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Established 1882

Vol. XVII.—No. 6.

MONTREAL—OTTAWA—HALIFAX.

JUNE, 1898.

**WHY** are some mines using hand drills when a power machine will save them the labor of 6 to 10 men.

**WHY** do other people use steam for running drills when a large saving can be made by using compressed air.

**WHY** are old type and un-economical compressors in use when a saving of 15 p.c. or more can be obtained by modern plant

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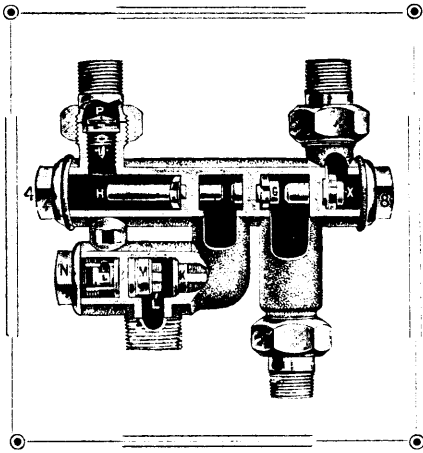
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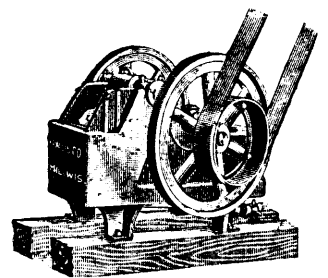
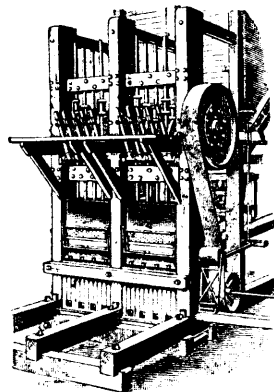
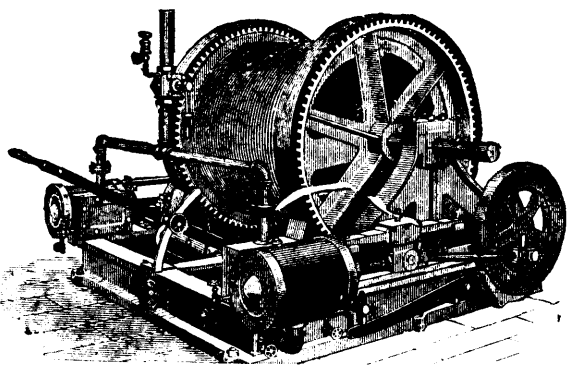
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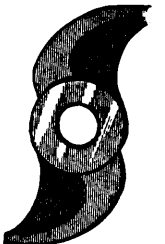
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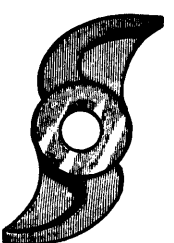
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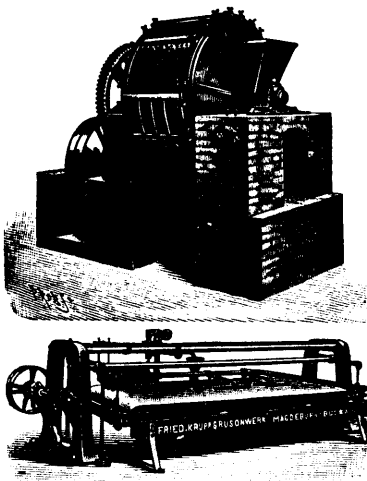


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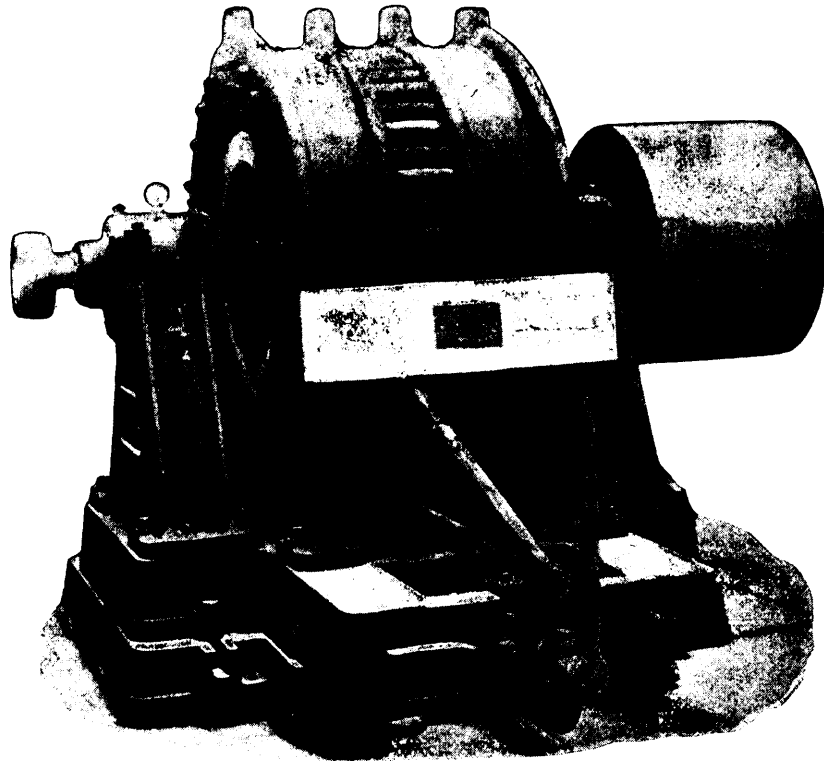
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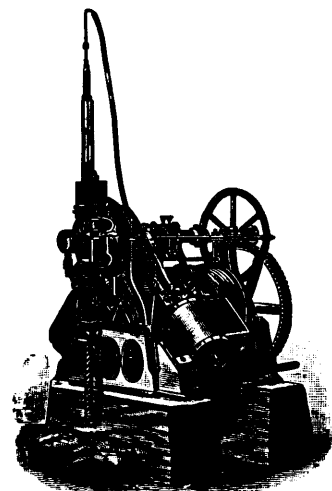


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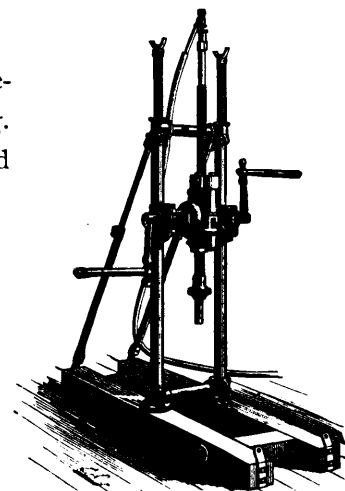
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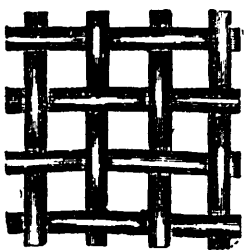
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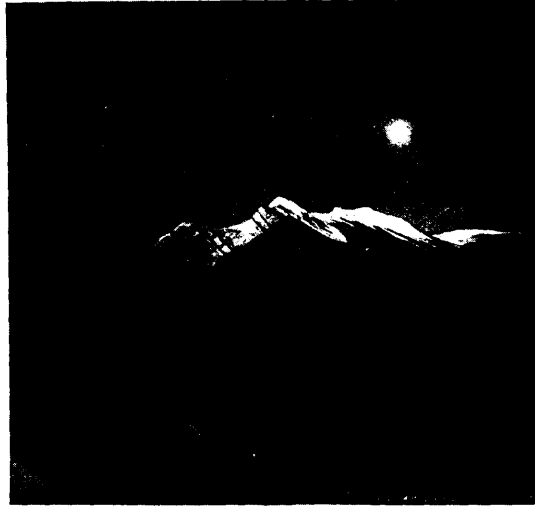


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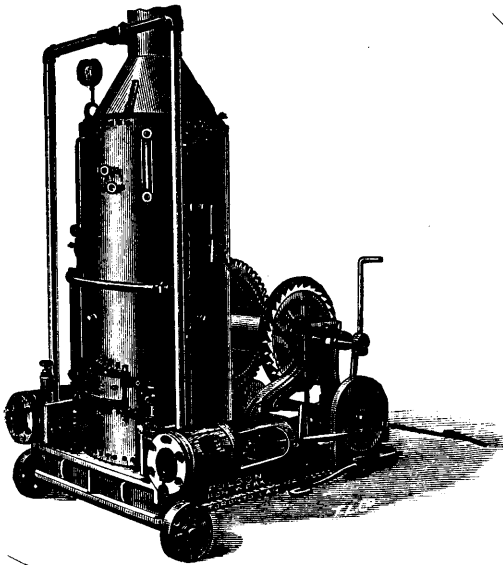
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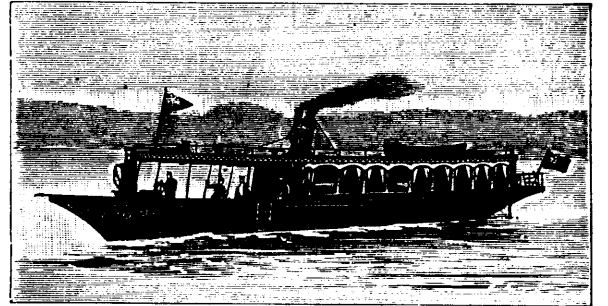
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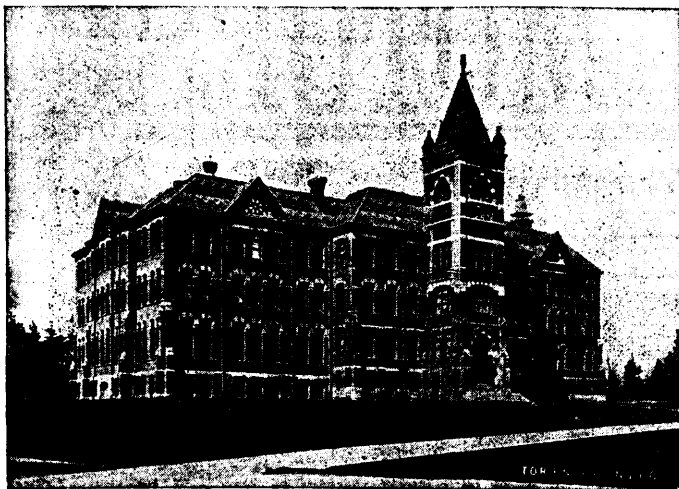
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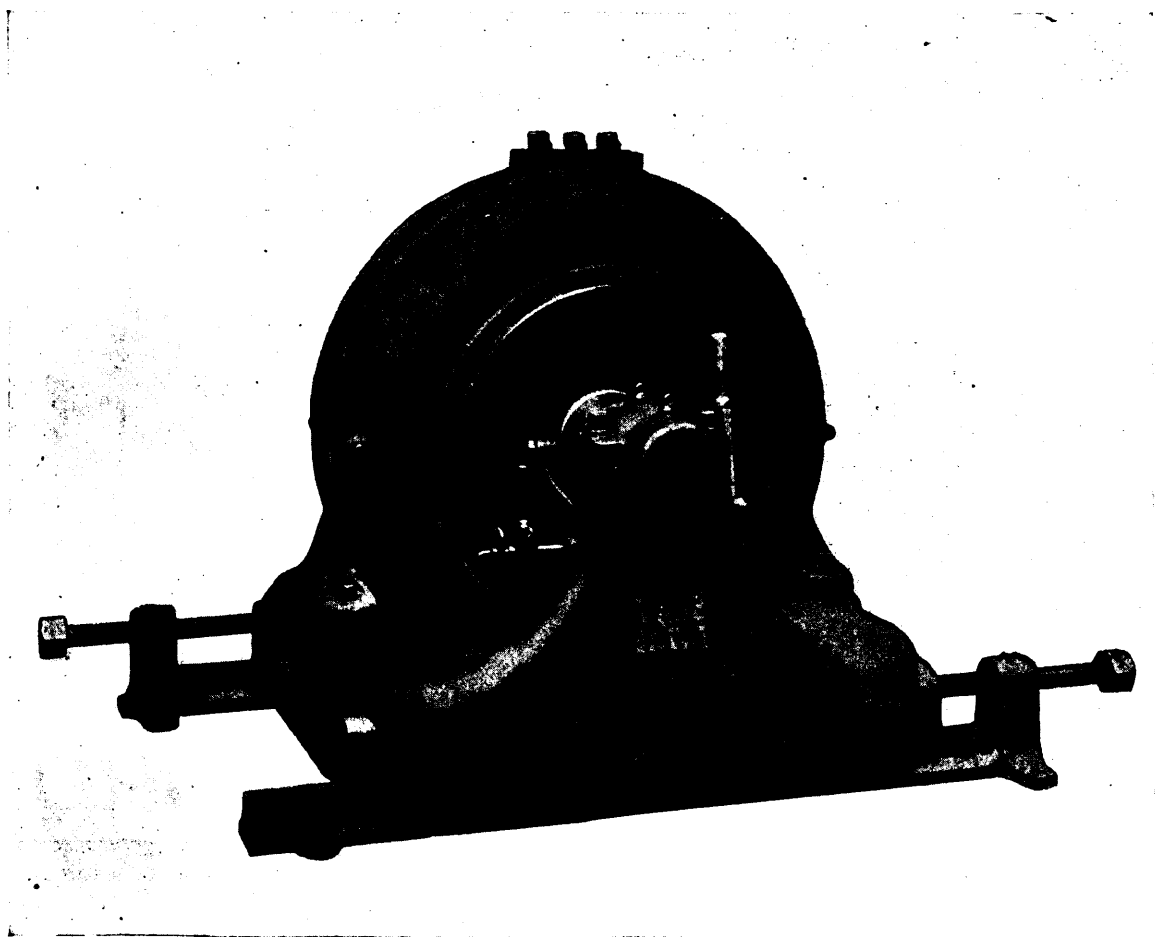
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		Quantity.	Value.	Quantity.	Value.
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“ Quartz .....	Oz. ....	62,259	1,244,180	106,141	2,122,820
Silver .....	Oz. ....	3,135,343	2,100,689	5,472,971	3,272,836
Copper .....	Lbs. ....	3,818,556	190,926	5,325,180	266,258
Lead .....	Lbs. ....	24,199,977	721,384	38,841,135	1,390,517
Coal .....	Tons ....	894,882	2,688,666	882,854	2,648,562
Coke .....	Tons ....	615	3,075	17,832	89,155
Other materials.....			15,000		151,600
			\$7,507,946		\$10,455,268

Production for 1890, \$2,608,608; for 1896, \$7,146,425; for 1897, \$10,452,268.

## GOLD.

Gold-bearing lodes are now being prospected in many parts of the province, and at Rossland magnificent ore-chutes of very profitable gold-copper ore are being mined and smelted, the Le Roi having paid to date, \$725,000 in dividends, with a large and increasing amount of ore in sight as the workings attain greater depth, while systematic development on other properties is meeting with excellent results, mining having just fairly begun in this camp. Little doubt can now be entertained that Rossland will become a heavy producer of gold, and that excellent properties now only await sufficient and abundant capital to become paying mines, to further aid in which the facilities for cheaper transportation and smelting are being now supplied. At NELSON and at FAIRVIEW, CAMP MCKINLEY, GREENWOOD, CENTRAL and other camps in the southern part of Yale, important work is being done on the quartz ledges there, several new mills being under erection.

Exploratory work is also in progress in EAST KOOTENAY and in LILL-OOET, ALBERNI, and on the Gulf islands and along the coast line of the mainland, as well as in other parts of the province.

In CARIBOO, several large undertakings, involving a large amount of capital, are at work exploring both modern and ancient river channels, the Cariboo Hydraulic Mining Co., on the Quesnelle river, proving, on development, to have in a channel of the latter kind, a great gravel deposit of exceptional richness, while other parts of this district now offer every inducement to capital.

Into CASSIAR, OMENICA, and the great area to the north, as well as Cariboo, there now promises to be a great exodus of explorers, incited by rich diggings now being mined in the YUKON, as on the KLONDYKE, to the north, and river and creeks long reported to be gold-bearing will now be made accessible, and well tested.

## SILVER-LEAD.

Despite the drop in the price of silver, the SLOCAN mines are being much more extensively worked, while the shipments of high grade ore are constantly increasing, the higher price of lead more than compensating for the lower silver values. The production for 1897 has much exceeded that of 1896, as such mines as the "Payne," "Ruth," "Whitewater" and other mines increased their output.

At NELSON, the "Silver King" or Hall mines is shipping constantly a large amount of silver-copper ore, and the LARDEAU, TROUT TAKE, ILLE-CILLEWAET districts, on further exploration, promise to become rich districts. In EAST KOOTENAY large bodies of silver-lead ore will be mined on completion of the railroads now under construction.

## COPPER.

Copper is being produced to a limited extent at ROSSLAND and NELSON, but the large deposits of at present low-grade ore in the BOUNDARY CREEK district will be fully tested when the railroad, now almost assured, is constructed. Prospecting is being done at KAMLOOPS, along the west coast of

the mainland and of Vancouver island, as well as at many other points, and TEXADA is producing high grade bornite ore.

## COAL AND COKE.

The large collieries on VANCOUVER ISLAND are producing about a million tons of coal annually, and at COMOX an excellent coke is now being produced, much of which is shipped to the inland smelters. The great deposits of coking coal in East Kootenay, at the CROW'S NEST PASS, are now being opened, as the C.P.R. is now being built to the Columbia river to supply the great mining regions with cheap coal and coke.

## SMELTERS AND RAILROADS.

The smelting industry is now beginning to assume large proportions, as preparations are being made to treat the ores of this province within her own borders, a most important factor in the increasing prosperity of this country, entailing as it does, and will, the employment of much capital and many men. The extension of the railroad systems to different parts is now in progress, and the next few years will see many parts in which the prospects for good mining are excellent, made easy of access, while ores can be shipped with facility to the smelting centres, where the assembling of the various interfluxing ores will make possible the treatment of all British Columbia ores at home.

## CAPITAL.

Capital can now find here excellent and many opportunities for investment, if proper business care and the experience of qualified men are utilized, as the values placed on mines and undeveloped properties have reached a reasonable basis.

## MINERAL LANDS.

Mineral lands are open to location to any person over eighteen years of age, who has obtained a free miner's certificate, and perfect titles to lode claims can be easily secured after \$500 worth of work has been done per claim. A great extent of territory has yet to be prospected.

## YUKON GOLD FIELDS.

As the KLONDYKE and other gold fields in the Yukon in British territory is reached mostly via British Columbia, all SUPPLIES and OUT-FITS obtained at VICTORIA, VANCOUVER, ASHCROFT, KAMLOOPS, etc., can be taken in FREE OF DUTY, which otherwise WILL HAVE TO BE PAID if not purchased in CANADA.

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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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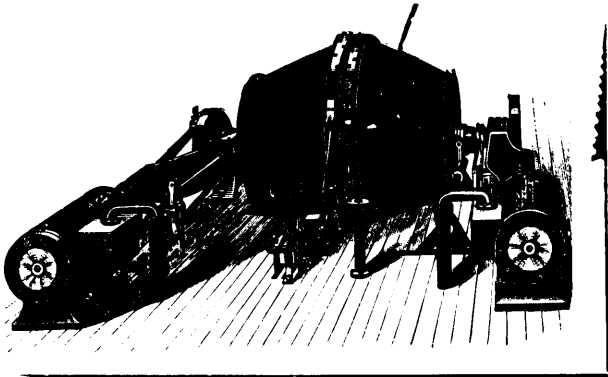
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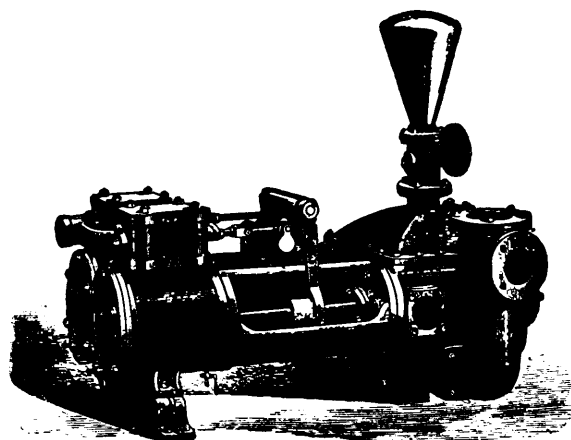
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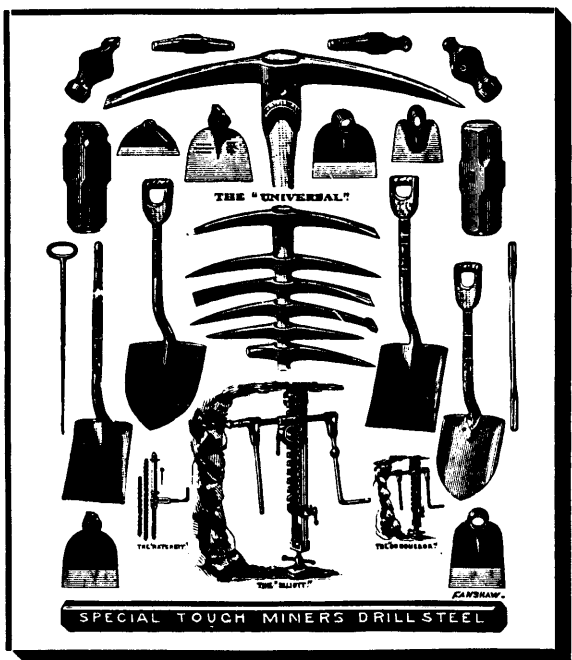


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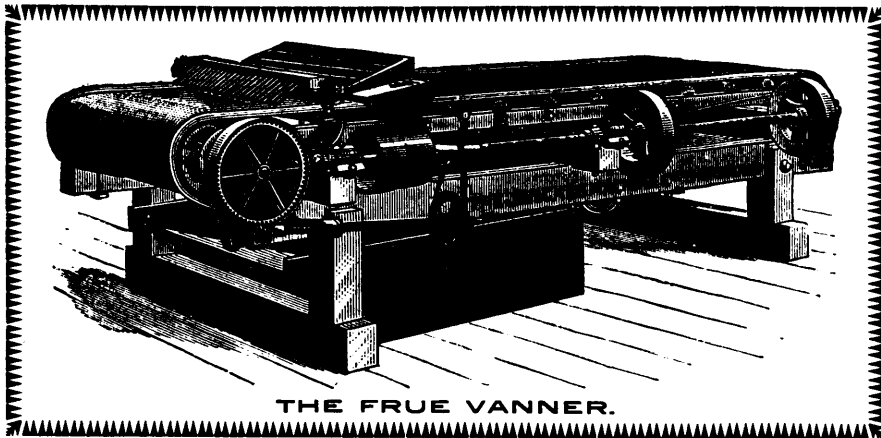
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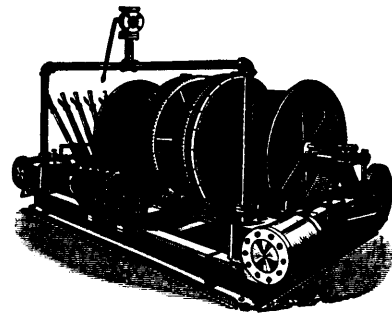
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JUNE, 1898.

