About \$100,000 has been spent by the Velvet Company in development work. The property is on Sophie Mountain.

The Cape Breton Copper Company, Limited, has concluded a deal looking toward the purchase of two square miles of copper areas at Eagle Head, Gabarus Bay, Cape Breton. The property has been bonded with the right to conduct prospecting and mining operations, pending the term of the bond, and Captain Andrew Whyte, formerly Manager of the Little Bay Copper Mine, Newfoundland, has been engaged to commence work on these areas at once, and will leave for Cape Breton on Wednesday. Three veins of chalcopryite ore crop out on the shore of Gabarus Bay; on the middle one a shaft was sunk to a depth of seventy-five feet, several years ago, by Mr. Ellershausen, a well-known promoter and capitalist, now deceased. Owing to disagreement with the owners the work was stopped, although the vein was making a remarkably fine showing at that time.

The location is only seven miles from the Louisburg terminus of Mr. Whitney's coal railroad, and the depth of water in Gabarus Bay, close up to the shore where the veins crop, is so great that a vessel of any size can easily load ore to freight to Sydney Harbor, where the Cape Breton Copper Co., Ltd., is to build smelting works for its Coxheath ores.

Canadian Mines Development Company, Limited.—Registered April 18, by Maddisons, 1, King's Arms-yard, E.C., with a capital of £300,000 in £1 shares. Object, to adopt and carry into effect an agreement expressed to be made between the Foley Syndicate, Limited, of the one part and this Company of the other part, for the acquisition of certain mines, mining rights, etc.

The first Directors—of whom there shall be not less than three nor more than seven—are to be elected by the signatories. Qualification, £200. Remuneration: Chairman, £200 per annum; ordinary Directors, £150 per annum each.

The Duncan Mines.—The Granite and Royal Canadian groups of claims, which are situated on Eagle Creek, in the Nelson district, are now the property of the Duncan Mines, the final payment on the bond having been recently made. The purchasers have already spent £10,000 in developing the claims, having employed upwards of fifty men for the past year.

The chief work on the Granite group, which consists of the Granite, Red Rock, White Swan, White Swan Fraction, Blue Grouse, and Tamarack, 202.52 acres in all, consists of a shaft on the Granite, known as the Drummond shaft. This shaft is an inclined double-compartment shaft, and has been sunk on the vein to a depth of 206 feet. Five hundred feet of levels, north and south, have also been driven, thus blocking out several thousand tons of ore. There is also the Duncan shaft, which is a single compartment, and has been sunk on the Red Rock to a depth of 60 feet. This shaft is 1,100 feet away from the main workings, and was sunk in order to prove the continuity of the Granite vein, which it most satisfactorily established. The average width of the vein is 2 feet. The ore, which is, high-grade, is a free-milling white quartz, carrying iron and copper pyrites. Many assays running over \$100 in gold have been obtained, but the ore averages something over \$25 in gold caught on the plates, not counting the value of the concentrates.

The Royal Canadian group is situated one mile and a quarter due west of the Granite, and consists of five claims—namely, the Royal Canadian, Roy, Colorado, Mocking Bird, and Nevada, 118.72 acres in all. The development work on this group has been done chiefly on the Royal Canadian, and consists of three tunnels driven in on the vein. The highest, or No. 1 tunnel, is in 280 feet, No. 2 is in 370 feet and is connected with No. 1 by a 60-foot upraise, and No. 3 is in 220 feet, connected with No. 2 by a 75-foot upraise. The vein on this property also averages about 2 feet in width, and though the ore is not quite so high grade as that of the Granite, it is of the same character. All the above three tunnels are now being worked. Other work on this group consists of what is known as the Colorado tunnel, which is in 162 feet.

The Company has decided to erect a 20-stamp mill on their property, and are now considering estimates and tenders therefor. The mill will be connected with the Granite workings by an aerial tramway, but the ore from the Royal Canadian will at first be brought down by waggons, though a surface gravity tramway will probably be eventually laid.