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### The Nova Scotia Mining Law.

Canadian mining laws in general are based on the policy of retaining in the Crown the ownership of certain mineral rights, and of administering the same, by means of licenses and leases, so as to secure, on the one hand, the most effective and economical development of mineral resources, and, on the other hand, a continuous revenue from the mining industry. There is plausible ground for this policy, in the fact that mineral deposits are absolutely and irreparably exhaustible. Wasteful methods in agriculture, or in the utilization of forests, are not utterly beyond remedy. But the destruction of mineral resources is final, and may involve ruinous consequences to national prosperity. It is not easy to see, however, how this argument affects certain classes of minerals only. Coal and iron, for instance, are very generally exempted from its application, and private parties are permitted to acquire unconditional ownership of coal and iron ore deposits and to squander them at will. Yet these materials are really more important to national power, whether in war or in peace, than gold or silver. This is especially true of coal, which has assumed in modern naval warfare a value scarcely second to that of gunpowder, and certainly surpassing that of gold or silver.

The other consideration, namely, the realization of a continuous revenue from mining, is open to the question whether such a revenue can be best secured by a governmental administration, special supervision and special taxation of the mining industry, or by treating that industry like all others, and leaving its development to the operation of unhampered self-interest. The latter course is unquestionably simpler. Whether it is wiser, remains to be proved. The example of the United States system can scarcely be said to have furnished a satisfactory answer to the question. The United States federal law is complicated with unwise and unnecessary peculiarities of mining titles (extra lateral rights, etc.) which operate as a handicap upon legitimate industry, without adding in any way to the revenue of the government. At the same time, the enormous extent of the mineral resources of the United States public domain is such as to postpone to a remote future the prospect of their approaching exhaustion. Hence the policy of the United States, in its almost recklessly liberal encouragement of private enterprise, may be the best for the present stage of the national development. Unquestionably, notwithstanding all its incidental defects, that policy has effected an unexampled activity in mining on the public domain, and has built up great and wealthy communities, from which the nation receives indirectly much more benefit than could have been secured by a direct and exceptional taxation of the fundamental industry to which they owe their existence.

But the Canadian system, being, as it is, free from some of the vicious elements of the United States law, could be made equally effective in the encouragement of mining, if it were wisely adjusted to the conditions affecting that industry. In our opinion, it is a mistake to lay upon mining a tax heavier in proportionate amount, or more vexatious in manner of collection, than those to which other industries of production, manufacture or transportation are subject. The average profits of mining are not excessive. If they were, the rush of capital into this industry would both prove the fact and, sooner or later, cause it to cease to be a fact. In these days, no industry not enjoying some sort of legal monopoly, can long be excessively profitable. At all events—to take as an instance the ultimate subject of this article—there is no evidence that mining (especially gold mining) in Nova Scotia is so attractive to investors that it may safely be regarded by the Provincial Government as a special source of revenue rather than as a co-ordinated element of the general activity of citizens, to be rated and burdened like the rest, or even as a business deserving special encouragement, because an element of future prosperity and wealth to the whole community.

Upon any theory, it is clear that all regulations, interferences, requirements and exactions which burden a particular industry, without yielding an adequate compensatory benefit to the State, are to be condemned. To be more specific, the two most desirable features in a mining code are simplicity and permanent uniformity. Investors of capital in mining (and there can be, nowadays, no largely productive mining without large investment of capital) need to know exactly both the present and the future conditions of their rights. Few things are more annoying and discouraging, to all concerned, than the annual change of a mining law by amendments, substitutions and additions, which must be laboriously hunted up and studied, before it can be safely determined what the law actually is.

The law relating to mines and minerals in Nova Scotia, though by no means the worst instance that could be cited in this respect, is bad enough to serve as an illustration of this proposition. To go no further back than 1892, when the "Act to amend and consolidate the Acts relating to mines and minerals" was passed, an examination of the Provincial legislation shows that only two days after the passage of that Act, one important section (Sec. 132) was unconditionally repealed, and another (Sec. 117) was largely augmented and qualified; that in 1893, ten sections were amended or repealed, and in many instances replaced with substitutes; that in 1897 the amendatory Act of 1893 was again amended by an Act which was itself amended *the same day* (one important section being repealed and replaced with a substitute, and another being qualified); and that during the present

year three Acts have been passed (Chapters 26, 27 and 28 of the Acts of 1898), which largely affect all preceding legislation, without precisely specifying the particular sections affected. Undoubtedly these three recent Acts, which enlarge the authorized area of single grants for alluvial gold mining, etc., and give additional (though too limited) discretionary powers to the Mines Department, constitute a step in the right direction. For the true way to formulate such a system is to lay down, by legislation, certain outlines which will not require perpetual modification, and then give to the Mines department authority over the details of administration. The attempt to cover by legislation both general principles and specific administrative details, inevitably results in patchwork. A patch is put upon a statute to remedy an observed or asserted defect, previously overlooked; then that patch produces wrongs or evils not intended, and another patch is called for to cover these, and so on, *ad absurdum*. Bearing in mind that every such piece of tinkering is almost certainly urged and secured by parties suffering, or professing to suffer, wrong or hardship under the existing law, and not concerned as to the collateral effect of the provision which will give immediate relief to them; that legislators, as a rule, do not understand the conditions of mining; that they cannot be relied upon to perceive the full legal effects of apparently innocent amendatory Acts, which seem to them to be called for in simple justice to individual cases; and, finally, that, under pleas of this nature, schemes of pernicious character have, in times past, actually secured legislative aid.\* We must confess that the worst form of a mining law is that which consists of statutes, defective at the beginning (because framed in ignorance, to cover in detail unknown conditions), and subsequently amended at frequent intervals, upon the solicitation of particular interests. The final result of such successive amendments is pretty generally a riddle for courts to solve. At all events, it is likely to present a formidable objection in the eyes of laymen who have money to invest, and are willing to take the inevitable risks of mining, but do not feel inclined to assume in addition other burdens, either of expense or of uncertainty.

In this connection, the paper read by Mr. B. C. Wilson, of Waverley, before the April meeting of the Mining Society of Nova Scotia, and published in the May number of the REVIEW, is worthy of special attention. What we have said above indicates the need of a codification and simplification of the Nova Scotia statutes. Mr. Wilson goes further, pointing out, by way of illustration, irregularities, inconsistencies and deficiencies of the law, apart from its complications and obscurities. Without attempting, at this time, to discuss either the evils he describes, or the specific remedies which might be devised for them severally, we would heartily express our approval of his main proposition, namely: that the situation calls for a thorough revision of the statutes—not for additional patches, laid on the existing pile—and that this revision should proceed primarily from mining experts, not from Government officials or ordinary legislative committees. We may add that the best legal talent employed to aid in such a work, would not be thrown away. Mining men may know very clearly what reforms are needed; but the art of formulating laws which will have neither more nor less than the intended effect is an art by itself.

The desideratum, in our judgment, is a clear and simple mining code, which will not need amendments. To this end, provisions likely to need modification for temporary or local reasons should be omitted from the statute, and left, within liberal limits, to executive discretion.

\* We deem it proper to say here that we do not now refer to anything which has taken place in the Province of Nova Scotia, or, indeed, in the Dominion. Possibly our Canadian records are not wholly free from stain in this respect; but the particular instance we have in mind was furnished in 1894 by the Legislature of the State of New York. That, however, "is another story."

The formulation of such a code ought to be a deliberate and careful proceeding. The authors of it would be disgraced, if (like the Act of 1892) it had to be amended two days after its passage by the Legislature; or (like the Act of 1897, amending the amendatory Act of 1893) it had to be repealed in part on the same day. Rather than risk such mortifying results, it would be wise to secure thorough scrutiny and discussion beforehand, even at the cost of some delay.

Mr. Wilson favors a separate Act for mines of gold and silver as permitting the avoidance of cumbrous paraphrases. We see no objection to this, though we think it might be better to omit "silver," which, except as an alloy of very subordinate value with gold in gold mines, usually occurs with lead or copper ores, or (when in veins of "true" silver ores, of which we now recall no important instance in Nova Scotia) under conditions justifying its separate classification by the law. Our own observations in this article have been designed to refer chiefly to the gold mines of Nova Scotia, since these appear to be the principal sufferers from the present law, and gold mining appears to be, perhaps for this reason, the industry of Nova Scotia most needing a reform of the mining law, and most likely to respond to such a reform with increased enterprise of exploration and activity of production. If the miners of other metals, or of coal, have anything to complain of, they can agitate in their own time and way for relief. For the present, it seems to us that Mr. Wilson's proposal contemplates as much as can wisely be attempted at one time; and we hope that it will speedily be realized in universal, harmonious, intelligent and effective action by the representatives of gold mining in Nova Scotia.

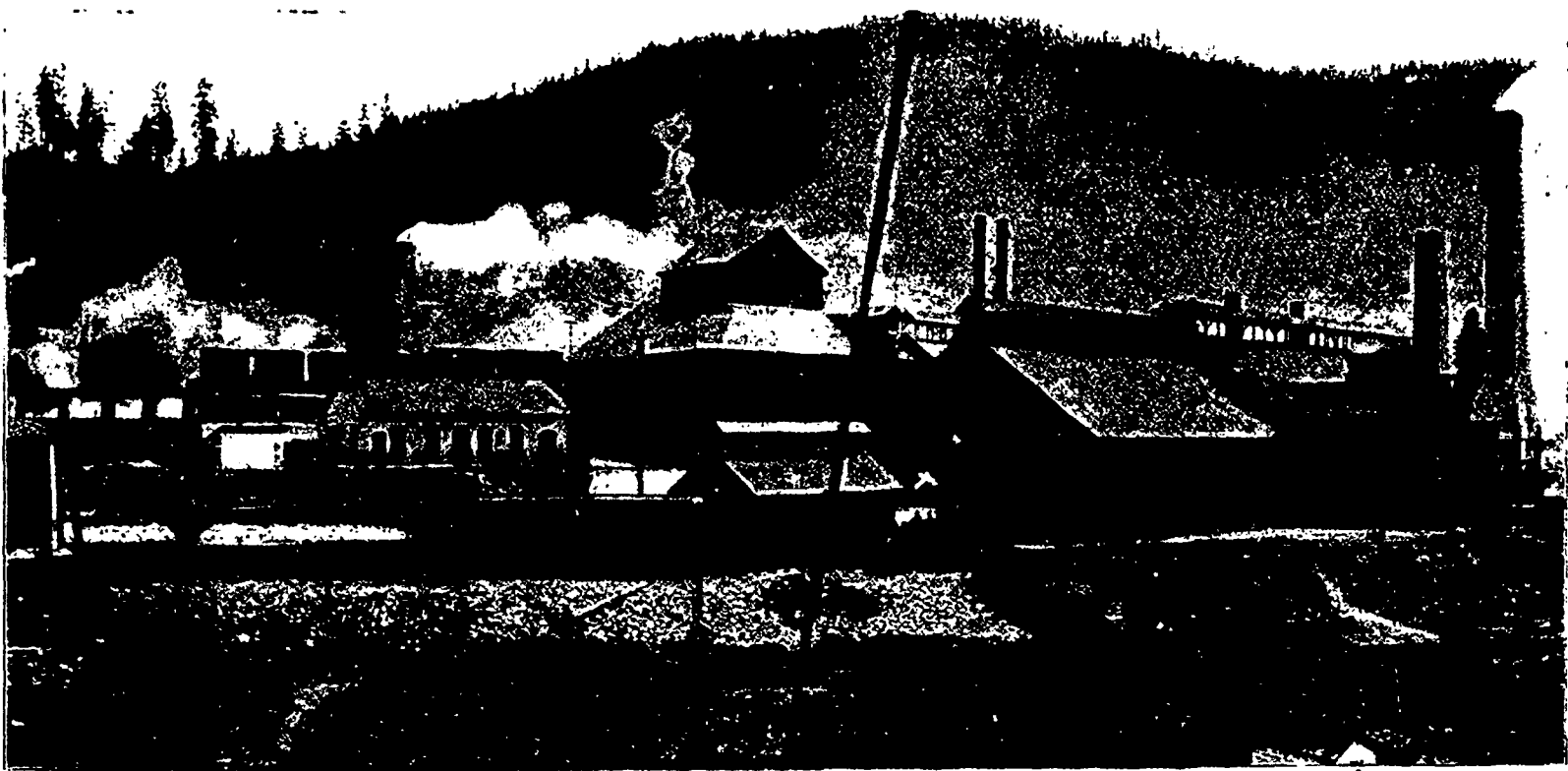
### The Gold Fields of Canada.

(From Canadian Mining Manual, 1898.)

It may be regarded as strange that a country, in which the discovery of alluvial gold antedates the similar discovery in Australia by fifteen years, and that in California by thirteen years, should be only now attracting the attention of the financial world to the wealth of its auriferous gravels and lode mines. Yet that is Canada's position today, although it is a country in which the political and economic conditions existent are most favorable for a development of a mining industry; a country where one operates under the security of the British flag, where there is a salubrious climate, where the necessary factors of wood, water, food and supplies are in abundance, where the titles are secure, and the administration of law and order are unquestionable, where labor and fuel are abundant and comparatively cheap, and where the home industries supply all the machinery, tools and equipment desired. This region so favored has been passed over by capital for nearly sixty years in favor of the greater wealth of the Western United States, the golden stores of Australia, and, more recently, the phenomenal deposits of the Transvaal. Possibly the exceedingly burdensome restrictions imposed on the mining industry by the Government of this last country has directed the attention of Englishmen (who practically are the capitalists of the world in mining matters) to a country over which their own flag floats and in which the only struggle will be with economic and not with political conditions.

In the statistical compilation published each year by the Geological Survey of Canada as a "Summary of the Mineral Production of Canada," it appears that the total value of all minerals produced in the Dominion in 1886 was in round numbers about \$10,000,000, but for the year 1897 this value had increased to \$29,000,000, of which coal and coke contributed about \$7,500,000, and gold something over \$6,000,000.

In 1886 the production of gold amounted to \$1,365,496, being 13 per cent. of the full total; in 1897 the gold product constituted



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over 21 per cent. in value of all metallic and non-metallic minerals produced in Canada. Its ratio of increased production each year for the last three or four years has also been greater than that of any other mineral, and in consequence of the attention which has been directed to Canada during that period, there has been a general inquiry by investors from abroad regarding the extent, situation and probable profits of the various gold fields of this Dominion. To answer this inquiry in a broad and general way, but yet with a statement of uncolored facts, is the object of this article, lack of space, however, precluding any attempt to go into details of different districts or of individual properties.

It may be said, broadly speaking, that a traveller landing in Halifax puts his foot on gold-bearing rock when he steps on shore, and that, from the time he takes a transcontinental train in that city bound for the Pacific Coast, there is not a day of his journey on the railway that he does not pass over some portion of territory which is, or has been, more or less auriferous. During his first day he will travel for a time within sight of some of the gold districts in Nova Scotia, in which the first successful vein mining for gold was done in Canada; before daylight of the next day he will pass near portions of the Province of Quebec in which alluvial mining has been carried on since the early sixties, and twenty-four hours later he touches the border of the region round Lake Wahnapiatā, in which gold quartz veins have been found and are now working. In the evening of this third day he enters a district of that promising new Ontario, which is beginning to have a respectable production of the precious metal, and in which developments are so rapid as to justify a belief that only experienced exploitation is necessary in order to establish a permanent and profitable gold mining industry. The fourth day finds him at the western boundary of this new Ontario, and it is only the fifth day that will be passed in going through territory which has, perhaps, a doubt of possible auriferous deposits; but from the time he enters the portal of the mountain regions to the last moment of his journey's end he is passing through a succession of mineral bearing districts in which the mining of gold has been more or less prominent since 1860.

Along this stretch of 3,762 miles of railway journey are four provinces which contain the principal gold fields of the Dominion, excepting only that unknown and uncertain tract of the North-West known as the "Yukon Region."

These provinces are Nova Scotia, Quebec, Ontario and British Columbia, and a brief account of the history, production, area and geology of each of the known fields is given below, beginning at the east and proceeding westerly.

#### NOVA SCOTIA.

*History.*—The first discovery of gold in this Province is imputed to Captain L'Estrange, R.A., during a fishing trip made in 1858, but the first discovery to be made public and to attract attention was undoubtedly that of a farmer, John Pulsiver, in the summer of 1860, in a portion of what is now Tangier district, known as "Mooseland." Mr. Pulsiver's discovery resulted in numerous explorations by other people in other sections that same summer and the following spring.

The industry of gold mining dates from the year 1862, when the Government appointed an officer known as the "Chief Gold Commissioner," and framed laws governing the acquisition and working of gold bearing lands, imposing a royalty upon the gold produced, and commenced the publication of a series of annual reports. In this year also arose the excitement consequent upon the finding of gold in many and separated portions of the Province and the inception of mining work in many of these districts. This excitement was fed for many years by the richness of quartz veins which were found cropping to

the surface, and was increased to a "boom" by the schemes of both American and English speculators and promoters, which boom was due in no small respect to the very exaggerated ideas of the richness of the veins discovered. The excitement began to fade in 1868, when the lean and poorer portions of the lodes began to predominate over the rich pay-streaks, and when shareholders began to realize that their extravagant expectations of dividends were unfounded.

When one considers that these early discoveries were all of narrow veins carrying very high value in pay chutes, that the development and working of these veins was intrusted to men more accustomed to fishing than to any other pursuit, that the milling was of a very imperfect kind entailing large losses, and that the character of the ore favored speculation by the workmen (a source of no inconsiderable loss), such a reaction can be seen to have been inevitable. The unprofitable character of many of the early investments made was due not only to the narrowness of the veins and their uncertain continuity, but in a greater measure to the gross incapacity of the management supplied. From 1868 to 1882 there followed a period of depression, and amongst capitalists there arose a distrust of Nova Scotia gold properties and a feeling that the veins were too patchy or pockety in character to be reliable as an investment. During this period of depression the production fell off to about half of what it had formerly been, and the greater part of this diminished production came from discoveries of new districts, or from new and rich veins in some of the older districts; but the management did not improve and the same fate befell these later discoveries which had befallen the earlier ones, viz., that they were worked in a manner entirely devoid of system or economy, no ore bodies were opened up ahead, and no reserve fund was maintained in the treasury.

Some twenty years after discovery, in 1883 or 1884, a new era began, especially in regard to the character of the management employed. A number of men of experience and training in other mining countries were intrusted with the direction of mines, which were chiefly properties that had been idle for ten years or more. The effect of the introduction of American methods, of modern machinery, better mills and business management was seen in the yield for the year 1885, since which time the value of the yearly production has been from \$400,000 to \$500,000. The result of this new management has been an increased attention paid to the mining of large bodies of low grade material which hitherto had been disregarded as profitless, and the notable profits which have been made during the last few years from material yielding only from four to six dwts. to the ton have occasioned a partial disappearance of that distrust amongst capitalists which had previously marked this field. Nor is it unfair to say that the mine owners themselves must be largely held responsible for the delay in the development of this Province, for the reason that prices largely in excess of values were asked for properties upon which there were absolutely no reserves, little development and no plant of value. In almost every case since 1885, where ordinary business prudence has been exercised in the selection of a property and the price paid for the same, and in the choice of a managing man, success has resulted from the venture, and to-day many properties are equipped with plants that will stand comparison for effectiveness and economy with those of any other gold producing country.

*Production.*—From the year 1862 the Department of Mines has required sworn quarterly returns to be made by each person or company operating a gold mine, showing the number of tons of stuff milled, the yield of gold therefrom and the amount of days' labor performed. From these sworn returns on file in the office of the department at Halifax, the following tables have been prepared:—

TABLE NO. 1.

Annual yield of Nova Scotia gold fields from 1861 to 1897.

Year.	Tons Milled.	Gold Obtained.			Value at \$19.50 per Oz.	Average Yield per Ton.
		Ozs.	Dwts.	Grs.		
1861 (a)	.....	6,070	0	0	\$117,000	.....
1862	6,473	7,275	0	0	141,862	\$21 91
1863	17,002	14,001	14	17	273,034	16 06
1864	21,434	20,002	18	13	390,447	18 21
1865	24,423	25,454	4	8	496,357	20 32
1866	32,162	25,204	13	2	491,491	15 28
1867	31,386	27,314	11	11	532,634	16 96
1868	32,262	20,541	6	10	400,555	12 41
1869	35,147	17,868	0	19	348,426	9 91
1870	30,829	19,866	5	5	387,392	12 56
1871	30,791	19,227	7	4	374,933	12 17
1872	17,093	13,094	17	6	255,350	14 94
1873	17,708	11,852	7	19	231,122	13 05
1874	13,844	9,140	13	9	178,243	12 87
1875	14,810	11,208	14	19	218,571	14 76
1876	15,490	12,038	13	18	234,754	15 15
1877	17,369	16,882	6	1	329,205	18 95
1878	17,990	12,577	1	22	245,253	13 63
1879	15,936	13,801	8	10	269,127	16 83
1880	14,037	13,234	0	4	258,063	18 37
1881	15,556	10,756	13	2	209,755	13 48
1882	22,081	14,107	3	20	275,090	12 45
1883	25,954	15,446	9	23	301,206	11 60
1884	25,147	16,059	18	17	313,169	12 45
1885	28,890	22,202	12	20	432,952	14 98
1886	29,010	23,362	5	13	455,564	15 70
1887	22,280	21,211	17	18	413,632	18 56
1888	36,178	22,407	3	10	436,940	12 08
1889	39,160	26,155	6	13	510,029	13 02
1890	42,749	24,358	9	9	474,990	11 11
1891	35,212	23,391	0	0	456,125	12 95
1892	33,633	21,080	3	18	411,063	12 22
1893 (b)	28,040	14,030	5	7	273,590	9 75
1894	39,333	14,980	7	13	282,117	7 17
1895	58,082	22,112	17	21	431,202	7 42
1896	65,873	25,596	14	6	499,136	7 57
1897	76,559	26,579	19	21	518,311	6 78
Totals..	1,029,923	660,446	8	14	\$12,878,710	\$12 50

(a) Estimated, authority of A. Heatherington, in "Practical Guide to the Gold Fields of Nova Scotia."

(b) For 9 mos. only, the Govt. fiscal year being changed in 1893.

**Area.**—The area of the lower Cambrian rocks which constitute the gold measures of Nova Scotia has been estimated by various authorities to embrace from five thousand to seven thousand square miles. These rocks extend along the Atlantic coast-line, in a general north-east and south-west direction for about 250 miles, with a width ranging from 10 to 30 miles. But a large portion of this area is occupied by granitic and gneissic rocks, occurring in patches and in continuous masses, which, when fully mapped out, will probably reduce the area of the gold measures to between 3,000 and 3,500 square miles.

The combined area, however, of the different districts which are producers is only about fifty square miles.

A study of the excellent maps which have been made of this gold field by Mr. E. R. Faribault, of the Geological Survey of Canada, leads one to the conclusion that there are many eroded anticlinals, not yet explored, which may ultimately become gold districts, since a very considerable portion of Nova Scotia is yet a comparative wilderness, known only to the hunter and the lumberman.

**Geology.**—The gold of Nova Scotia occurs both in quartz veins and in broad bands or belts of bluish fissile slates in which are inter-laminated, or interstratified, veins and veinlets of quartz, with threads and stringers of the same material ramifying in all directions throughout the mass, the gold being found in the laminæ of the slate as well as in the quartz itself. The quartz of the veins is both vitreous and opaque, ranging in color from bluish-black to milk-white, and carrying as associated minerals arsenopyrite and pyrite chiefly, with smaller quantities of chalcopyrite, blend and galena, and occasional specks of cal-

cite, rhodocroisite and bismuthite. The continuous (or "main" lodes so called) vary greatly in width, running from an inch to twenty feet, but averaging usually from six to twelve inches. The auriferous slate belts range from three feet to over sixty feet in width, but are low grade in character, those worked having yielded from \$2 to \$10 per ton of rock milled; the quartz veins are higher in grade, those worked yielding from \$10 to \$1,600 per ton.

Owing to the intense metamorphism to which these veins have been subjected, no fossil remains have yet been found in them, and their age is therefore to be determined by their stratigraphical relations and not from the fossils contained. They consist of quartzites and argillites having a thickness of from ten to twelve thousand feet, and are referred by the Geological Survey of Canada to the Lower Cambrian or Pre-Cambrian age, on account of their similarity lithologically to the measures of Quebec of this age. These rocks are usually divided into two groups, an upper and a lower series, but Mr. H. S. Poole, and some others, have been disposed to subdivide the lower group into two. The upper series is composed of black, sometimes greenish, argillites both graphitic and ferruginous in character, and always fissile. The lower series is made up of compact beds of quartzite and bluish-black slates, and in it occur the gold-bearing quartz veins. This quartzite is essentially a sandstone, with usually a felspathic, but sometimes an argillaceous, cementing material. The lower part of this series, according to Mr. Poole, is made up of beds of slates and grits, not carrying quartz veins but much crumpled and contorted. Mr. Faribault does not include these beds in the gold series.

The gold districts occur along the axial lines of a series of great anticlinal folds which are the result of contraction forces applied tangentially. The tops of these folds, in places, have been so eroded as to expose the edges of the constituent strata of quartzite and slate, with the included quartz veins, constituting the "proclaimed gold districts" of the Province. These veins, in common with the slate bands above referred to, are parallel in their strike to the course of the country rock, and for that reason (amongst others) were supposed, in the earlier years of mining, to be contemporaneous bedded veins, a view taken at that time by Dr. T. Sterry Hunt, Prof. H. Y. Hind, and others, as the conformability throughout with the large beds of quartzite and slate is marked. Later investigations, after more extensive workings, tend to disprove this view and to refer them to a class of true veins which were formed by the infiltration and segregation of siliceous matter into the openings between the layers of slate and quartzite occurring along the lines of minimum pressure, or of least resistance, produced during the folding. The resultant of these two forces of gravitation and of contraction, is a force tending to separate or force apart the constituent layers of the series, and it is believed that to these forces is to be ascribed the openings (subsequently filled in by infiltration or lateral secretion) which have formed the present quartz deposits of the series. Mr. H. S. Poole (a) thus summarizes the main arguments in favor of the theory of true veins:—

"The distinctive features of the gold leads are their general conformability with the slate and quartzite beds and their regularity, suggesting that they are rather beds than veins. But there are characters that point to their being true veins in spite of these features, and they are the following: The roughness of the planes of contact between quartz and slate and quartzite; the crushed state of the slate or gouge on some foot-walls; the irregularity of the vein contents; the termination of the leads; the effects of contemporary dislocations; and the influence of stringers and offshoots on the richness of the leads."

(a) Report of the Department of Mines, N.S., 1878, p. 27.



Dr. Selwyn (*a*) holds the opinion that the quartz veins are not contemporaneous and that they must be considered as true veins. He also has pointed out the analogy between these quartz veins and those of the Bendigo district in Australia, and indicated the probability of similar origin.

The main difference or distinction between the Australian and Nova Scotia veins arises from the fact that the folds or flexures of the strata in Nova Scotia are much broader than in Bendigo, of greater extent and farther apart, and in consequence the "legs" of the "saddle reefs" extend to much greater depths than in Bendigo. The greatest depths upon the dip of the vein yet attained in Nova Scotia (some six hundred feet) show the quartz to be continuous, whereas in Bendigo "the vertical extent of the auriferous quartz is very limited," (*b*) being under rather than over two hundred feet.

The influence which the granitic masses (which, as already mentioned, cut the gold measures) have exerted upon their gold veins and their metallic contents has not been determined and requires closer study, but that they have played an important part is quite probable since in many places they must be regarded as intrusive and their influence is seen all along the edges of the sedimentary strata penetrated by them. At the Crow's Nest mine on Cochrane Hill, in Guysboro county, the metamorphic action exerted by these granites is well seen, beds of quartzite becoming vitreous quartz in their vicinity; the slates also become garnetiferous and crystals of staurolite and andalusite are of frequent occurrence.

From the similarity in structure and probable genesis of these deposits with those of Bendigo, and from the data obtained from these Nova Scotia districts which have been extensively worked, it would appear that the auriferous contents of these quartz veins and slate bands are in direct relation with the horizontal distance of such deposits from the axis of the anticlinal fold in which they occur. As some of these folds are quite sharp (having a vertical dip upon one side and from 40 to 45 degrees on the other) and others are broad, this distance will vary with each district within limits. For the narrow folds Mr. Faribault has placed the limits at from 600 to 800 feet, and for some of the broader ones the limit appears to be from 1,200 to 1,300 feet. Therefore it may be expected that, in a series of veins, the pay zone will be confined horizontally, but unconfined vertically, although the quartz is continuous beyond these defined limits.

The summary of results which will be available when the Geological Survey has completed its work in these gold districts will be of the greatest value in arriving at a probable rule for governing the pay zone of these Nova Scotia deposits.

The bulk of the gold hitherto won has come from the smaller parallel quartz veins which, in some districts, have recorded phenomenal yields (*c*). The district of Montagu is particularly noted in this respect.

The occurrence of gold in the slate has been alluded to, and more recently quartzite carrying gold in paying quantities has been found at the Richardson mine near Isaac's Harbor. To the development of these quartzose slate belts the industry must look for its enlargement and greatest profits in the future, and an indication that the industry is already turning in this direction is afforded by the returns for the year ending December 31st, 1897, which show a return of \$539,048 from 83,234 tons milled, or an average value of \$6.47 per ton.

By reason of the cheap but excellent labor, the low cost of fuel, supplies and machinery, the favorable climate and the easy means of

access, the gold industries of this Province are worthy of more attention from capitalists than they have yet received.

*Laws.*—The mining law of Nova Scotia is exceedingly fair and easy to interpret. The main provisions are:—

(1.) All mines are the property of the Crown, and the product from the gold mines is subject to a royalty of 2 per cent. upon the gross output, verified by affidavit.

(2.) Gold mining lands are laid out in rectangular "areas," having a length of 150 feet along the course of the veins and a width of 250 feet across the same. A license to prospect may include up to, but not over 100 areas, and costs the prospector 50 cents for each area in his application; the license is valid for one year.

(3.) Leases, running for forty years, can be obtained for any number of areas up to 100, upon payment of \$2.00 for each and every area leased, and a further rental of 50 cents per area per annum; this rental is rebated if the provisions of the lease regarding labor to be performed thereon are complied with; such labor being performed or such rental being paid, the lease is non-forfeitable, and the title is absolute for the period of forty years. Such leases are renewable for a second period of forty years, and are transferable, being regarded as personal property.

(4.) If the areas are upon private lands, provision is made for an agreement with the owner of such lands, failing which a method of arbitration is provided whereby the property may be acquired.

#### QUEBEC.

*History.*—Unconfirmed accounts place the first discovery of gold in the Province of Quebec as occurring during the first quarter of the century, but the first authenticated discovery was made in the gravels of the Gilbert river near its junction with the Chaudiere in the Seigneurie of Rigaud-Vaudreuil in 1834.

A young girl, Clothilde Gilbert by name, (still living in 1896) in watering her father's horse in the Gilbert one Sunday morning had her attention attracted to a glittering stone at her feet, which she picked up and took to her parents as a curiosity. On account of its weight, color and oddity the stone (a nugget weighing 2 ozs. 4 dwts.) was placed on the chimney-shelf where a short time after it was noticed by Mr. Charles DeLery, the seignior of the district, who had business with her father, one of his censitaires.

Mr. DeLery bought the nugget from Mr. Gilbert, though uncertain that it was real gold, and when he went to France that year he took the nugget with him, from which, on learning its real character, he had some teaspoons made which are still in the possession of the DeLery family.

The first public announcement of this discovery was published the following year in a communication to the *American Journal of Science*,\* by Lieut. F. H. Baddeley, R. E., then stationed in Quebec.

Upon learning the value of this discovery further search was instituted resulting in the discovery of several nuggets, but no attempt to work the gravel was made until about twelve years later. In 1846, for political services it is reported, Mr. DeLery received from the Government a grant in perpetuity of the mining rights within his seigniorie, covering about 100 square miles.

In 1847 these rights were leased to a concern called the "Chaudiere Mining Co.," which, after desultory operations on the Gilbert and Des Plantes rivers for two or three years, ceased active operations.

The finding of this gold stimulated search on the other tributaries of the Chaudiere, resulting in the discovery of auriferous gravels at various points in the valley from the parish of St. Joseph northward to the boundary line. Some operations near the mouth of the DuLoup

(a) Report of Progress, Geological Survey of Canada, 1870-71.

(b) Transactions American Institute Mining Engineers, vol. xx., p. 542.

(c) The year 1891 was notable for high yields. South Uniacke returned values of 10 to 20 ozs. per ton, and Oldham had one yield of 643 ozs. from 8 tons milled.

\*Am. Journal Science, 1st series, vol. xxvii, p. 112.

produced (1851-52) over \$4,300 from an area of one acre in which the pay gravel was only 2 feet thick. The workings were a crude form of ground sluicing and were suspended in 1852 on account of troubles with the owner of the soil, although many nuggets had been found ranging from one ounce to six ounces in weight.

From 1854 to 1863 no organized work was carried on, but a few individuals, singly or in groups, continued to prospect and work small patches with the pan and rocker. In 1863 some of these individuals, the Poulin brothers, discovered rich gravel on the north fork of the Gilbert river, and the result of this discovery was a small "rush" in 1863 and 1864, during which time some five or six thousand men were attracted to these fields.

Trouble at once arose over titles, the farmers giving leases to the miners in ignorance or disregard of the fact that the seignor held all mining rights. Excitement ran high, and provincial constables were required to preserve the peace and maintain the rights Mr. DeLery had conveyed to the Chaudiere Mining Co.

In consequence of these troubles and of the difficulty of obtaining satisfactory terms from the Chaudiere Company, there resulted as large an exodus of men in 1865 as there had been an influx during the two preceding years.

The difficulties of this time, supplemented by those occurring in 1877-78, are the origin of the bad reputation which the gold fields of Quebec have had as to insecure and imperfect titles. While it is true that a very complicated and unsatisfactory condition of titles still exists in the seignior of Rigaud-Vaudreuil (largely due to leases and sub-leases *ad infinitum*) titles outside of that seignior are clear and secure, and by far the larger portion of the auriferous gravels lie outside the limits of the DeLery seignior. In 1864 the DeLery Gold Mining Company was formed, inheriting all the privileges of the Chaudiere Company for a period of 30 years from June, 1864, with the right of renewal for another 30 years. This renewal was given in 1894, and the seignior of Rigaud-Vaudreuil is now practically locked up until 1924.

The DeLery Company made a futile attempt at quartz mining near the Devil's rapids, and then ceased active work, preferring to sub let its territory. The most important of these sub-lessees was Mr. W. P. Lockwood, who, by himself and companies organized through him, undertook investigations extending over many years which demonstrated the existence of an ancient river channel on the Gilbert, and proved that the gold in the modern gravels was derived from this pre-glacial bed.

Mr. Lockwood's troubles with titles in 1877 and 1878 have been referred to above; they arose from the policy of the Government in permitting the habitants, or farmers, to grant rights, and in issuing licenses to work upon ground already covered by the rights of the DeLery Company. These difficulties culminated in 1881, when the Government entered suit to test the validity of the grant to Mr. DeLery, and to set it aside. In 1883 the court dismissed the action, declaring in favor of the validity of the grant, and in 1884 this decision was affirmed on appeal.\*

Owing to causes already mentioned this seignior has not been in favor and little or no work has been done since 1885. In 1880-83 an attempt was made, under the guidance of a man totally ignorant of his subject, to work some bench gravels on the DuLoup river by the hydraulic method, and something over \$200,000 is reported to have been expended in a ditch, pipe-line, monitors, etc., only to find after construction was finished that there existed no dump for the tailings.

Several other attempts to reach and work old channels failed for lack of capital, but demonstrated the existence of gravels carrying

gold, in quantities sufficient to yield large profits, over a large extent of country.

Gold has also been found in the superficial gravels of the Little Dittou river in the county of Compton, but as these lands are entirely in private hands (the estate of the late Hon. J. H. Pope) they are not accessible, and no information is available.

The existence of gold in the drift of the St. Francis Valley, and about the shores of Lake St. Francis, has been noted for many years, but these gravels do not appear to have been so rich as those of the Chaudiere, and little or no gold has been obtained from them. The same may be said of the deposits occurring in the townships of Weeden and Dudswell, although systematic exploration might show the existence of pay dirt.

*Production.*—It is impossible to give exact figures of the production of these fields for the reason that the Government of Quebec did not exact official returns for many years. There are returns only since 1868, and these are but fragmentary.

From 1868 to 1883 inclusive there were returned some \$280,000. From the statement of Mr. Obalski, Government Mining Engineer,† it would appear that the total production of the whole province from 1846 to 1889 is estimated, after extensive research, at \$2,000,000.

Of this amount it is estimated, by competent persons, that the alluvions of the Gilbert river alone produced fully one-half, or over one million of dollars.

*Area.*—The area over which superficial gravels carrying gold have been found has been variously reported at from 2,000 to 10,000 square miles in the different reports made to the Provincial Government and to the Geological Survey. While gold in minute quantities is widely disseminated in Quebec, the area of the region over which it is likely to be found in economic quantities is from 4,000 to 4,500 square miles.

This area is irregularly shaped, having for its largest dimensions a line running north-easterly from Massawippi Lake to Lake Etchemin, a distance of about 120 miles; its transverse width in a northwesterly direction is comparatively uniform running from 40 to 50 miles.

It must not be understood that the whole of this large area has been proved auriferous, but that within these bounds are included practically all the regions in which auriferous alluvions have been found.

The boundaries are approximately: The international boundary line on the south-east, a north-west line drawn through Lake Massawippi on the south-west, the main anticlinal axis of the Province (running from the Township of Shipton to the Township of Frampton) on the north-west, and the valley of the Etchemin river on the north-east.

Within this area are the four districts of the Chaudiere, Ditton, Dudswell and Magog. The Chaudiere (as was previously mentioned in the historical sketch) is the chief district and the largest. It comprises all the water-shed of the Chaudiere above Beauce Junction on the Quebec Central Railway, and extends in a north and south direction for nearly 50 miles, with a greatest width of about 28 miles, embracing the seigniories of Rigaud-Vaudreuil, Aubert Gallionand, Aubin de L'Isle, and also the Townships of Shenly, Dorset, Gayhurst, Spalding, Risborough, Marlow, Jersey, Liniere, Metgermette, Watford and Cranbourne.

The Ditton district covers a small area in the County of Compton of some 15 or 20 square miles.

The Dudswell area is indeterminate, but so far gold has been found here only over a few square miles.

The district along the valley of the Magog has a length of about 12 miles with a width of 20 or 30 miles.

\* "Mines and Minerals of Quebec." J. Obalski, Govt. Mining Engineer. 1889-90, p. 58.

† "Mines and Minerals of Quebec." J. Obalski, p. 62.

*Geology.*—The gold which has been obtained in Quebec has come entirely from alluvions, both ancient and modern.

That there are workable quartz veins in the Cambrian and Cambro-Silurian slates which underlie the auriferous gravels has long been the opinion of several authorities conversant with the country, (a) but the depth of the superficial deposits overlying these rocks is so great (from 50 to 200 feet) in most places as to preclude prospecting in the ordinary way.

Mr. Lockwood has informed me that several quartz veins were uncovered while working the ancient channel of Gilbert river, some of which carried visible gold and were very promising, but which nowhere cropped to the surface, and upon which no development was ever prosecuted. From the outcrop of several veins occurring in Cambro-Silurian rocks of the DuLoup valley, I have seen minute particles of free gold, but the size of the veins was too small to admit of working at a profit.