Mica Mining in British Columbia.—Mr. J. McEvoy describes the occurrence of mica at Bonanza Mine, near Tete Janne Cache, at an elevation of 5,300 feet above the level of the Fraser River. "The vein is about fifteen feet wide, where an opening has been made, dipping S. 45° W. conformably with the country-rock. Its continuation toward the north-west is covered with talus from the mountain, while on the south-west side of the opening the original top of the deposit is seen covered by the mica-schist. At the time of our visit, Messrs. S. Winter and J. F. Smith, with a party of ten men, were engaged in taking out and cutting mica intended for shipment

by pack horses to the nearest railway point. The quartz, felspar and mica are separated into large masses, the crystals of mica being frequently eighteen inches long and eleven inches wide, and are found in greatest abundance near the hanging wall. It is evident that the mass was cooled at a great depth and very slowly to permit of this amount of segregation. While practically no work has been done with a view of proving the extent of the deposit, it may reasonably be expected, from what actually appears, that a large quantity of mica can be obtained here. The mica is a transparent muscovite with a very light-greenish cast and is otherwise of excellent quality. The probabilities of further important developments appear to be very favourable.

Another claim owned by some Edmonton miners, is situated a few miles south-east of the Bonanza. Fifteen miles to the south-east on the mountains, near the head-waters of Canoe River, several claims have also been staked. On one of these some work is reported to have been done, exposing a deposit of marketable mica. It may be expected that further discoveries of valuable mica deposits will be made in these rocks, which are of the same character for a distance of twenty miles at least, and probably much further."

Receipts from the sale and lease of mining lands and the amount received as fees for incorporation of companies in Ontario, Canada, for the first four months of the present year afford some indication of the business activity throughout the Province. The revenue from mining lands, consisting entirely of sales and leases for the period ending May 1 was \$80,411.13, as against \$36,063.70 for the first four months of last year, or an increase of no less than \$44,347.

Notes on a Combination Mill in the United States.

(Communicated by Walter McDermott, President, to the Institution of Mining and Metallurgy)

So much is heard now of cyanide and chlorination mills, that it is as well to occasionally have a reminder of the existence of other processes in mills of modern construction. The following notes are furnished to me by Mr. Arthur Buckbee, Superintendent of the Eureka Hill Mining Company of Utah. To this gentleman I freely assign all credit for any usefulness in the notes, and to him I cheerfully transfer any criticisms which they may provoke. There is nothing in the bye-laws of the Institution, which requires that a communication by a member shall be evolved from his own inner consciousness. What is required are facts connected with practical working, and the ultimate source or the fact is of secondary importance.

The mill as first erected in September, 1894, consisted of 40 stamps, subsequently increased to 100 stamps of 950 lbs. These have an average drop of 7½ in., 100 drops per minute. Below the stamps, and receiving the pulp from the same after classifying on Brown's hydrometric sizers, are 45 plain belt Frue vanners 6 feet wide, and