Dr. Selwyn, who twenty years earlier (b) suggested the vigorous exploitation of the old deep channels, has expressed the opinion (c) that the future of the gold mining industry of Quebec must lie in the working of the solid vein stone.

It is from the working of alluvial deposits, however, that a stimulus for prospecting for auriferous veinstone must come.

The area alluded to on the preceding page is occupied chiefly by two synclinal basins trending north-east and south-west. The first or easterly one of these synclinals lies between the ridge forming the International boundary and the uplifts of the pre-Cambrian rocks known as the "Stoke Mountain Range." This uplift is less pronounced to the north-east of Lake St. Francis but is represented by a back-bone of Cambrian rocks, some two to four miles wide, which keeps a general northeasterly course to Moose Mountain.

The second or western synclinal lies between the ridge just described and the main anticline axis of Pre-Cambrian rocks which traverses the Province in a north-easterly direction for many miles, and which is regarded as the prolongation of the Green Mountain range of the Appalachian system.

The eastern synclinal is almost entirely underlain by rocks of Cambro-Silurian age, portions towards the north, however, embracing areas of Cambrian rocks.

The bulk of the Chaudiere district and all of the Ditton district are within this eastern basin, while the Dudswell and Magog areas are in the western. The broad basin of the eastern synclinal is for the most part covered with a great thickness of superficial gravels and boulder clay, the latter of which may, or may not, have been originally deposited in this basin, but which certainly has been re-arranged by the action of the great ice sheet.

These superficial deposits have a general arrangement (d) which is as follows in descending order:

- (1.) Modern gravel and sand of a few feet in thickness sometimes containing fine gold.
- (2.) Boulder clay, often exceeding 100 feet in thickness.
- (3.) Stratified clay and fine sand; the clay usually bluish, sometimes a white "pipe-clay;" the sand hard and firm when dry, but running freely when saturated with water, forming a "quick-sand."
- (4.) Stratified yellow or reddish gravel, containing flat water-worn pebbles lying conformably and presenting the unmistakable "ear-marks of "river-wash." This gravel is usually auriferous and is the

direct debris from the wearing action of the streams of Devonian and later ages.

In some cases there is found a thin bed of sand between the yellow gravel and the bed-rock, when the gravel is then found usually to be poor and the gold lies directly on and in the rock and slate.

The gold is usually concentrated in the lowest portions of the gravel and in the seams of the decomposed slate bed-rock where the latter has been uptilted or has presented edges to the stream. Where the old bed is smooth little or no gold is found, and to this circumstance we think must be attributed the conclusion reached by a recent writer (a) that the distribution of gold in these old channels is sporadic. This opinion is strenuously opposed by Mr. W. P. Lockwood as regards the Gilbert River, and since that is the only old river bed which has yet been worked, it is not justifiable to infer that other old channels, yet to be worked, will be sporadic in character. Nor is it unusual to find, in the undisturbed, ancient river gravels of California and Australia, that there has been a greater accumulation of the gold in one portion of the river-bed than in another; the uncertainties of "smooth bed-rock" are known to every miner experienced in alluvial mining.

The authorities of the Geological Survey (b) are strongly of the opinion that the gold found in the superficies has been derived from the erosion of the Cambrian and pre-Cambrian rocks with their contained quartz veins, and that proximity to these veins is a necessary condition of a rich deposit of gravel; although as yet no quartz vein has been found which has contained gold in anything like paying quantity.

The fact exists that the richest gravels yet worked are ancient, and occur in the old channels of rivers running across Cambrian and Cambro-Silurian rocks. There is evidence to show that these rocks have had but little disturbance since Silurian times and that the rivers of that period excavated their valleys and perhaps filled them again with debris to such an extent as to divert the waters into a new course, long before the re-arrangement of surface material during the ice age; in other cases it is probable that this diversion was caused by the glacial re-arrangement.

From the fact that gold is not found in the boulder-clay it is evident that the gold alluvions were distributed prior to the clays. Where gold has occurred in modern gravels it has occurred in places below where one of these old river-beds has been crossed transversely, or impinged upon, by the course of the present river, which has acted to redistribute and concentrate the old gravels, thus causing a local spot richly auriferous.

No systematic attempt has been made to locate or map out the courses of these ancient river-beds, which may be accounted for by the fact that many of them are unquestionably below the level of the modern streams, and would entail heavy expense to keep prospect shafts and mine-workings free from water, but "it is in these old deep channels that the heaviest particles of gold may be looked for," and it is in them alone that gold mining in Quebec may expect to be remunerative; for quartz mining is not likely to speedily become a profitable industry owing to the heavy surface already spoken of. With judicious expenditure of money, advised by ability and experience, the gold fields of the Chaudiere valley should be highly remunerative to capital invested therein.

*Laws.*—The laws governing the acquisition and working of mines in Quebec do not encourage either the miner or the investor. The right to prospect and explore upon public lands is granted without fee, but before one can do any mining he is required either to obtain a

(a) T. Sterry Hunt and A. Michael, Geol. Survey of Canada, 1886. R. W. Ellis, Geol. Survey of Canada, 1885.

(b) Reports of Progress, Geol. Survey of Canada, 1870-71.

(c) Summary Report Geol. Survey of Canada, 1891.

(d) "The Gold Bearing Deposits of the Eastern Townships of Quebec," by Robt. Chalmers, Journal of the Federated Canadian Mining Institute, vol. 2, p. 21.

(a) R. Chalmers, Op. Cit.

(b) Report of Progress, 1870-71, Dr. Selwyn; ditto, 1888-89, Dr. Ellis.

"mining license" or to purchase the "mining rights" over the territory he has selected.

The former can be acquired by the annual payment of a fee of \$5.00 and \$1.00 per acre for each acre desired; the latter can be purchased outright by paying for each acre \$5.00 if "more than twelve miles from a railway in operation," or \$10.00 if less than twelve miles from such railway. No one license can be granted for more than 200 acres, and no sale of "rights" containing more than 400 acres can be made to one person.

To acquire either a license to mine, or mining rights, upon lands already granted, he must first buy the preferential right (a) from the owner of the soil, or if not able to do so he may "arbitrate" for "damages"—a procedure involving from three months to many months delay.

The Quebec law makes a clear statutory division into two realties of "the soil" and "the property under the soil" (b), and gives the owner of the soil a "preferential right" to the purchase of the property under the soil, more tersely designated as "mining rights."

There is a provision empowering the Governor-in-Council to levy a royalty, not exceeding 3 per cent., upon the net value of the gold, *i.e.*, "upon the value at the mine after deducting the cost of extraction," but this provision has never been enforced, and is not likely to be, although it hangs like the sword of Damocles over the investor's head. For the interests of the province, this section (No. 1435) should be taken off the statute book.

JOHN E. HARDMAN.

(To be continued.)

### Developments in Gold-Extracting Machinery, and Some Causes of Failure.

By JOHN W. JAFFRAY.\*

This subject is a very extensive one, whether we view it as compared with the primitive methods of ancient times, or only take into consideration the advances made in late years and the scientific methods of to-day.

My object in this brief summary will be not so much to enter into details, or to take notice of a more than very small proportion of the many new inventions that are brought out day by day, but mainly to draw attention to some of the appliances that are best known in Australia, with some notes of my own observations.

I do not presume to educate practical mill managers—many with world-wide experience in gold milling; but I do hope for their friendly criticism and their notes of actual practice. This, in my opinion, will tend to serve one of the main objects of this Institute, and thus lead to practical good, and after all the living voice testimony in a matter of this kind is by far the most effective.

In Australia during the past 40 years, over 1,300 patents have been granted in connection with mines, minerals and mining appliances; fully the half of this number have been granted during the past five years; and now scarcely a week passes without producing the subject of some improved patent in connection with this fascinating industry. And if we could place reliance on the many glowing reports we get from time to time of new and improved quartz crushers, perfect concentrators and amalgamators, and other means of saving even the finest of fine gold from the most refractory auriferous ores, surely we should have reached the acme of perfection long ago; but unfortunately actual practice tells a different tale.

(a) Sec. 1441, Quebec Mining Law, Acts of 1892.

(b) Secs. 1423-1424.

\*Australasian Institute of Mining Engineers.

All look very well on paper, and if we did not belong to an unbelieving and faithless generation, we would swallow those many statements as they are presented to us by editors and others, whom, we are quite sure, have no idea of misleading anyone; we then might well rest in calm repose, and feel satisfied that the most obstinate of refractory ores had been brought under perfect control, and must yield up the full contents of their precious metals to one or other of the many so-called perfect methods and processes available to us.

It is a remarkable fact that there are never any doubtful paying mines placed on the market for flotation; everyone of them, from the prospector's point of view, is the road to a sure fortune. And so it is with the majority of inventors. I say it with all due respect; each one of them believes that he has found some missing link, and generally they are filled with an enthusiasm that in many cases would be worthy of a better cause. Many of them die hard because it is not easy for some to see why the invention of their fertile brains is not better appreciated; but fortunately or otherwise, we are not all constituted alike and do not see things with the same eyes.

We used to laugh at the tale of the man who had a good supply of sand in his back yard and felt confident that if the ungenerous capitalist would only supply the money to float a company for him, he would soon establish a flourishing business in sand ropes. But we can match this in up-to-date experience, where an inventor sees his way to produce, not only a self power producing machine, but in addition, to give out ample power for ore crushing and amalgamating purposes, and not only so, but—contrary to all old-fashioned ideas—actually to store up an increasing force by every expended stroke, instead of reducing such force; and has this so clearly demonstrated in his own mind that he actually provides a break to prevent a run-away.

These illustrations may be considered ridiculous, but they are founded on fact, and many others of a similar character could be cited.

It is to be regretted that out of the hundreds of new inventions and patents that come out year by year—many of them with glowing reports of exhibition tests and good promises—there are few indeed that are of any practical utility. I was going to say utterly useless, but that would not be quite correct, because all help to provide revenue for our patent organisations.

At the same time we are all ready to admit the importance and great value of many inventions in connection with the treatment of gold-bearing ores, which have done much, very much, to facilitate and simplify the treatment of mineral ores, so as to secure the largest percentage of the available metals in a marketable condition at a minimum cost.

Considering the very many new inventions that have been brought out during the past years, one cannot but be struck with their rarity in actual practice. Within the past few years I have visited the principal mining centres in all the Australasian colonies, always on the outlook for good practical ideas that are not common property, and while I am ready to admit that there are instances where the old trodden path has been departed from and some new method adopted, yet they are the exception and not the rule.

There is evidently too much of the spirit of an old-time engineer who, when asked by one of his managers to modernise and improve the patterns of one of their machines, replied: "The thing has done before and why can't it do again?" That man was Scotch and it is proverbial that they are cautious; but we are Australians and if we are to uphold the motto of our standard, we must advance with the revelations of science, and we must make our gear to work in harmony with the increasing knowledge that is being imparted to us through those revelations.

Science is undoubtedly advancing. Fresh revelations are being made every day, and are being applied in many of the other industries and professions; and it is obvious, if we are to keep pace with the times, that the mining industry must throw off its "Do as we have done before" policy, and seek out the better methods, prove them, and put them into practice.

There is still too much of the old idea existent, that if a certain plant has given good results in one part of Australia, yielding dividends on say 4 to 5 dwts., the same class of plant ought to be quite as suitable for any other district without any reference to the character of the stone.

I can refer to cases, not a thousand miles from Sydney, where the stone assays on an average from 4 to 6 ozs. per ton, where they have the best of old-fashioned plants, and yet are only saving 55 to 60 per cent. of the assay value. The balance goes to the tailings heap, not lost, of course, because they know where it is.

Before passing on to consider the mechanical appliances, we are pleased to notice a decided advance in late years in the management of many of our mines, where scientific reasoning and experienced mechanical knowledge are taking the place of unscientific groping and "rule of thumb" engineering. This undoubtedly is the only way to solve the physical and chemical mysteries of our auriferous and other ores, in order to secure the precious metals in solid bullion.

In reviewing developments in gold-extracting machinery, we have to deal with a matrix, usually quartz, slate or other rock, in which the precious metals may be free, and readily amalgamated with a solvent, such as mercury, or at other times interwoven and attached to the matrix in the form of crystals, alloys, oxides, sulphides, etc., etc.

The matrix requires to be reduced or pulverized. The limit of maximum size of the grains of gangue has always to be determined by experiment, and the machinery constructed and adjusted to produce the size that will liberate enough minerals to leave the coarsest size commercially barren, and then to separate the metals from the pulp or gangue. And when we compare the methods used now and 2,000 years ago, we do not see the advances that might be expected. A form of stamper battery and amalgamation by quicksilver was used then as it is to-day. In our days there are, it is true, many forms and styles of batteries, and there have been many attempts to get something better, as in the form of rolls, centrifugal mills, ball mills and pans in a great variety of design; many of them claiming to do more work with the same power and a lesser percentage of cost for tear and wear than the stampers, and some of them, we believe, are capable of giving demonstrative proof that they possess these advantages, if put on the same footing as the stampers. A good many are doing so already, but, whatever may be the cause, it is significant that wherever there is a large crushing plant wanted, the preponderance of favor goes with the stampers. I was much struck when paying a visit to the dumping yard at Fremantle early this year, at seeing hundreds of stamper mortar boxes in great variety of design and only one Huntington mill.

In one direction we have not advanced: whereas in olden times they could make it pay to crush and amalgamate for a yield of 1 to 2 ozs. of gold per 50 tons, or about 15 grs. per ton, we, with all our improvements cannot look at anything so poor.

Stamper batteries embrace a great variety in detail—each point designed with a special object in view: to gain increased crushing power, to reduce the motive power required, to minimise the cost for wear and tear, to make it more effective as an amalgamator, and so on. Much would be gained if more attention were given to the actual requirements of each particular case, and if the various improvements, as they became available, were adopted if suitable to the particular class of ore to be treated. But, speaking generally, when

a stamper battery is the selected crushing power, it is customary simply to order any well known make without taking into consideration the class of stone to be treated.

Speaking in a general way again, I find that most of the Australian-made gold stamper batteries differ very little in design. Each colony has its own favorites. We have improved designs and makes of cams: improved tappets or dies in great variety; more durable shoes and dies as, for example, those of compressed or hammered steel, which are more lasting and wear more equally all over than any cast ones; and other improvements in details that it is needless to refer to here. But there is one point of special notice: in nearly all the American and English made batteries the gratings are set at an angle outwards, whereas the most of the Australian made ones have the screens set perpendicularly. Each has its own advocates, but if I am not very much mistaken in my observations, the sloping screen is advancing in favor in Australia. The screens themselves have also been the subject of several improvements; punched, slotted and woven in various metals, including aluminum bronze, which has been introduced lately, and, although more costly to begin with, is said to be more profitable in the end.

The American batteries also have, as a rule, larger screen areas, which is important; for if the pulp cannot escape as fast as it is reduced to the fixed maximum size, some of it will be made finer and cause more "slimes," thus increasing the difficulty of ore dressing. This of course applies to other means of crushing besides batteries, and we are pleased to notice that the latest designs of mortar boxes have been turned out with larger screen area and are being appreciated.

The importance of rapid amalgamation has received some attention, and several new devices have been introduced and adopted, such as inside amalgam plates, both front and back, and, in some cases, amalgam ripples below the screens; these are all improvements, especially for free milling ores. Steel liners in the boxes is also a modern idea and has come to stay.

We have not much experience with direct-acting steam-stampers in Australia, although I have seen several different makes giving exhibition tests; some were undoubted failures, and all I can say for the others is that more proofs of their efficiency are required. The same remarks in a general sense apply to stampers with recoil spring actions; so far they have not been a success. I had the opportunity lately of seeing the latest development in this line: one of Saunders' Rapid Ore Stamp Batteries, which the patentee says have been designed with the object of securing the maximum of work with the minimum of power, cost of maintenance, etc. It is claimed for it that there is a saving of 40 to 50 per cent. in motive power; that a 3-head plant with 250 lb. stamps will do as much work as 5-head with 600 lb cam stampers; that it is lighter, and can be run faster than the cam stamper. I have not seen it at work, and can only say that reports speak well of it.

Pneumatic ore stampers, although adopted with some success, I believe, in tin mines, have not, so far as I know, been adopted in gold mines in Australia. The Elephant 2-head ore stamper was introduced some years ago in New South Wales and was found to do fairly good work with clean quartz; but when any mullock was present, the screens got clogged after a very few strokes, the wear and tear also being large.

One thing I think will be admitted in connection with any kind of stamper battery, even with all the latest improvements—improvements in theory, if not also in actual practice—that the effective crushing power is less per h.p. exerted than by crushers with a continuous rotary action: and yet the stamper, in point of popularity, is a long way in the lead. What is the reason for this? I am inclined to



think, with all due respect to the stamper, that "old use and wont" has something to do with it; and that, in some cases at any rate, the newer crushing devices have not had the patient, unbiassed trials that perhaps they merited. And let me remark here, because it applies to all modes of crushing, but more particularly to rotary crushers, that many failures are due to irregular feeding. No crushing machine should be without the adjunct of a good stone breaker and an automatic ore feeder. There is no lack of efficiency in these, and a big list of good makes to choose from, such as—in reciprocating jaw breakers—the Blake & Marsden, the Baxter, the Dodge, and the Jacques' Victorian Patent Stone Crusher—a colonial make which, in any point, compares very favorably with any of the imported machines. There is practically very little alteration of late years in the principle of any of the best proved jaw breakers, but what are known as the Rotary or Gyratory Crushers are a distinct advance on the jaw crushers. The Gates Iron Works was the first to introduce this class. The crushing is done between a cone placed on a gyratory shaft working vertically through the centre of a cylindrical shell; as it gyrates the crushing cone impinges on the sides of the shell. The top of the cone shaft is fixed in position, while the bottom is gyrated more or less as required; hence a continuous action crusher in lieu of the intermittent action in the old jaw crushers, and consequently more work obtained for the same motive power.

The Phillips' Patent Improved Rotary Crusher is of later date than the Gates, and was brought out with several improvements. It is right to say, however, that both these machines have been improved lately, and can now be considered great acquisitions in point of economy as compared with the old style of jaw crushers, and so be more used in connection with pulverisers of any kind, as a much more equal feed is insured and consequently less wear and tear, fewer breakdowns, and larger crushing power are gained.

Ore feeders, as I have said, are an indispensable adjunct to pulverisers, and there are many varieties of them. I need only name a few—all very simple in construction and yet effective; the Victor Automatic Ore Feeder, the Tulloch Automatic Ore Feeder, the Challenge Automatic Ore Feeder, the Stamford, Smithson's, and others, including also some simple tripping gears which have not been honored with any special name, but are none the less effective for that.

At all the best regulated mines nowadays, the advantages of a rock crusher to reduce the ore to the size of walnuts, or even less, in conjunction with an ore feeder, are fully appreciated, because it is the cheapest means of reducing the ore to a certain gauge; and which, if fed into the pulveriser regularly, whether it be stampers or otherwise, prevents overcrowding or the needless friction and wear and tear of, at times, running the machine empty. The adoption of some kind of rock-crusher and ore-feeder is then a distinct advance on old time practice. Regularity of the feed is of the utmost importance with any system of pulverising, and those who have not realised this are losing more than they are aware of.

In point of development the system of roll pulverisers follows the stamper batteries. Theoretically they are the more economical form of crusher; their action is continuous, instead of, as in the stamper battery, being intermittent; and they make less dust or slimes than the stampers.

The old style of slow running Cornish rolls has been superseded by various makes of fast running rolls, including the Reliance Crushing Rolls, Gates' Improved Cornish Rolls, Krom's Crushing Rolls, and the improved Krom Rolls. This latter, in conjunction with a good rock breaker, a fine crusher, proper screening arrangements, an automatic ore-feeder, etc., does remarkably good work with any kind of ore, and crushes to any degree of fineness. The effect of roll

crushing is to break up the ore into its natural crystals, and as there is no rubbing or pounding it produces less dust or slimes, or in other words, can be adjusted to produce a more regular grain, near the limit of maximum size required to liberate the precious metal. Another important improvement in all these rolls is that they are clad with forged steel shells or rings, which makes them more economical in point of wear and tear, and which, when worn out, are very easily replaced. They are best adapted for dry crushing, and of course give the best results when evenly fed. Some reports say that they are not a success as very fine crushers; but I have seen a good many at work and can say that, with proper grading and regular feeding it would be difficult to get better execution.

The other crushing or pulverising machines which have been introduced from time to time, make up a very long list; but the most of them may be said to have only paid a flying visit. Others have come to stay, and, as referred to in an earlier part of this paper, some, in my opinion, are worthy of a better reception than they have had, and in some cases, at any rate, would give a better account of themselves if the prejudices of "old use and wont" would give place to fair and unprejudiced treatment. And, I repeat once more, because it is of the utmost importance, that special care should be given to regular and even feeding. The cause of failure with some otherwise good machines may undoubtedly be attributed to lack of this attention. A good many of the newer order of pulverisers are quick running, and that, according to the late J. Cosmo Newbery, may be another of the causes of failure. He says: "All high speed grinding mills have the tendency to reduce both quartz and gold to impalpable powder, more so than in some of the slower methods. This is more perceptible where there is pyrites in conjunction with the tough quartz. While crushing the quartz, the brittle pyrites is reduced to a slime, and if the gold is not lost it is certainly more difficult to recover."

I can only refer to a few of the developments of quartz crushers that have come to us with high testimonials as to the powers of crushing with the minimum of energy and waste, and with the maximum of amalgamating and gold-saving properties; but many of them, from some cause or other, have not vindicated their good characters, as far as Australia is concerned. In some the capacity, in conjunction with the motive power required, and the large percentage of costs for renewals and repairs, is undoubtedly out of proportion to even the old-fashioned stamper battery.

The Huntington Mill is one of the first real innovations in quartz crushers of modern times. It is a distinct departure from any of the modes in vogue up to its advent; and it will also be admitted that it possesses special merit. A description is unnecessary, because its general construction is well known already. The centrifugal action of the suspended rotating rollers against the ring die is one of impact rather than of grinding—the ore being granulated without making much slimes, and the gold, as soon as it is liberated from the matrix, is in great part amalgamated and retained in the bottom of the pan, and another portion is caught on the copper plates outside. The rollers being adjusted to pass freely over the mercury without contact, it is not so liable to be stirred up and "floured;" but yet the action keeps the pulp in contact with the quicksilver, and thus favors amalgamation. The cost of replaces in this machine has been much reduced since the makers adopted hard forged steel roller and die rings, which, although more costly at first, are very much more durable in proportion. "Regular feeding" applies in a special sense to this machine. Automatic feeders are applicable but they need to be watched and regulated by hand, according to the output of the machine, as there is no means of making a connection to act where it is over or under fed; and even when set for any particular class of ore, it requires to be intelligently

attended to so as to give the best results. But when this is done, I think there is evidence that its capacity, taking motive power and wear and tear into account, is in its favor as compared with the stamper. I know this is not a general opinion, and I am not prepared to admit the maker's assertion "that it will do the same crushing as the stampers, with half the power." Yet it is a crusher of considerable merit in many respects; and it would be interesting to have evidence of its practical working results alongside a good stamp battery on the same class of ore—both being worked intelligently and without prejudice. As there are various makers of these machines, so there is diversity in quality, design, workmanship, effectiveness and durability; but a practical engineer has no difficulty in selecting the best make.

The Howland Quartz Pulveriser and the Griffin Mill are both of a similar class to the Huntington. The latter, however, instead of having several rolls as in the others, has only one roller, run at 200 revolutions per minute, with high pressure due to centrifugal force on the material being crushed between the roll and die, and is said to crush from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  tons through 1600 mesh screens per hour.

I have next to notice some pulverizers that belong to the same class as the Arrastra and the Chilian Mill, amongst which we find Woods' Patent Pulveriser, which resembles the Chilian Mill, but gets increased crushing and grinding power through the bottom die or crushing surface being bevelled up towards the periphery of the pan, and the face of the muller rings being bevelled to match. Besides the weight of the rollers there is a powerful spring pressure applied which can be adjusted at will. This mill is equally applicable for wet or dry crushing, and gives good results with little power and small wear.

Bryan's Patent Roller Quartz Mill is another innovation of this class. It has three steel-tired rollers running over steel dies in an annular plane, with an iron drum around which the driving belt passes, bearing on the face of the rollers. In operation the pulp is arranged to run round the pan, next to the screens, with a rapid current; but towards the centre, the movement being much slower, the gold, as liberated from the matrix, falls towards the centre, and in practice is found amalgamated around the centre cone. It has the merit of being very simple, easily driven, but I am unable to give a comparison of its capacity with that of other machines.

The Wiswell Ore Pulveriser, Harvey & Co's Roller Quartz Mill, Merral's Hydraulic Quartz Mill are all of the same class, and have all been tried in Australia, each claiming some special merit over its contemporary, but practical results have not made them popular so far. Indeed, when we take into account the good work done by, and the simplicity of, the old primitive Arrastra—the parent of them all—it is very questionable if some of these can be termed improvements at all. The old Arrastra is by no means to be despised. It holds its own very creditably amongst all the later advents, and many of our best authorities admit that the old original, with its stone crushing surfaces, has special virtues not possessed by any of the newer fashioned tribe.

The Sturtevant Mill came to light some years back as quite an original idea, claiming that its action caused the ore to grind itself. The mill is composed of two cylindrical heads—one on each side of a hopper and screening case: these heads run at high velocity in opposite directions and these two opposite forces hurl the ores against each other and thus reduce them to powder. It is said to crush and powder hard steel balls without any perceptible wear on the machine: but with all the merits claimed for it, has not found favor in Australia, whatever it may be doing elsewhere.

The Cyclone Pulveriser, another American invention, is unique in its way. As its name would indicate, the active agents here are very strong currents of air, supplied by powerful fans, so arranged that the currents of air seize the material as it is fed in, and keep it in action in a perfect vortex, rubbing and grinding itself; and the force of air can

be so arranged as to keep the ore suspended until it is reduced to the size required. This also brought very high testimonials with it, but has not been a success here.

Inventive energy has been much exercised on a great variety of devices in Spherical Ball Mills, from the "Cyclops Globe" or "Lion" Mill with its single ball, to the "Krupp" or Otis Mill with their many balls of various sizes. Nearly all claim to crush wet or dry; but I notice that some take the precaution of noting, that if used to crush dry the ore must be properly dry, not damp or sticky; and this is where one of the troubles begins, because unless specially dried, it is a rarity to find ores in a fit state to be crushed dry by these machines. The variety is large, and the mechanical devices for operating them are equally varied; some of them come from other countries, where dozens are at work crushing ores and giving the best of satisfaction. In Australia we find the same machine in one or two solitary cases only, doing their work well, but none of them making much progress. For some years back, I have been watching the progress of this class of pulverizer, and have often referred to acknowledged authorities in search of some light on the subject; but it is a remarkable fact that instances where even two agreed on the merits of the same machine are very scarce indeed. Under these circumstances I think it would be invidious to single out any particular machine for criticism.

The following are a few of the better known mills of this class:—The Globe Mill, with one ball; the Lion Mill, an improvement on the above; the Cyclops Mill, with one ball; the Lamberton Mill, with six balls; Hall's Perfect Ball Mill; Jordan's Ball Mill; the Crawford Mill; the Ashcroft Ball Mill; Tornagie's New Patent Ball Mill; the Morrell Grinding Mill; Beer's Combined Crusher, Amalgamator, &c.; Krupp or Gruson Ball Mill; the Otis Ore Crusher, and others. The diversity of opinion which I referred to in an earlier part of this paper is very noticeable in connection with this class of machine. Some make special provision for the quick delivery of the crushed ore as soon as it is reduced to the fixed maximum gauge, and are designed to avoid sliming; but others claim as a special point of merit that they not only crush the ore, but grind it to an impalpable powder; and as a consequence they are slime makers. The reason for this diversity is obvious: one inventor has had to deal with a free milling quartz where a coarse crushing gives up the precious metals, whilst another has had to deal with refractory ores, and finds very fine crushing is necessary to secure the treasure. Each works on the basis of his own experience and invents a machine to suit his own particular case, which it may do very well; but the failure comes when it is put on the market, and these conditions are not taken into consideration when the machine is ordered.

In practice it is found that most of the ball mills are very extravagant in wear and tear of the grinding surfaces, and it thus follows that they, with some exceptions, are also very extravagant in grinding power. Another objection to some of them is that the balls soon wear into irregular shapes, and thus their efficiency is very much reduced. In this class of crusher we get continuous action, but so far as I am aware we have not got increased production from the same power as expended on intermittent crushers, and so there is still room for improvement.

Tustin's Rotary Pulverizing Mill and Granulator is a very near relation to the Krupp or Otis Ball Mills, the principle being very much the same except that instead of spherical balls, as in the latter, the crushing power in the Tustin Mill is two rollers, which are the full width of the casings—about 18 inches long and  $19\frac{1}{2}$  and 14 inches in diameter respectively. These roll upon the shoes or grating bars and crush the ore, the pulp escaping in the same manner as in the Krupp. An example of this machine is erected in the New South Wales Government Metallurgical Works at Clyde, where it will have a good opportunity of proving itself.

Poley's Patent Ore Pulveriser and Electrical Amalgamator is one of the most ambitious combinations we have yet referred to; it is described as a continuous grinder or pulveriser, having a strictly balanced action, requiring a minimum of motive power. The ore, after passing the rock breaker, is fed through openings into and between a pair of concave and convex grinding stones, and after leaving the outer periphery it then gets a finer crushing by passing between a lower pair of crushing cones, which are arranged at a more acute angle and are of finer adjustment. This grading of grinding surfaces is said to be absolutely controllable, so that tailings can be reduced to an impalpable pulp if required. The gangue is then discharged into a set of electrically charged revolving ripples containing mercury; then through an annular ring with electrically charged mercury and a series of other ripples with metal balls—one or more of them being made of copper; and before the gangue is finally disposed of, it is passed over a set of electric magnets, and finally through a steam heated mercurial bath. The arrangement of the crushing and grinding power is novel, and the idea of the electric amalgamating arrangement is ingenious. Exhibition tests have passed off satisfactorily showing a capacity of about 2 tons per hour with 5 to 6 h.p. So far, I am unable to refer to any extended practical test.

The Lightner Quartz Crushing and Grinding Mill, although a stranger in Australia, has some good mechanical points, which deserve more than a passing notice. The rock is fed into a hopper which surrounds a gyrating muller, from which it passes through quartz to the inside of a bottom muller, where it is crushed between the muller and the central cone in the mortar, then dropping below is ground between the lower muller shoe and die. The gyrating motion of the muller causes a strong wave splash against the screen, securing a quick discharge. Some of its claims are: cheapness, small cost of maintenance, small amount of sliming and comparatively little driving power. Judging from its general construction and the reports I have seen of its work, I am inclined to give it a place of merit.

Amongst the "Jaw" Fine Crushers I need only name "Marsden's" Pulveriser or Fine Crusher, which is too well known to need any description; the "Samson" Fine Crusher and Granulator, with two vibrating jaws; Grinrod and Carter's Patent Jaw Ore Crusher and Pulveriser, which is made in small sizes suitable for assay rooms and also for large milling purposes; Carver's Patent Ore Reducer—one of the latest of this class; and Jacques' Combined Jaw Breaker and Roller Mill Pulveriser, which has given a very good account of itself wherever it has been put to full practical duty. All these jaw crushers and combinations are eminently adapted for dry crushing and with them it is not necessary to stipulate that the ore must be perfectly dry as noticed in connection with some other types of crushers.

The "Suckling" Dry Stamp Battery is referred to in connection with some workings; it has both back and front screens, but there is otherwise nothing special to notice about it.

From New Zealand we have good accounts of another class of grinders known as "The Fraser Pans." There are two distinct machines passing under this name, similar in their main features, but differing in some details—one is the invention of G. Fraser, of Auckland, and the other of J. C. Fraser, of Coromandel. I have seen one of the former at work in Sydney, doing fairly good work, and I have seen several of the same invention at work in New Zealand; but I must confess that the latter were giving by far the best results and were working with comparatively little power. A good many of them have been adopted in New Zealand and are found to compare favorably with other crushers and amalgamators. I have also had experience with Lockwood and Nicholson's Patent in New South Wales, which is another of the same class, but evidently not so well balanced, for I can say without hesitation

that it would require the produce of a good mine to keep it in going order.

I have named these crushers as some of the better known examples of the various classes of modern times. It is not by any means an exhaustive list, because their name is legion, and still they come, with more or less merit; mostly in the latter, unfortunately.

But I cannot pass without taking special notice of one of the latest developments in ore crushers, which certainly is a novelty in its way, and lays claim to be very far in advance of anything of its kind known hitherto. I refer to the "Juggernaut," (Banfield's Patent). It claims to be a "crusher without any grinding," to have a capacity very much in excess of any other known crusher with the same motive power, and that friction of operating parts is minimized and consequently wear and tear and driving power economized. Briefly described, it is a revolving circular pan, with a series of steps forming crushing grooves or surfaces, each step raised toward the centre where the ore is fed. There are four steps or racers in the pan, and a set of 16 revolving mullers in pairs is arranged to run on the side steps or crushing races; one pair acting in the first and the third races, the next in the second and fourth races, and so on alternately. These mullers are only three inches wide each, and in all with their carriers, give a crushing weight of about 6 tons. Comparing the "Juggernaut" with the stamper battery which the owners refer to as the only other machine which crushes without grinding," they give results as follows:—

"An average stamp measuring 50 square inches and weighing 700 lbs., dropping 3,600 times per hour, requires about 1 h. p. nominal to drive it and exerts a crushing power of about 16 lbs. per square inch, and thus covers 180,000 square inches in the hour, which with 16 lbs. to the inch gives about 1,286 tons per hour for one stamp. The total weight of the "Juggernaut" is about 13 tons, and 10 h.p. nominal will work it to its full power with a speed of 15 revolutions per minute, or 900 revolutions per hour. The crushing power is arrived at thus:— "Total weight bearing on the material, 6 tons, 13,440 lbs.; this bears on 16 points 3 inches wide, and allowing  $\frac{1}{2}$  an inch of the wheels or mullers to do the crushing we get the sum  $16 \times 3 \times \frac{1}{2} = 24$  square inches and thus  $13,440 \text{ lbs.} \div 24 = 560 \text{ lbs. per square inch.}$  The area covered the crushing wheels is: 4 concentric tracks, 15, 18, 21 and 24 feet respectively, in all 78 feet or 936 inches: in each of these tracks wheels travel, each wheel 3 inches wide, so that one revolution of the 16 wheels in all the tracks covers  $(936 \times 4) \times 3 = 11,232$  square inches; this multiplied by 900 revolutions per hour = 10,108,800 square inches. On every inch of this surface the pressure is 560 lbs per square inch = 2,527,200 tons per hour, or according to these figures a crushing power equal to 1,965 head of stampers, for an expenditure of 10 h.p."

I am not prepared to admit that these figures are correct, and in the meantime am waiting some further particulars. In any case it appears to have capacity very much in excess of any other crusher within my knowledge.

Many of these crushing machines claim to be good amalgamators as well, and no doubt this is so with some classes of ore, but in other cases greater care should be given to the selection of the machinery best suited for the particular class of ore in hand, so that it may be crushed in the best form fit for amalgamation or whatever treatment has to follow the crushing in order to secure the precious metal. I am convinced that many of the crushing devices already referred to as in a sense untried would give a good account of themselves if their merits were properly put to the test; not simply exhibition tests, but with practical unbiassed parties to watch their progress in actual work from time to time and report the results to future meetings such as this. By this means many would be rejected; but the economic and profitable would then be selected to do good service in their proper places.



Ore concentrating appliances come next in order, and here again we have a big list of inventions: and perhaps competition has been as keen in this as in almost any other department of gold saving appliances, the chemical processes not excepted.

For the rougher concentrations, we have as an advance on the old style of shaking tables the Gilpin County Concentrator, which is very good for separating the coarse pyrites, but in which almost all the slimes are lost in the tailings. Haley's Improved Percussion Table, which has a bumping action endways by means of cams and recoil springs which can be adjusted to give any degree of force required. This machine is very popular in Victoria. Rettinger's Latest Double Side Action Percussion Table (side bumping), which claims to be an improvement on the Haley in that it will treat fine slimes as well as heavy gangue if properly adjusted. The Salzburg Percussion Table is another development of classifier with a lengthwise bumping action, and claims to have larger capacity than the others. These machines serve the purpose to a certain extent, and with a following of blanket strakes and ripple launders save a fair proportion of pyrites; but I have had the opportunity of testing tailings at some of the biggest gold mills in Australia where these or similar machines have been in use, and have been surprised to find a large percentage of payable tailings going to waste. One defect of these machines is that they are not continuous in their action, and do not deliver the products automatically, but have to be stopped as the surfaces fill up, to be discharged.

The Gilt Edge Concentrator, the invention of an American who has remedied this defect by removing the board at the top end of the table, and has otherwise adapted it to deliver the concentrates over the top end into suitable receiving boxes. Gauthier's Shaking Table is an arrangement of silvered copper plates as wide as the discharge of the mortar box and 12 to 16 feet long with a longitudinal vibrating motion adjustable to suit the different classes of ore. Wynne and Tregurtha's Concentrator is one of the latest on the market. The main feature of this invention is an iron cylinder with a movable bottom, which gradually sinks as the pyrites accumulates upon it; the reason given for the deposition of the pyrites being that the current is suddenly checked and spread by its descent into the wide cylinder, and thus effective concentration is secured.

In rotary concentrators we still find examples of the old concave and convex round buddles doing good work in the good old-fashioned way, and I could refer to several improvements in these, but at their best they have their disadvantages: and I pass on to notice perhaps one of the first developments of modern centrifugal concentrators. The Hendy Concentrator was, I believe, one of the earliest rotary oscillating machines, and is still found doing good service. It was undoubtedly the progenitor of a great many others of a similar class; acting by centrifugal force with a reciprocating or circular bumping motion obtained by one device or another, they may differ in the sectional shapes of the reciprocating pans and the modes of delivering the concentrated pyrites or sulphides, but otherwise belong to the Hendy family and are a distinct advance on the old lateral movement bumping percussion tables.

The Duncan Concentrator is one of the most popular of this class, and amongst others we may name Stanfield's Improved Concentrator, Liddell's Patent Concentrator, Harrison's Patent Rotary Concentrator, Rodda and Mitchell's Concentrator, Clarkson and Stanfield's Dry Concentrator, the Otis Rotary Concentrator, McNeill's Patent Concentrator, and many others. They are not all successful in actual practice, although most of them pass test exhibitions very creditably; the failures may not be the fault of the machines, but being put to do a certain class of work for which they are not suited, and hence it is, in many cases, that apparent improvements, when left to the care of that "old use and wont," are found wanting and are passed aside without further consideration.

(To be Continued.)

# CANADIAN MINING INSTITUTE.

## SPECIAL MEETING IN MONTREAL.

### Many New Members Elected.—Government gives a Grant of \$1,000.

In accordance with the Charter of Incorporation granted to the Canadian Mining Institute at the last Session of Parliament, a special general meeting of the members was held in the room of the Institute, Windsor Hotel, Montreal, on Friday evening, 3rd June, to formally ratify the election of officers and the Constitution and By-Laws. There was a good attendance, Mr. John E. Hardman, S.B., M.E., President, in the chair.

The Secretary read the minutes of previous meetings, which were, on motion, confirmed and duly signed.

#### NEW MEMBERS.

The following having been approved by Council were duly elected members:

ALDRIDGE, W. H., Mining Engineer, Trail Smelting Works, Trail, B.C.  
 BRELICH, HENRY, Mining Engineer, Nelson, B.C.  
 BRENT, CHARLES, Mining Engineer, Rat Portage, Ont.  
 BUCKE, M.A., Mining Engineer, Kaslo, B.C.  
 BOSS, J. E., Spokane, Wash.  
 CHAMPION, JAMES, C. & M.E., Cariboo Gold Fields, Ltd., Barkerville, B.C.  
 COSTE, EUGENE, Mining Engineer, Windsor, Ont.  
 COWANS, J. R., Mechanical Engineer, General Manager, Cumberland Ry. and Coal Co., Springhill, N.S.  
 CLARKE, ROY, Mining Engineer, Rossland, B.C.  
 CROASDALE, H. E., Manager, Hall Mines Ltd., Nelson, B.C.  
 DICK, ALEXANDER, Rossland, B.C.  
 DEACON, T. R., C.E., Rat Portage, Ont.  
 DOUGLAS, LORD SHOLTO, Bruce Mines, Ont.  
 EVANS, J. W., C. & M. E., Sudbury, Ont.  
 FOWLER, S. S., Mining Engineer, New Gold Fields of B.C., Ltd., Nelson, B.C.  
 FLAHERTY, R., Mine Superintendent, Yum Yum Gold Mine, Rat Portage.  
 GUESS, GEORGE A., Analytical Chemist, Greenwood, B.C.  
 GUE, T. R., Acadia Powder Co., Halifax.  
 HEDLEY, ROBERT R., Metallurgist, Hall Mines, Ltd., Nelson, B.C.  
 HAYWARD, ALONZO A., Mining Engineer, Halifax, N.S.  
 HILL, LESLIE, C.E., Vancouver, B.C.  
 HOLDICH, A. H., Assayer, Nelson, B.C.  
 JOHNSTONE, R. C. CAMPBELL, Mining Engineer, Nelson, B.C.  
 KIRKGAARD, P., M.E., Canadian Gold Fields, Ltd., Deloro, Ont.  
 KEHOE, Henry, M.E., Rossland.  
 LOW, ALBERT P., B.A. Sc., Geologist, Geol. Sur. of Canada, Ottawa.  
 LEAKE, H. PERRY, M.E., Gold Fields of British Columbia, Revelstoke, B.C.  
 LECKIE, J. E., Mining Engineer, Rossland, B.C.  
 MACDONALD, BERNARD, Mining Engineer, Montreal and London Gold and Silver Dev. Co., Dufferin Mine, Salmon River, N.S.  
 MONTPETIT, D. ELZEAR, Montreal.  
 MASON, F. H., F.C.S., Analytical Chemist, Halifax.  
 MCCONNELL, RINALDO, Crystal Gold Mining Co. of Rathburn, Mattawa, Ont.  
 MCCYBIG, CLARENCE J., Montreal.  
 NELSON, CHAS., Montreal.  
 NEWMAN, W. T., Vancouver, B.C.  
 NANKIBELL, E. J., Mining Engineer, Fern Gold Mining and Milling Co., Hall's Siding, via Nelson, B.C.  
 PARKER, CHARLES, Consulting Mining Engineer, Rossland, B.C.  
 STUART, GEORGE, Mining Engineer, Truro, N.S.  
 TOPPING, E. S., Trail, B.C.