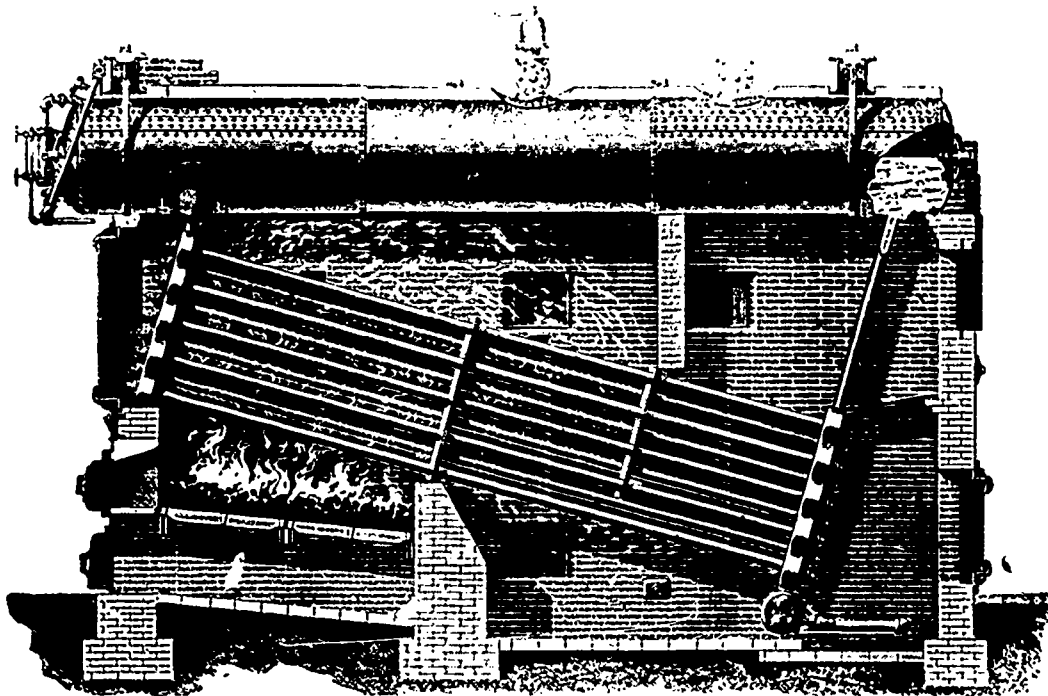
five corrugated belt vanners of the same width, making 50 in all. Below the vanners are 32 5-ft. standard amalgamating pans, and 16 8-ft. settlers, with the usual elevators for quicksilver, clean-up pans, retorts, etc. The power is supplied by a twin compound non-condensing Corliss engine 20 in. and 32 in. x 48 in. stroke, and seven boilers 54 in. x 16 ft. Comet rock breakers above the ore bins feeding the stamps break the ore to pass a 3-ft. ring. The ore is stamped wet through a 35-mesh brass wire screen.

The ore has a value of about 20 oz. silver, 2 dwt. gold, 4 per cent. lead, and a little copper. About half the value is taken out by the Frue vanners as a concentrate, worth on the average about 75 oz. silver, 6 to 7 dwt. gold, and 22 per cent. lead. These concentrates are shipped to smelters. The tailings of the vanners go direct into a system of settling tanks, above and behind the pans, the overflow water being pumped back to the stamps, as it is not entirely clear. The settled pulp is dumped by trap doors in the bottom of the tanks, on to the floor below level with the top of the pans. It is charged into these in charges of about 3,000 lbs., and sufficient slimes added to bring it to the proper consistency. The chemicals used for charge are about 5 per cent. salt, 3 lbs. copper sulphate, 2 lbs. sulphuric acid, 2 lbs. iron borings, 2 ozs. concentrated lye; all charged in with the ore. Steam is turned on and temperature raised to about 180° F., this usually taking about two hours, and then 200 lbs. of quicksilver added. The pan is run another six hours, making total time, eight hours, and then discharged into a settler, where water is added, amalgam settled, and drawn off through syphon taps. The average extraction is about 80 per cent., which is considered very fair work for the raw treatment of a complex ore. The rock is hard, and only crushes up to 1.7 tons per 24 hours per stamp.

British America Corporation.—According to the statement of W. A. Carlyle, the head office in London has decided to do more extensive development than heretofore. The output of the mine is to be trebled. The new vertical shaft is to be sunk to 2,500 ft. at a short distance above the compressor, where there is a large showing on the surface. The new shaft is to be 6 compartments, 12 x 18 inside the timbers. The two cage compartments for hoisting will be 4 x 9 ft. each, to carry two mine cars. Power will be supplied by a 500-H.P. electric hoist, with a speed of 1,600 ft. per minute. The entire plant has been designed to sink to 2,500 ft., with an output capacity of 1,500 tons. The shaft is similar to that in the Homestake Mine, South Dakota. These improvements will begin in a few days. D. W. Brunton, of Denver, Colo., has designed the electrical machinery, and he will supply most of it.