#### ACT OF INCORPORATION.

The Secretary reported that in accordance with the instructions of Council he had consulted with Messrs. Gemmill & May, Barristers, Ottawa, respecting an Act of Incorporation, and a Bill had been drawn up and adopted by both Houses of Parliament to the following effect:—

BILL NO. 116.

#### *An Act to incorporate the Canadian Mining Institute.*

WHEREAS the persons hereinafter named have, by their petition, represented that an association known as the Canadian Mining Institute has been founded by the said persons and others, for the following purposes, namely: First, to promote the arts and sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications. Second, the establishment of a central reference library and a headquarters for the purpose of this organization. Third, to take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada. Fourth, to encourage and promote these industries by all lawful and honourable means. And whereas the said persons have prayed that it be enacted as hereinafter set forth, and it is expedient to grant the prayer of the said petition: Therefore Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

## Our London Letter.

LONDON, 11th June, 1898.

1. John E. Hardman, George M. Dawson, William A. Carlyle, Charles Fergie, John Blue, B. T. A. Bell, A. W. Stevenson, James McArthur, Archibald Blue, William Hamilton Merritt, F. T. Snyder, Henry S. Poole, Wilbur L. Libbey, Robert G. Leckie, Clarence H. Dimock, Geo. E. Drummond, Geo. R. Smith, J. Obalski, John J. Penhale, R. G. McConnell, Frank C. Loring, John B. Hobson and Wm. Blakemore, together with such persons as hereafter become members of the Institute, are hereby incorporated under the name of "The Canadian Mining Institute," hereinafter called "the Institute," for the purpose set forth in the preamble.

2. The Institute may acquire and hold such lands and property as are necessary to carry out the objects and purposes for which incorporation is sought; provided that the annual value of the real estate held at any one time for the actual use of the Institute shall not exceed five thousand dollars.

3. The Institute may make such by-laws, not contrary to law, as it deems expedient for the administration and government of the Institute.

4. The affairs and business of the Institute shall be managed by such officers and committees, and under such restrictions touching the duties and powers of such officers and committees, as may be prescribed by by-law.

5. The head office of the Institute shall be in the city of Montreal, or in such other place as may, from time to time, be determined by a vote of two-thirds of the members of the Institute.

\*THE SECRETARY—Valuable assistance had been given to the passing of the Act by Messrs. D. C. Fraser, M.P., Allan Haley, M.P., and C. J. Logan, M.P., to whose influence also the Institute was indebted for the remission of the fees ordinarily charged for the enactment of such a Bill.

Mr. R. T. Hopper moved, seconded by Mr. A. W. Stevenson, that the Secretary be instructed to convey the cordial thanks of the members to Mr. Haley, Mr. Fraser and Mr. Logan, for their valuable co-operation.—Carried.

## BOOKS FOR THE LIBRARY.

The Secretary reported that he had shipped to the library four cases of books and periodicals, and that, according to instructions of Council, he had purchased the first 15 volumes of the Transactions of the American Institute of Mining Engineers from the estate of the late Sir John A. Macdonald.

On motion of Mr. Stevenson, seconded by Mr. T. J. Drummond, the President was authorized to negotiate for the acquisition, by purchase or otherwise, of the remaining volumes necessary to complete the set of these valuable proceedings.

## DOMINION GRANT.

The Secretary was pleased to report that as the result of their interview with the Premier and Finance Minister, the sum of one thousand dollars appeared in the estimates as a grant towards the work of the Institute.

## LIBRARY APPROPRIATION.

On motion of Mr. Stevenson Brown, the following amounts were voted towards the equipment and maintenance of the Library and Reading Room of the Institute:

Windsor Hotel, rent 1898-9.....	\$400 00
Purchase of new books and maintenance.....	300 00
	<hr/>
	\$700 00

## ELECTION OF HONORARY MEMBERS.

On motion of the Secretary, the following were unanimously elected Honorary members of the Institute:

DR. A. R. C. SELWYN, C.M.G., late Director of the Geological Survey of Canada, Vancouver.

HON. W. S. FIELDING, M.P., Minister of Finance, Ottawa.

## LIBRARY COMMITTEE.

The following were elected members of the Library Committee during the ensuing year:—Messrs. H. W. DeCourtenay, J. Stevenson Brown, George E. Drummond, the President and Secretary; Mr. Drummond to be convener.

## ELECTION OF A MEMBER OF COUNCIL.

The Secretary having explained that Mr. R. G. McConnell, who had been elected a member of Council for British Columbia, in view of his acceptance of the position of Provincial mineralogist, had decided to remain on the staff of the Geological Survey; it would therefore be advisable to elect a resident of British Columbia to the Council.

On motion of Mr. Drummond, seconded by Mr. DeCourtenay, Mr. S. S. Fowler, M.E., Consulting Engineer to the New Gold Fields of British Columbia, Nelson, was duly elected to fill the vacancy.

## BRITISH COLUMBIA MEETING.

Mr. McCuaig recommended holding a meeting of the members in British Columbia in the fall, and the suggestion being approved the Secretary was instructed to communicate with the local members at Nelson, and if the matter met with their approval to proceed with the necessary arrangements.

Mr. Meredith recommended that the minutes of all meetings be printed.

The Secretary hardly thought it necessary to go to this expense, as particulars of all meetings were published in their Transactions.

After some discussion the Secretary was instructed to distribute among the members the minutes of this meeting.

This being all the business the meeting adjourned.

A meeting of the Library Committee was held afterwards, when arrangements were made to have the rooms of the Institute in the Windsor Hotel suitably fitted up and equipped. It is hoped to have the reading room open to the public by the 1st of July.

During the past month the Canadian mining market has remained very inactive, partly in sympathy with the general apathy of the London stock exchange, and partly owing to interest in this section having, to use a mining phrase, temporarily "pinched out." To continue the metaphor, however, there is every probability that the vein will be recovered shortly, and that it will continue to increase in richness with depth. As a matter of fact, for nearly twelve months this country has been continually asked to study the prospectus of some proposition or the other, having for its object the transfer of capital from British pockets to Canada. In addition to the purely mining enterprises, there have been a number of flotations of perhaps a less speculative character, but all helping to assist in the satiation of the English capitalist. It is difficult to say how much capital has actually been raised to furnish the funds for the exploitation of mining enterprises in British Columbia and Klondyke during the past twelve months, but it must run into a very big figure, and some authorities put the nominal amount at £6,000,000 or £7,000,000. When we remember that up to the present no purely Klondyke mining concern has had a chance of proving its claim to be regarded as a prospective dividend payer, and that only two or three British Columbian companies have yet obtained admittance to the dividend list, it is not surprising, perhaps, that investors in this country and on the continent have been displaying a disposition to await developments before furnishing further capital for the purpose of exploiting your mines. That the promoting community still regard British Columbia and the Klondyke as an excellent medium whereby to effect a transfer of funds from the pockets of the European investor to their own banking accounts, however, is proved by the constant registration of schemes, good, bad and indifferent, for the carrying on of operations in that region, and the only reason that the newspaper press has not been deluged with the alluring prospectuses already prepared by these gentlemen, is that the depressed condition of the stock markets and the city generally, due to the uncertain political outlook in all parts of the world, have so jeopardised the probable success of such appeals, that it was thought safest to await a more favorable opportunity. At the time of writing, the outlook is decidedly brighter, and markets are rather brisker than they have been for some time past. It is, therefore, probable that the appeal which is, I understand, to be made next week by the Associated Gold Mines of British Columbia (which is to be brought out with a capital of about half a million to acquire some hundred properties in British Columbia), may be followed by the appearance of the prospectuses of other enterprises which have been shelved pending the arrival of the transformation in the financial world which is considered indispensable to the successful flotation of Canadian mining companies. As you will see, however, by the budget of registrations which I have sent you, Klondyke and British Columbia are still in the van of the movement, and Ontario, about which we heard so much a year ago, is very much in the rear. Whether the friends of the latter, in this country, are strong enough to obtain for it that prominence which they claim is its due, has yet to be determined; but I can only say that while Rossland and Dawson City have become as well known in London as Johannesburg or Hannan's, Ontario attracts little publicity, and I should think not a tithe of the capital which has been raised in some form or the other on behalf of Canada during the past twelve months has been bespoken on its behalf. Newfoundland, as you will have learned from my previous communications, has not been entirely overlooked, but Nova Scotia, so far, has not received any attention at all.

The report that a commission is to sit to investigate and formulate plans for the settlement of the outstanding differences between the United States and Canada and this country, will probably act as a fresh stimulus to public interest in the doings of the Dominion, and as I write our leading newspapers are congratulating themselves upon the good results which should follow the *rapprochement* between the United States and this country. It is recognised that the commission will have a difficult task to adjust all the differences that on so many occasions threatened to embroil the two chief members of the Anglo-Saxon race, but as it is believed that the members forming it will be fully impressed with the advisability of arriving at a basis which shall prevent the possibility of these disturbing elements being reopened in the future, strenuous efforts will probably be made on both sides to bring about a complete settlement of the questions at issue.

That Canada will receive all the attention and support she deserves from the mother country is certain, and we have so much idle capital in England that we can quite easily furnish you with a good deal more capital than has already been subscribed to the various companies issued during 1897-98. Many of our leading financiers now regard Canada as likely to prove a serious competitor with South Africa and West Australia, and although it will probably be some time before the Dominion equals or excels the gold output of the former, it will have but little trouble to win public support from the Australian colony. It is to be hoped that the scandal connected with the flotation of West Australian "wild cats" will not be repeated in the case of Canada, but I am afraid that unless the commission which has been enquiring into the working of the present Companies Act is able to induce the Legislature to take active steps for their immediate amendment, Canada will not escape the objectionable attentions of the financial sharks who prey upon the credulousness of the public. Already a number of "wild cats" have been launched, and even respectably introduced concerns have been over-weighted with capital in order to provide promoters with handsome profits. Take the case of the British American Corporation as an instance. Here we have, out of a total capital of £1,500,000, £500,000 taken as the purchase money for a few options on second and third rate British Columbian and Klondyke properties, which probably did not cost the promoters a tenth part of this large sum. The prospectus of this scheme was one of the baldest I ever read, and although Mr. Whitaker Wright seems to have at last secured the LeRoi mine, I do not think he is to be complimented upon the misleading way in which he drafted his prospectus. Unfortunately your severe criticism of this scheme was too late to be of any service to those who might have been guided by it, and induced to save their money for some more promising enterprise. The group is un-

doubtedly a strong one, but the shares have been very weak lately, and at one time were quoted in the London Stock Exchange at as low as 17 shillings, after having been up to about 24 shillings or 25 shillings at the beginning of the year. Another company which illustrates the evil of over-capitalisation is furnished by the Klondyke Goldfields, the latest flotation of Sir Charles Tupper's company, the New Goldfields of British Columbia. This concern was brought out in April, with a capital of £350,000, to acquire properties in the Klondyke region. These were highly praised in the prospectus, but opinions as to their value differed considerably, and it was rumoured that the promoting company obtained £100,000 profit by the flotation of this concern. Of course, one cannot expect a promoting company to work for nothing, but it seems a great pity that financiers who undertake this class of business cannot see the necessity for exercising self-restraint in this matter. Many companies which could, no doubt, pay respectable dividends on a capital of £100,000, are capitalised at such an extravagant rate that from the very first their prospects of proving decently remunerative are reduced to the vanishing point. I am only giving you a couple of instances of over-capitalisation. If such leading companies as these will do such things, one can hardly be surprised if the smaller fry in the promoting world display the desire to obtain as much as possible from the operations in which they may be engaged.

The unfortunate part of it is that the public never seem to profit by past experience. They are invited to subscribe capital to a venture which the lessons of the past should teach them requires the strictest investigation. The prospectus which is issued has been drafted by the individuals who have purchased the property they wish to dispose of, and who will naturally do all in their power to present as attractive a picture as possible. The public never seems to see that a prospectus is nothing more or less than an alluring advertisement put forward by a financial tradesman who wished to sell his goods at as big a figure as possible, and who has no intention of guaranteeing the quality of the articles he supplies. He can always plead that he believed that they were genuine, and that he was giving good value, and that he was entitled to say so in his advertisement, and that the buyer (the investor) should naturally on his part have made careful enquiry as to the value of the goods he was purchasing before parting with his money. The public, however, go on in the old way, accepting prospectuses as if they were gospel, and often taking only the slightest trouble to verify the statements put forward. The average investor still places himself in the hands of the directors, who in this country, in too many cases, are merely the dupes of the promoters. He takes it for granted that if the names of the directors inspire confidence, he need not bother himself about enquiring further. Is it surprising therefore, that unscrupulous persons take advantage of this weakness and prey upon those who really are not capable of safeguarding the funds which the irony of fate has placed at their disposal? Of course, a great responsibility rests upon the State in this matter, and for some time past it has been recognised that our present Companies Acts do not sufficiently protect those who have not common sense enough, seemingly, to protect themselves. As I have already remarked, a commission has been sitting to enquire into the best means of protecting investors from the rapacity of the unscrupulous promoting community in this country. Probably the Legislature will be called upon to discuss their report at an early date, and it is possible that the Government may recognise the urgency of the question and introduce a measure which will be decidedly less encouraging to financial rogues and vagabonds than the present Acts.

Although the markets have been as dull as ditch-water, and quite unfavorable to financial negotiations of any kind whatever, I am constantly meeting Canadians who are over here with the object of bringing properties they are interested in before the English public, either direct or by means of those financiers who play the part of the middleman in the realm of Joint Stockracy. Many have been sadly disappointed at the results of their visit, but on the other hand I am in a position to state that a number have succeeded in obtaining the most careful attention of those who have it in their power to influence large capital, and promises of financial assistance to their schemes, so soon as the present market apathy gives way to cheerfulness and activity.

The LeRoi deal has been fixed up at last, and Whitaker Wright should be happy seeing that he has, after many days, secured the chief property, upon which, according to the prospectus of the B. A. C., he had obtained an option so far back as December 10th.

Ontario properties are dull and seldom mentioned, and the market for their shares is a purely nominal one, dealing in them being a matter of negotiation.

Despite the dullness of the times, the Canadian railway securities have been appreciating in value, their recent traffics being so encouraging as to attract investment support. It is said that insurance companies have been buying Grand Trunk guaranteed on the improving prospects of this road, while on the statement that the Government guarantee of the bonds of the Quebec & Lake St. John was to be extended for ten years from the date of lapse, these securities became unprocurable. Hudson Bay have fluctuated a good deal, having been very weak at one time owing to the steady stream of realisations that followed the sharp advance in these shares last year, and which was based on the supposition that the old trading company would be among the first to materially benefit from the rush to Klondyke. They are now quoted at 21½. Canadian Pacific Railway, 87¾; Asbestos & Asbestic, 7½; Bank of British Columbia, 20; Bank of British North America, 64; Bank of Montreal, 475; Gold Explorers, 1½; Ontario Gold Reefs, 1; Hall Mines, 1¼; British America Corporation, 18s 6d; London & British Columbia Goldfields, par; British Columbia Development, 7s 8d; New Goldfields of B.C., par; Gold Fields of B.C., par; Mikado, 3. Dawson City Trading corporations are quoted at a discount, viz: 15-16, and very nominal at that. Indeed, the Dawson City group are decidedly dull, and despite the 2 p.c. dividend paid by one of the Turner companies—the Klondyke and Columbia Goldfields—out of the promotion of a much be-puffed Ontario concern (the New Golden Turner) the companies with which the Premier of British Columbia has associated himself, do not hold a very high position in the opinion of London financiers. The Tupper companies are lower, like the Turner group, but are really regarded more seriously, although it was a significant point, not overlooked here, that the venerable Canadian statesman did not associate himself with the New Goldfields Co's latest promotion—the Klondyke

Goldfields. As a matter of fact there is but a nominal market for the purely Klondyke ventures, the market itself, like the public, being disposed to await further information before losing its head further over the new region. The Canadian market is still a very limited one, but with good news from the Dominion it would speedily expand. The latest recruit is Mr. Harry Mosenthal, but I fancy that the present members of this section of the London Stock Exchange do not find it at all difficult to do all the work in connection therewith. On the other hand, like Oliver Twist, they are always asking for more. Meetings have been few and of reports lately there have been none beyond the detailed statement issued some time ago by the B. A. C. dealing with the properties it has acquired, or has under option, in both cases in conjunction with its partner the London and Globe Finance Corporation.

There are two other matters to which I should like to refer before I close. The first is regarding Mr. W. Ogilvie's visit to this country, and his lectures. In my opinion he has done more to check the boom in Klondyke companies than any other living person. He has impressed all whom he met with his sterling qualities, and his absolute integrity. Often, at personal inconvenience, (for our climate did not agree with him) he has addressed big audiences in the city, and although devoid of florid rhetoric his remarks were always deeply interesting, and a valuable addition to our store of information regarding the Klondyke region. Of course, the promoting fraternity have not appreciated his warnings, and I was much amused at the elephantine efforts of a certain member of Parliament, at one of Mr. Ogilvie's lectures, to try and smooth away the somewhat blunt language in which he had denounced the wholesale pillage of his official reports to embellish prospectuses. But investors generally have much to be thankful for in his efforts to save them from becoming the victims of that section of our financial community which I have dealt with above, and which has produced a Jabez Balfour, and others who, although as guilty, have hitherto escaped detection by the strong arm of the law.

The second point is the formation of the Incorporated London Chamber of Mines, which has recently been formed to furnish information to its subscribers about colonial mines. Particular attention will be paid to Canada: British Columbia, Ontario, and the Klondyke will be carefully nursed by the Chamber, whose monthly report has already come to be recognised as a useful record about Canadian mines.

## COMPANIES.

**Dominion Coal Company, Limited.**—The Directors report for the year ended 28th February as follows:—

"As will appear from the Treasurer's statement, the output for 1897 was 1,221,471 tons, larger by 51,686 tons than for the previous year.

"All the construction work, both ordinary and extraordinary, of which a considerable amount has been done, has been charged to operating expenses and depreciation account, so that the property account, as compared with a year ago, stands reduced by \$12,000, being the amount of bonds purchased last year under the sinking fund.

"Since the close of the fiscal year, under the operation of the Sinking Fund, \$53,000 of the bonds of the company have been purchased and cancelled, reducing the bonded indebtedness to the sum of \$2,935,000. There still remains in the hands of the New England Trust Company the sum of \$125,000 as a special deposit under the terms of the deed of trust.

"It is expected that the company will begin delivering coal on its contract with the New England Gas and Coke Company by or before the first of January. Requirements under the contract, if the works are run to their full capacity, will call for an increase of about seventy-five per cent. of the present output of the company."

The annual statement shows:—

Net proceeds 1,221,471 tons, and net income from steamships, railways, barges, real estate, etc.....		\$540,853 44
Less—Interest on bonds.....	\$179,280 00	
Other interest paid and accrued.....	27,576 72	
Sinking fund.....	54,680 35	261,537 07
		\$279,316 37
Less—Dividend preferred stock paid and accrued.....		160,000 00
		\$119,316 37
Balance.....		\$119,316 37
Additions and improvements to property in 1897 charged off.....	\$79,547 41	
Carried to general surplus.....	39,768 96	119,316 37

BALANCES FEBRUARY 28, 1898.

Assets:

Property accounts..... \$20,168,274 33

Cash Assets:

Cash in banks and offices.....	\$46,341 70
Accounts and bills receivable.....	102,741 43
Balances due from agents, and coal at distributing points.....	235,381 46
New supplies in warehouse and stores....	122,826 63
Cash in New England Trust Co. for outstanding coupons.....	90,420 00
Cash in New England Trust Co. for sinking fund.....	125,138 95
Cash in American Loan and Trust Co. for uncalled-for dividends.....	1,512 00
	724,362 17

Total..... \$20,892,636 50

*Liabilities:*

Capital stock, common.....	\$15,000,000 00	
"    "    preferred.....	2,000,000 00	
First mortgage bonds.....	2,988,000 00	
Bills payable.....	123,812 61	
Unpaid coupons.....	90,420 00	
"    dividends.....	1,512 00	
Sinking fund, 1897.....	54,680 35	
Dividend 2 months.....	26,666 67	
Royalty.....	34,214 48	
Interest accrued.....	5,175 91	
Accounts payable.....	268,124 56	
Railway suspense account.....	125,000 00	
Balance, general surplus.....	175,029 92	\$20,892,636 50

## GENERAL SURPLUS ACCOUNT.

Surplus from 1897 balance.....	\$92,363 31
Net contribution to permanent sinking fund, 1896 (\$54,172.65 less \$11,275 used for purchase of bonds).....	42,897 65
Surplus from 1897 as above.....	39,768 96

Total general surplus carried forward..... \$175,029 92

Railroad suspense account, subsidy held for depreciation of R.R. \$125,000 00

## SINKING FUND, APRIL 1, 1898.

\$111,800 U.S. Reg. 4s @ 1.08½.....	\$121,303 00	Used for retirement 53 bonds.....	\$55,250 84
Uninvested funds.....	4,267 49		
From 1897 business.....	54,680 35	Balance carried forward.....	125,000 00
	\$180,250 84		\$180,250 84
Brought forward.....	\$125,000 00		

**The New Vancouver Coal Mining and Land Co., Ltd.**—The following is excerpted from the thirteenth report of the Directors presented at the annual meeting of shareholders on 17th ulto.:

The net output for the past half year was 121,037 tons, making a total for the year 1897 of 267,552 tons, as against 269,676 tons for the year 1896.

The sales for the past half year were 123,031 tons making a total for the year 1897 of 265,878 tons, against 272,943 tons for the year 1896.

The market continued in a depressed condition until nearly the close of the year, when there was a little better demand, but there was no increase in prices.

*East Field Mine.*—The net output during the last half year from this mine was 84,269 tons, making the total for the year 156,779 tons.

*Protection Island Shaft.*—The net output from the upper seam for the past half year was 9,848 tons, making a total for the year of 59,015 tons, but this mine has been closed since July last in consequence of the dullness of the market.

*South Field, No. 5 Shaft.*—The net output from this mine for the past half year was 26,920 tons, making a total of 51,758 tons for the year.

It will be seen from the accounts that there is an available balance for the past half year of £5,969 8s. 9d., out of which the Directors recommend the payment of a £2 per cent. dividend, free of income tax, making (with the interim dividend paid in November last) £4 per cent. for the year 1897; this will absorb £4,300; the balance will be carried forward. The proposed dividend will be payable immediately after declaration.

On the recommendation of Messrs. Rosenfeld and Mr. Robins, the Directors have purchased the steamer "Peter Jebesen," 3,077 tons gross register, at a cost of £30,000. The amount was paid by Messrs. Rosenfeld and charged by them to the company in their account current for January last. The ownership of this steamer and the ability shewn by Messrs. Rosenfeld in securing other steamers on time charter, has enabled the company to provide tonnage for a large amount at normal rates.

**Whitewater Mines, Limited**—The first general (statutory) meeting of the members of the Whitewater Mines, Limited, was held in London on 10th instant, Mr. H. W. Forster, M.P. (chairman of the company), presiding.

The Secretary (Mr. E. R. Tasman), having read the notice convening the meeting, the Chairman said: Whilst the object of to-day's meeting is to comply with the Joint Stock Companies' Acts, I feel that I should meet the wishes of those shareholders who are present if I made a few observations with reference to the constitution of your company. After hearing what I have to say to-day, I feel sure you will all agree with me that not only have your Directors and staff acted with the utmost dispatch and promptitude in the conduct of your affairs, but that they have done everything possible in the fulfilment of their duty in guarding and forwarding your best interests. Had it not been for the unusually inclement weather experienced in British Columbia since the beginning of February we should have already been able to make large shipments of ore and corresponding profits. I may tell you that, although we went to allotment on February 16, the company was duly licensed in British Columbia and entered into full possession of its property on the 24th of the following month, which certainly would not have been possible had we not had the advantage of the assistance of the staff of the London and British Columbia Goldfields, Limited. Mr. Fowler, in his report, values the mine contained in the Whitewater claim alone at \$585,000, although, he states, from an intimate knowledge of the ground, that the Whitewater vein has been proved to run not only across the Whitewater claim, but right across the Irene and Myrtle R claims to the extreme western

limit of this company's property. If, then, we have a value of \$585,000 on the Whitewater claim alone, it is not unreasonable to expect that we have in both the Irene and Myrtle R claims two properties which will prove to be as valuable as the Whitewater proper, and this is the more probable as the southern boundaries of these claims extend further on the dip of the vein than is the case on the Whitewater. I draw your attention to this to show that although no work of considerable extent has been carried out upon the Irene and Myrtle R claims, there is no doubt that we have in these and the Tennie C, the whole of which belong to your company, a value far and away above that of the Whitewater claim alone, and that the capitalization of your company was fixed without considering these outside claims, and with a view to securing the commercial success of the undertaking. To give you some idea of the immense returns of ore available for stopping in our mine, the latest information received from our manager in British Columbia is to the effect that there is now in sight a sufficient quantity of ore to supply a concentrating mill with 100 tons daily for eighteen months. This places our property in a position which I believe to be unequalled by any other mine in the district. (Applause.) I have explained to you that the development work carried out by the company since the property became ours has rendered available for shipment a very largely increased quantity of ore; but further than this, our neighbors on the south—evidently believing in its continuity—have conclusively proved for us the existence of our vein at depth by carrying out the necessary work on their ground, and striking the Whitewater vein, of similar quality to that above, at something over 1,000 ft. below its outcrop on our property. We understand, it is fairly reasonable to suppose, that these outside workings are at a point where our outcrop is nearest to the southern boundary; nevertheless, our manager informs us that our vein will have a depth of 500 ft. below our lowest level, No. 4, at this narrowest point before dipping out of our property. We may assume, therefore, that everywhere else we shall be able to follow the vein to a much greater depth. This is especially so in the case of the Myrtle R and Tennie C, and in these claims, moreover, the ground rises to the westward, and the total backs are consequently increased. I have endeavored to explain to you the large potentialities which our property possesses, and I have every reason to believe that before our next yearly meeting you will have had proofs of its character which would satisfy the most exacting in the shape of good dividends. (Hear, hear.)

A vote of thanks to the Chairman and Directors terminated the meeting.

**The Asbestos and Asbestic Co., Limited.**—This company has issued its first report and statement of accounts, being for the period of 13 months to 31st March. After providing for all expenses of management and writing off £3,541 for depreciation, there was a net profit of £2,180, which is to be carried forward. "The directors regret that from various causes the output of asbestos during the period has been much smaller than was anticipated, and, as a consequence, the company has not been able even to supply contract quantities to the H. W. Johns Company, still less to effect sales in other directions. It was found necessary, soon after taking possession of the property, to abandon for the present the intention of working the mill by water power, and to undertake the putting down of additional plant and machinery to be worked by steam, in order to increase the output as proposed in the prospectus. The asbestos and asbestic produced during the period has cost appreciably more, in consequence of the disturbance and interruption, than the present cost under proper working conditions, and the directors expect to produce much larger quantities of asbestos during the current year, at such a reasonable cost as will enable them not only to profitably fulfil the H. W. Johns Company's contract but also to make satisfactory sales in other directions." The directors propose to make an extra stock-taking on the 30th of September next, and to issue a circular letter to the shareholders giving the result of the first half of the current year's operations.

**Athabasca Gold Mining Co.**—A meeting of the shareholders of this company was held in New Westminster this month to ratify a sale of the Athabasca group of mines, which was unanimously approved of. The agreement of sale provides for the incorporation of a new company in England, to be known as the Athabasca Gold Mines, Limited, with a capital of £200,000 to take over the property. One hundred and forty thousand pounds, being 70 per cent. of the entire capital, is given to the present company as purchase money for their property. Ten thousand pounds has been put up in cash for the purchase of machinery and for the further development of the property. An additional £10,000 will be available for working capital, if required. Provision is also made for the placing of stock on the English market under a pool agreement with the English company which has promoted the deal, which practically assures to the present holders of stock at least 60 to 65 cents per share, while, with the increase! development it is confidently expected that the value of the stock will go up. The new company takes the property dating from April 12 last, and their engineer has been in charge of the work since May 1. Work is proceeding on three different ledges at the present time. Altogether the prospects of the company never looked so well as they do at the present time.

**Athabasca Gold Mine, Limited.**—Registered April 20th, by A. Fell, 46 Queen Victoria St., E.C. Capital, £200,000, in £1 shares. Objects: To enter into an agreement dated 23rd March and expressed to be made between A. E. Rand, as trustee for the Athabasca Gold Mining Co. (Limited Liability) and the British Columbia and New Find Goldfields Corporation, being an agreement for the purchase of all the mining rights, concessions, undertakings, business and good will of the Athabasca Gold Mining Co., Limited, and to develop and turn to account the same and further to acquire any other mines, mining, water, and other rights, grants, leases, claims, concessions, options of purchase, metalliferous land, alluvial ground, &c., in any part of the world to carry on the business of a mining, milling, smelting and trading company in all its branches.



## MINING NOTES.

### Ontario.

#### LAKE OF THE WOODS.

Mining matters in the region around Rat Portage have, during the past winter and spring, been what the holders of mining locations term "quiet;" that is to say, very little has been effected in the way of properties changing hands. If it is true that we had a boom here a twelve-month ago, there is certainly no sign of one here now. Of speculation there can scarcely be said to be any, the pendulum of interest having apparently swung to the opposite extreme almost; for our district is not getting as much attention as it is justly entitled to. But the outlook is not by any means dark, for all that. The "boom," or whatever name we may choose to give to the unusual activity in matters relating to mining which characterized this district of country last year, was not the healthiest condition of affairs for us; for a large share of the abnormal activity was devoted to the mere acquisition of mining locations, resulting in the surveyor's chain "being thrown around everything that could, with the widest latitude, be called a "vein," be it lode, dyke, belt, band or stringer. The prospectors, like "the man that is an householder," brought "forth from their treasures things both new and old," and many an old "find" was re-visited, the surveyor being of the party, until everything that had been discovered up to date was surveyed and duly applied for in the Crown Lands Department. This year the surveyors that are left complain of having too much leisure; partly because prospectors have nothing in the "bank," as the loggers say in the lumber shanty. The most objectionable feature of the boom, however, and the one whose ill effects are with us yet, was the boom in the prices of mining prospects. Here, of course, we can imagine we hear the protest from the prospector, and probably there are two sides to this as to almost every question; still, it is a fact that a number of men came here in the spring of 1897 with the intention of investing in mining claims who went away disgusted with the prices that were asked for properties, most of which, too, were in a totally undeveloped condition. Claim holders are much more sane this year, however, and locations can be had at pretty reasonable figures. But apart from transactions in transfers, mining is not wearing an unhealthy aspect. The three established mines are holding on the even tenor of their way, increasing in development work and producing the desired gold brick with greater or less regularity, whilst development work is doing on numbers of properties. Some of these prospects have stopped work, one from one cause, another from another; in some cases the vagaries of the vein itself have given the miners "pause;" in other instances it is to be feared that lack of funds was the real trouble. A good many are anxious, but are hoping that when the Klondike excitement has experienced the abatement which it is certain to suffer, and when the war-clouds have rolled by, capitalists will again direct their attention to this country, and will take hold of some of the good things which are here undoubtedly. And when the money comes along next time, the holders of claims will think several times before letting it pass.

Notwithstanding the generally admitted "quietness," there are a few prospectors in the field, but no very important finds are reported as yet. The latest excitement is over the reported discovery of placer ground about eight miles east of the town; one of the local papers gives quite an enthusiastic account of the matter, but so many similar reports have been heard in the past that the average inhabitant will await developments with composure.

The use of the diamond drill in the exploration of quartz ledges is becoming quite a notable feature in this part of the district. But in the opinion of many its promiscuous employment in this manner is of doubtful advantage. It is a subject, however, which would give rise to a good deal of discussion. It may be said, however, that in the mind of the ordinary unsophisticated individual the diamond drill is the universal instrument for laying bare the secrets of the rocks, and for quickly and infallibly procuring all needed information relating to the exploitation of a mineral deposit.

The principal inconvenience to the mining interests in this part arising out of the present abnormally low stage of water in the Lake of the Woods is perhaps the difficulty experienced in getting ore and other freight through Ash Rapids. The improvements to navigation effected there last spring consisted in the deepening of the channel at each of the two chutes by removing boulders and the blasting out of some rock *in situ* as well. In ordinary years this would have made it comparatively easy for Shoal Lake craft to pass up and down, but this season steamers from the Lake of the Woods have to stop at the lower rapids, and the boats that have with great labor been got into Shoal Lake have to stop at the upper rapids. There is thus a space of about half a mile between the rapids over which the barges bearing the freight have to be warped by hand, entailing much delay, besides the delay often experienced in running the actual rapids themselves. A regular canal lock is the only thing that will meet the emergency, and the interests involved demand the construction of such a lock as soon as possible. The water is lower than usual also on the streams and inland lakes, adding to the difficulties of the navigation of those waters by canoes, etc. The ordinary swamps are very dry for the time of year.

*Regina Mine.*—The deepest shaft is now down 450 ft. The vein is 6 to 7 ft. in width, while its gold values have risen rather than fallen. The vein is becoming quite regular, too. Mining is practically stopped whilst the changes in the mill are being made. The old 10 stamp mill has been taken out, and six Tremaine stamp mills are being put in, which with the one already in use, makes seven of these machines installed there. This is quite an advertisement for the "Tremaine," and the results will be watched with great interest by mining men. The boilers for the new machinery that is being put in have an aggregate of 250 h.p.

*Stella Mine.*—Work has been going on steadily all winter. A new shaft is being sunk on the Stella vein at the mouth of the tunnel which was run for a short distance on the vein into the hillside. The shaft is down about 40 ft., and the vein is 4 to 5 ft. wide, consisting of a whitish quartz carrying pyrite, and good value in gold. There is a streak about 6 inches in width that is highly mineralized with pyrites chiefly and is quite rich in gold. A good-sized sample of this lately brought in shows gold quite freely. The owners are quite elated by the way this shaft is turning out. A shaft had been sunk on each of two other veins, but work on these is suspended at present. There is as yet no machinery on this property, the hoisting being done with a horse and "whip."

*Trigg's Mine.*—Work was suspended here some weeks ago, but is to be resumed shortly. The shaft is down 80 ft.; it is solidly timbered in two compartments, and all the work has been done in most workmanlike manner. The sinking was by contract, but all the work was done under the supervision of Tom Philbrook, an experienced California miner, who was placed in charge by the owners. Hoisting was effected with a horse and "whip." The country is a massive trap.

*Cameron Island.*—Work is going on regularly on this property, the deal on which was consummated during the past winter. In the latter part of May four barge loads of the ore was brought for treatment to the Keewatin Reduction Works, but it has not yet transpired what the yield was.

*Triumph.*—It is reported that an interest in this mine has recently been sold by the parties who acquired it a short time ago. Work has stopped for a while, but will soon begin again, when a drift, it is said, is to be driven at the 100-ft. level. The shaft is down about 230 ft. and the vein is about 7 ft. wide. Work was carried on during the greater part of last winter, and some good time was made in sinking with three shifts.

*Treasure.*—Situated a little north of the Triumph. A small force has been working here for some time, and a shaft is down over 60 ft. At 60 ft. a cross-cut was run to cut a vein which showed only faintly at the surface; it was struck at the point where it was expected, and was found to be about 6 ft. wide.

*Gold Cross.*—This is a prospect near the Triumph that has come into local notice this spring on account of its being owned by two ladies, and from the fact that some rich samples were brought to town from it not long ago. A shaft is being sunk which is now down about 30 ft., and Captain Jos. Thompson, who is in charge, says it shows gold all the way down.

*Combine Mine.*—Work is going on regularly on this property. It appears that at the start operations were of a somewhat tentative character, considerable mining having been done before the true vein was finally located. The vein was found, however, and work has been satisfactory ever since. The trouble was largely due to the fact that operations began after a considerable depth of snow had fallen, rendering it difficult to obtain a comprehensive knowledge of the ground and the veins. Only a small force is as yet engaged. The president and the treasurer of the company visited the property about the middle of May and returned well pleased with what they had seen. They spoke of putting a mill in as soon as the mine could be got ready. This is one of the Camp Bay properties which have attracted considerable notice during the past year; it is in the neighborhood of the Mascotte and the Trojan. The Bully Boy is another of the group; it is reported that this property has changed hands lately.

*Black Sturgeon.*—A small force has been at work here during the winter and some machinery has been put in. The owner has been on a visit to Sweden, his native land, during the winter. This property is near the Scramble.

*The Yum Yum.*—Work will shortly be resumed on this property. The same is reported of Bath Island.

*Vora.*—It is not known to outsiders when work will be resumed on this property. A shaft has been sunk to a depth of about 120 ft., but it would appear that there is a possibility that the shaft has left the main vein. Some Philadelphia people have or had an option on it, and the work was in charge of Mr. Hall.

*Burley Mine.*—This property is under the water of Bald Indian Bay, adjoining the Sultana. Operations have been going on satisfactorily under the management of Mr. Flaherty. Sheet piling has been driven around the wall of the cofferdam, outside and inside, and the work of pumping out is about to begin. There is an average depth of about 8 ft. of clay on the bed-rock of the lake at this point, making the formation of a watertight compartment comparatively easy with no doubt about its permanency.

*Bad Mine.*—The owners and the parties who took the option during the winter are at loggerheads over some ore which was shipped from the mine to the reduction works, the proceeds of which, it is alleged, were not properly accounted for. The case comes up at the approaching Assizes. In the meantime the optionee has returned to his home in Buffalo.

*Pipestone.*—A rather promising quartz lead was discovered late last autumn on the west shore of Pipestone Lake, east of Sabascong Bay, Lake of the Woods. It has been traced over a considerable distance, and it pans gold wherever it has been tried. Two claims were surveyed on it about Christmas, and this spring three of the owners went down to do some devel-

opment work in the way of sinking test pits, stripping, etc. Several locations have been made in this region, which has, however, not yet received much attention from prospectors.

N. B. Eagen, representing the Sentinel Consolidated Mining Co., Ltd., a Toronto syndicate, is examining some property on Shoal Lake with a view to taking an option on it.

The work of exploring the Engledeu concessions is being prosecuted this summer again, but as yet no reports have been received from either of the parties.

Mr. Conmee, M.P.P., is vigorously pushing his mining work at Shoal Lake and other places. He bought a small steamer not long ago for the better carrying out of his extensive operations.

J. M.

Rat Portage, 15th June, 1897.

#### MISCELLANEOUS.

The recent shipments of crude oil from the Brooke field are leading other operators in that direction, and before long the territory will be thoroughly tested. Considerable property is being bonded in Enniskillen, Sarnia, Brooke, Dawn, Enphemia, Zone and other townships. The summer season bids fair to be exceptionally active in field development work. Following are the shipments of crude, and refined reduced to crude equivalent, over the railways for the month of May: Grand Trunk—Crude, 11,680 bbls.; refined, 5,370 bbls.; equivalent, 25,105 lbs. Michigan Central—Crude, 2,800 bbls.; refined, 1,844; equivalent, 7,410 bbls. Total, 35,515 bbls. crude oil.

The charcoal iron plant of the Deseronto Iron Company is rapidly nearing completion.

Lord Sholto Douglas is having the old Bruce mines pumped out with a view to a resumption of mining.

At Sudbury the Canadian Copper Co. is enlarging its smelting plant and opening up several new mines this season. A trestle—in one place 60 feet high—is building for a railway track from the Big Jones mine to the Copper Cliff, and all the Company's old mines are being worked most vigorously.

#### Quebec.

The Gilbert Beauce Gold Mining Company continues to work with a small force on the Gilbert river. Mr. M. P. Angers, of St. Francis, is in charge of the work. About \$1,200 of coarse gold has been taken out in this prospecting work.

On des Meules Creek, M. A. Coupal is still prospecting with a couple of men, and apparently making his living out with the gold found in the bed of the Creek.

At the high fall of the Chaudiere, in Shenley, Mr. Currie has been prospecting with a few men since spring on a superficial bed of gravel which appears to give satisfactory results.

At Dudswell, M. L. Mathieu is sinking a shaft on the Big Hollow brook, the property of M. Trenholme. Some prospecting is also being done on the Harrison brook.

In the vicinity of Sherbrooke, a new company has started work on the Felton brook, which falls into the Little Magog Lake. This company is seeking incorporation under the name of "Rock Forest Gold Mining Company (limited)," with a few prominent men in it. The work consists of a shallow digging, bed rock being struck at a depth not exceeding seven or eight feet. The gold found there is not very coarse. In May last there were five or six men employed, sluices were in operation and some gold found. A puddling machine has been erected. There are also a few miners prospecting on the Grass Island brook (formerly Golconda mine), and in another small brook in Orford township.

At the works of the Asbestos and Asbestic Company, Danville, a serious fire occurred during the month, destroying valuable machinery and exploding dynamite by which three workmen were killed.

At Thetford mines, the three large asbestos companies, Bell's, Johnson's and King's, are very busy, as usual at this time of the year. The Johnson's Company is also doing some work on its Black Lake property.