Peat Coke.—A method for making compact coke from peat or other similar substances, with simultaneous extraction of the by-products, has been devised by Martini Ziegler. It claims to utilise all the heat developed at and in the retorts, sending the products of combustion that come from the retorts into one or other of two passages, arranged side by side, and one or other of which may be shut off, the

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one passage leading to a boiler for distillation or evaporation, and the other a drying chamber for the peat, arranged one behind the other, while on the other hand, the radiant heat of the incandescent coke is also utilized for drying the peat, this heat being collected in a passage, whence it is sent into the hopper containing the peat already dried in the air. The apparatus is distinguished by the special construction of the channels for leading the products of combustion, in this sense, that the boilers for distillation or evaporation, and afterwards the passages for drying the peat, are contained in the above-named channels; the boilers, as also the passages, being arranged in pairs, so that some may be charged while the others are exposed to the action of the fire.



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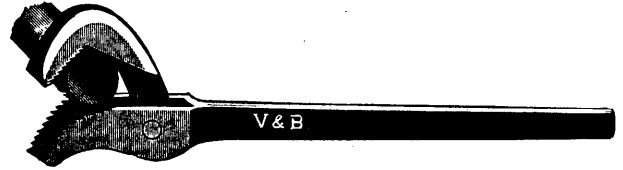
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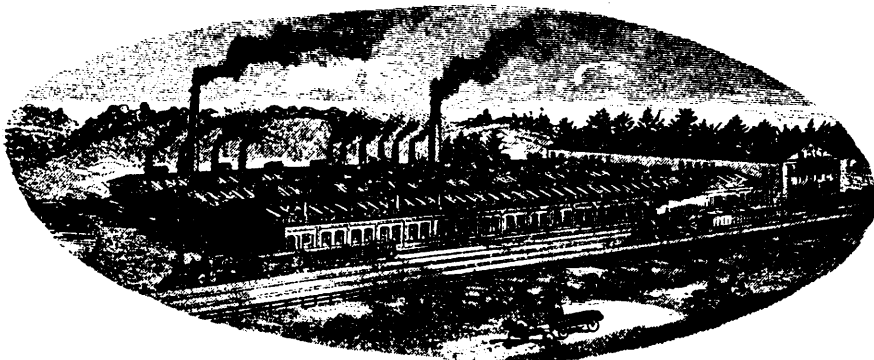
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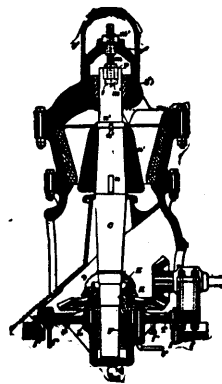
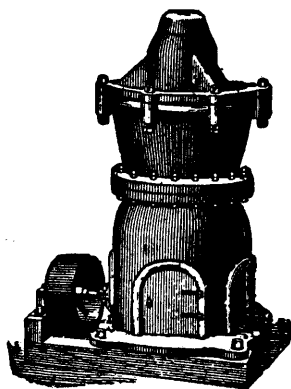
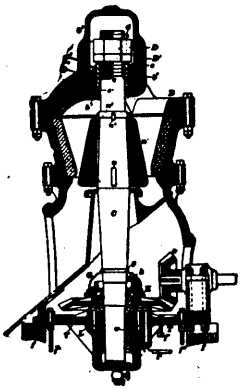
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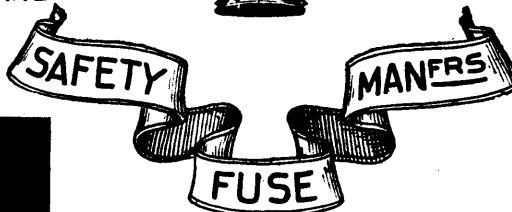
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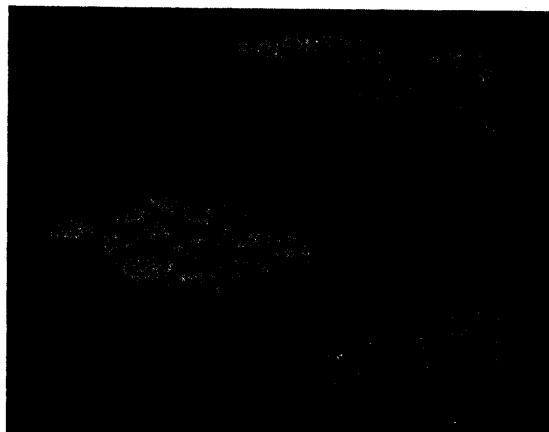
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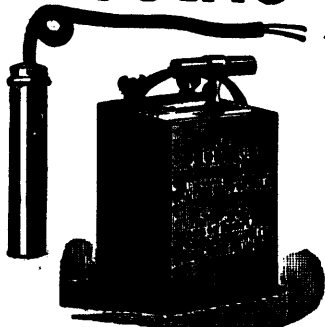
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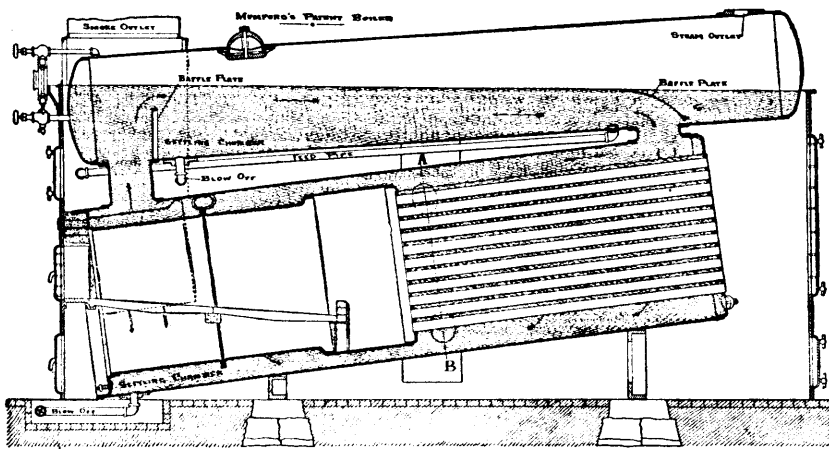
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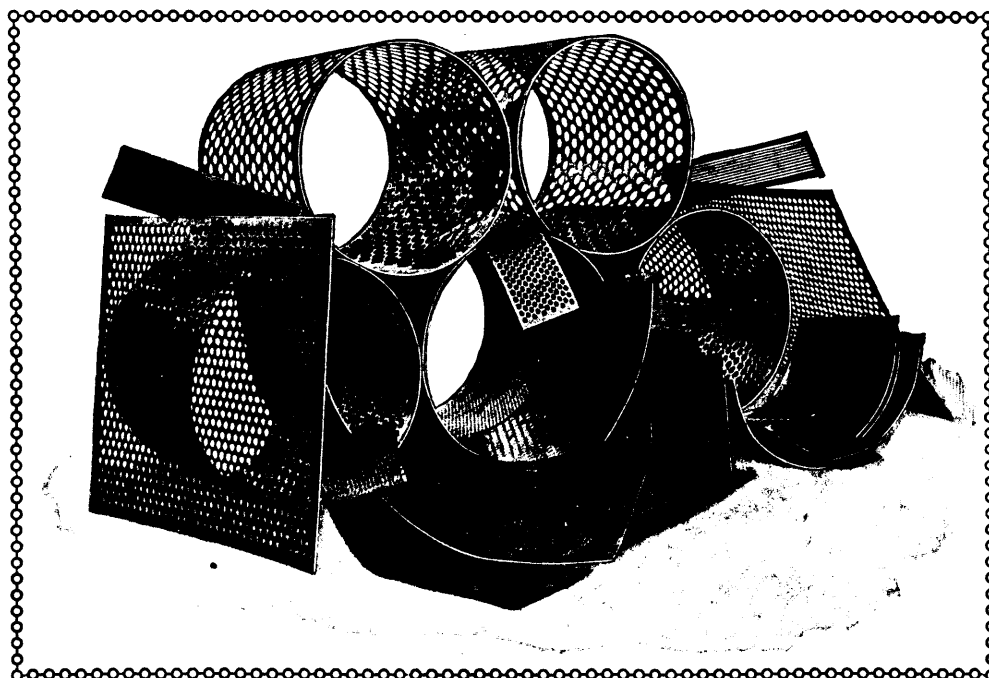
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