The production of chromite is being carried on at Black Lake by the Coleraine Mining Company, P. P. Hall, H. Frechette, and J. Carriere.

The Coleraine Mining Company has contracted for the erection of a concentrating plant, the contract for the machinery, we understand, having been given to the Jenckes Machine Co.

The United Asbestos Co. is doing some mining at Broughton.

The pyrites mines at Eustis and Capelton, and the iron furnaces at Radnor and Drummondville, are, as usual at this time of the year, working full time.

The Eastern Townships Chrome Iron Mining and Milling Company is seeking a charter of incorporation. Capital, \$50,000 in shares of \$50. The directors are R. Prefontaine, Q. C., M. P., Joseph R. Fair, C. G. Chenevert, Alfred Brosnan, J. N. Gregory, Col. Chas. King, H. F. Morrison, Charles Nelson and W. deF. Nelson. Head office is to be at Montreal, and mining to be carried on near Black Lake.

(From another Correspondent)

All the asbestos pits at Thetford are being worked to their full capacity and the shipments of both crude and fibre are steady and keep well up with the output. Prices for the better grades is fair and the demand are steady. All the mines are shipping steadily and in most cases have orders booked ahead for the best grades. Any one in the market for No. 1 would have to buy from the pit.

Messrs. King Bros. have recently equipped their pits with cable derricks, replacing the old style boom. They continue to produce their usual high grade stock.

Bell's Asbestos Co. are working their usual force. All the openings on this property have practically been joined, making one pit with working faces 600 ft. long by 200 ft. wide, giving them a large amount of working surface, and is probably the largest opening in all the asbestos mines.

Johnsons Co. are working a large force in their pit and are turning out large quantities of all grades. There is a very marked improvement in the grading of the fibre now being produced and shipped from this mine.

Extra hours are being worked in all the pits at Thetford and the mills are being run night and day to keep up with the demand.

None of the asbestos mines at Black Lake are being operated, with the exception of a few men on one of the lots of the Johnsons Co., where some work is being done under contract. This place is very rich and the fibre extra long. Probably the asbestos taken out from this lot is produced at a less cost per ton than at any other place.

The United Asbestos Co. are operating the East Broughton mine. A small mill has been put up to treat the short fibre taken out in mining the long fibre from the vein there, which is exceptionally long and of beautiful color and texture.

Although there is a temporary dullness in the asbestos mines at Black Lake, the chrome iron industry is being looked after and is in a fair way to become a permanent industry. The present good demand for chrome is creating a lively interest and all the lands hereabout are being thoroughly explored. There seems to be a very good demand for ore running from 48 per cent. and over, and prices are good. The shipments so far this year are quite up to last, but the greater part of what has been shipped has been ore running from 40 to 45 per cent., at prices ranging from \$10 to \$14 f.o.b. at the railway.

The Coleraine Mining Co., which owns a large tract of land in this district, upon which there is a large quantity of low grade ore, uncovered in taking out the "No. 1," has at last decided to erect a concentrating plant to treat these ores. Work has been commenced on the mill building, which is located on the shore of the lake, about one mile from Black Lake station. The Quebec Central Railway passes within 400 yards of the mill. An order has been placed with the Jenckes Machine Co. of Sherbrooke, for the crushing and concentrating machinery, and the whole is to be ready and in operation by August 1st. A description of this plant will be sent you when it is in operation.

There is also some talk of another concentrating plant going up at Chrome Siding, about four miles from Black Lake, to treat the ores from the Lake St. Francis district and adjoining lots, but at this writing no start has been made. It is quite possible that this will soon be done as there are large beds of low grade ore in that district, and the erection of a concentrator near them would make it possible to operate on a large scale.

J. J. P.

#### Nova Scotia.

The last returns of the Brookfield Mining Company show a yield of 352 ozs. from about 1200 tons of rock milled, exclusive of concentrates which were not treated.

Mr. Libbey, at last accounts, was about to start up the new plant on the Dunbrack property. A shaft house has been erected containing 50 h. p. boiler, 35 h. p. engine, and pumping gear, a belt-driven hoisting engine, rock breaker, etc., all under one roof. It is his intention to sink here at least 500 feet, running levels every 100 feet. 50 tons taken from this lode gave 2 ounces to the ton.

Prof. Richards and a party of students from the Massachusetts Institute of Technology, having been visiting the mines at N. Brookfield, and have been greatly interested in the important operations going on in the district.

A sixty stamp battery and an up to date mining plant is being installed at the Dufferin mine, Salmon River. Mr. Bernard Macdonald, the consulting engineer, of the Montreal-London Gold and Silver Dev. Co., Ltd., which has acquired the mine, has returned from the west and will superintend the mining work here.

A correspondent from Forest Hill writes:—The monthly returns which show a steady even yield from the Modstock and McConnell mines, are a good indication of the stability of the camp. Vigorous prospecting is being carried on on the Modstock Mining Company's property, and several promising leads have been cut. The McConnell Mining Company are also prospecting their ground with favorable results. The Phoenix Mining Company are again starting their mine which has been shut down for a few months. Arrangements are about being made for placing plant upon this valuable property. A number of parties holding areas in this vicinity are prospecting, and I believe that 1898 will prove to be a banner year on Forest Hill mines.

Just as we go to press we learn with deep regret of the sudden death of Mr. E. T. Moseley, Q.C., of Sydney, Cape Breton. Mr. Moseley was, we believe, Speaker in the Local Legislature during the Holmes-Thompson administration. He was greatly interested in the development of the mineral wealth of Cape Breton, particularly in its coal fields, and no later than the last meeting of the Mining Society of Nova Scotia he contributed an interesting paper on recent explorations near Cochrane Lake.

Mr. W. A. Sanders, the well known metallurgist, who has been identified with the Lake Lode and other gold producers, left the other day for Alaska, where he proposes to spend some time looking after his interests in that country. Mr. Sanders expects to return again to Nova Scotia.

The meeting of the Mining Society at Westville next month should attract a large attendance of local mining men. Mr. Fergie, the President of the Society, has the arrangements in hand, and visitors to the works of the Intercolonial are sure to receive a right hearty welcome.

The North Sydney Mining and Transportation Co. propose to increase their shipping facilities. A fair quantity of coal has been shipped this season, several vessels having received cargoes for Newfoundland.

### British Columbia.

Mr. W. F. Robertson, Mining Engineer, lately of New York, has been appointed to succeed Mr. W. A. Carlyle in the position of Provincial Mineralogist. Mr. Robertson graduated in Applied Science from McGill University, Montreal, about 1878, and has had an extensive experience in mining and smelting practice in Canada and the United States.

At the Mount Adams mine, operated by the Adams (B.C.) Company, work has been carried on steadily since July last year, with the result that the lowest tunnel on the main vein is now in 600 ft. on the north side of the summit, over which the claims lie and through which this vein passes. This tunnel has shown several chutes of ore which appear to be continuations of ore chutes found on the surface and opened by a tunnel higher up on the vein, giving from 300 to 700 feet of stoping ground. This vein can be traced for 1,500 feet and has been opened by adits and tunnels on both sides of the summit. A second vein which dips towards the main vein has been tunnelled on, and good showings of pure galena are found on it. This will probably be opened up from the low tunnel at its intersection with the main vein. The ore on the property is mostly that suited for concentration, though a portion of it can be shipped directly to the smelters. A trial shipment of 14 tons during the fall of '97 gave returns of 95 oz. silver and 65.5 per cent. lead. When fully developed an aerial tramway can be erected to Sandon, 1½ miles away, or down the south side of the mountain to Four Mile Creek, at either of which points a concentrator can be erected.

War Eagle dividend of 1½ cents per share, equivalent to 18 per cent. on the par value of the stock, and the statement that the dividend will be continued each month from now on, has created a decided flurry on the stock market and shares have advanced from 90 cents at the beginning of the year to \$2.50 at date of going to press. As the authorized capital is \$2,000,000, in \$1.00 shares, present quotations would place the present value of the property at about \$5,000,000. It is worthy of remark that (as pointed out in our December number) the last financial statement showed a working loss on the year's operations of \$56,626.48. The fact that the Le Roi, which is capitalized for \$2,500,000 and has paid over \$800,000 in dividends, and has virtually been sold to the B. C. Corporation for \$3,000,000, is also suggestive. We do not hesitate to say that, in our judgment, the stock is greatly inflated and holders at present prices are likely to get left.

A. B. Irwin, the manager of the Canadian Pacific Exploration, Limited, announces that his company will proceed at once with the erection of a 10-stamp mill and a 5-drill compressor at its property, the Porto Rico, near Ymir. It is expected that the new plant will be erected and in running order within six months. An aerial tramway of 2,500 ft. will be constructed to carry the ore from the mine to the mill. The ledge, which has been opened at three levels by tunnels, is producing excellent concentrating ore, and the mill is expected to yield fine results.

Late and reliable reports from Barkerville state that the Campbell Hydraulic Elevator under the personal supervision of the inventor, Senator R. H. Campbell, is working to perfection on the grounds of the Cariboo Gold Fields Company. The plant is located on the old Marysville ground, the lift being 90 ft., the greatest height to which gravel has been raised by this process. The pressure is 650 ft. and everything is working to perfection. The opening to bed-rock is now about completed and gravel to the full capacity of the elevators will soon be sent up.

There were shipped from Sandon between August 1st, last year, and May 27th last—a period of rather less than ten months—22,993 tons of Slocan ore. Of this goodly total the Payne mine accounted for no less than 10,010 tons, the Ruth coming next with an output of 5,374 tons, the Slocan Star following with 3,247 tons, and then after a long interval the Idaho with 1,864 tons, the Last Chance with 1,384 tons, and the Reco with 1,128 tons.

The winze on the Iron Mask, near Rosslund, has reached the 105-ft. level below the main tunnel, which is equivalent to a depth from the surface of 305 ft., the deepest working yet opened on the property. About 2 ft. of excellent shipping ore have been disclosed in the winze. In the west drift on the main tunnel level a raise is under way to open ground for stoping. The raise is disclosing some good ore.

From Quesnelle Forks, Horsefly and Barkerville good reports are beginning to come with regard to the opening up of the season's work. Washing has now been for some little time in progress at the Cariboo Gold Fields property. Everything is working satisfactorily, and the Campbell elevators are raising the boulders well. Washing will continue, and, if nothing happens, a good clean-up should be made on this rich ground. Mr. James Champion, C. & M. E., has full charge of the property.

It is reported that the Victoria Consolidated Company will also put in a large and expensive ditch this season, and some 500 men will be employed on the Cariboo Hydraulic Gold Mining Company's ditch and dam.

The Golden River Quesnelle Company is meanwhile giving out good reports, and it is said that nearly 300 men will be put to work there mining within a few weeks. The bed of the old South Fork has been known since '59 to be rich. Frequently one to two dollars have been raised on a single shovel of gravel at a favorable stage of the water. With present arrangements for mining the river-bed after closing the gates and shutting off the stream for about 150 days, an immense amount of this old channel should be worked. It will furnish employment to several hundred of men during the mining season at Quesnelle Forks.

The Horsefly Gold Mining Company is running two elevators and doing good work. About 25 men are employed, and about 2,000 yards of gravel per day are being elevated. The property is looking well, and a good output for the season seems likely.

The Miocene Company is now down 285 ft. to bedrock and found it pitching, and it is now sinking into the bedrock, intending to go down about 40 ft. and then drift out to the bottom of the channel. Gold was found on bedrock, and above some feet good gravel was found, but it was not rich enough for drifting. The outlook seems good for rich gravel on bedrock in the channel bottom. The bedrock where the shaft is now being sunk is easy to work, it being so soft that it can be picked and broken up without powder. The water has given considerable trouble, but is at present under control. The company is employing about 16 men working 8-hour shifts.

At the Horsefly Hydraulic Gold Mining Company's mine some men are at work and a small force has been at work all winter drifting. It is rumored that good gravel is now in sight in sufficient quantities to justify starting the mill soon.

Active development work is proceeding on the Tangier and Waverley mines. Hoisting and pumping works are being erected on the Tangier, and a concentrator and tramway in the Waverley, whilst a narrow-gauge railroad will shortly connect both properties with the C.P.R. main line. The English stockholders in the owning companies ought, therefore, this season to learn fairly thoroughly the true value of the mines which have been so highly eulogized by the managing director, Mr. Grant Govan.

It is stated that Messrs. Poupore & McVeigh, of Nelson, have secured the contract for the construction of 11 miles of flume for the Cariboo Hydraulic Mining Company at Quesnelle Forks.

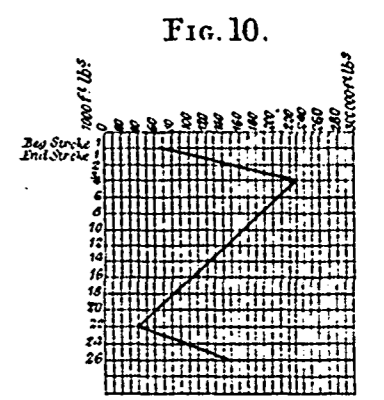
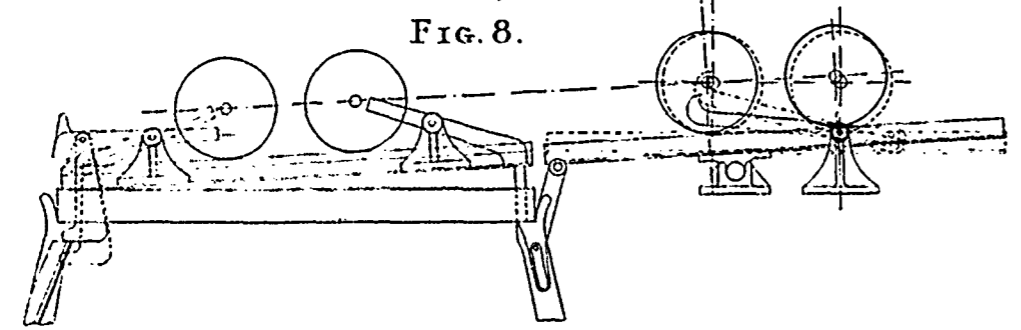
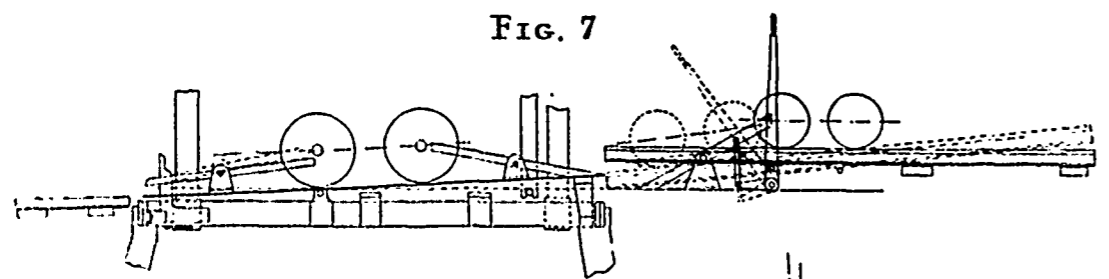
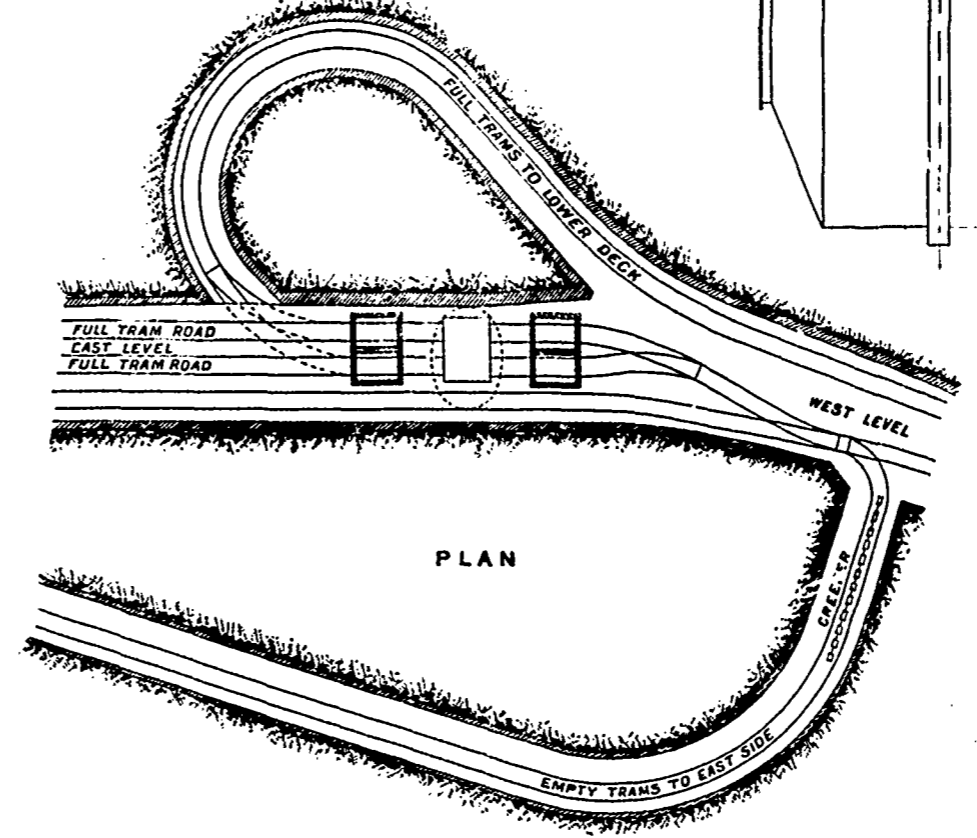
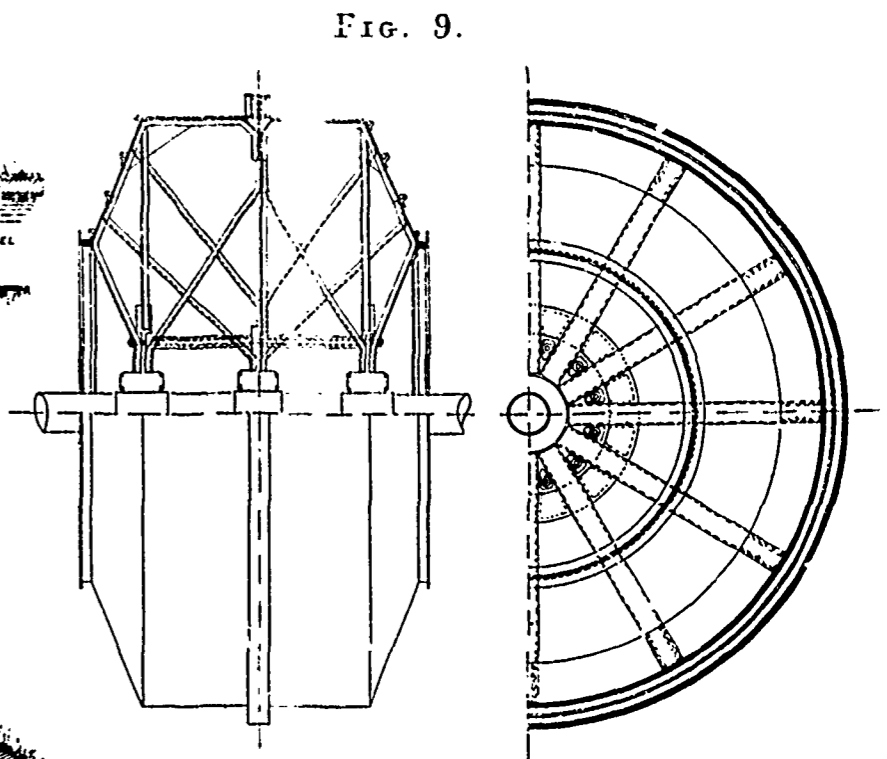
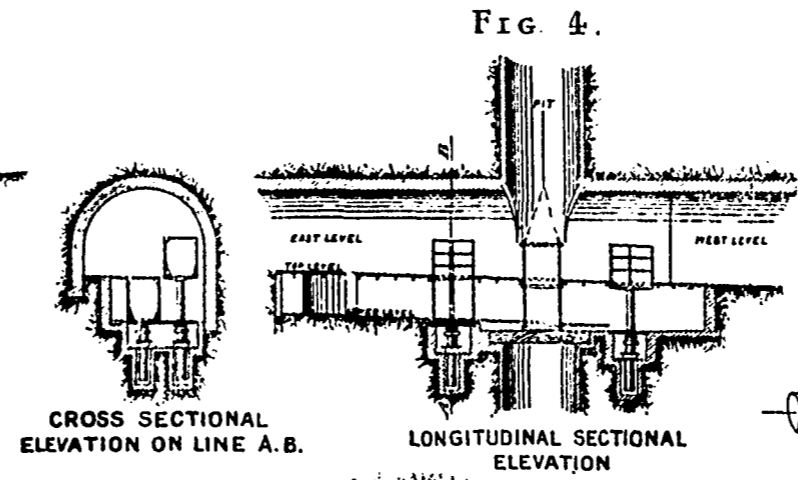
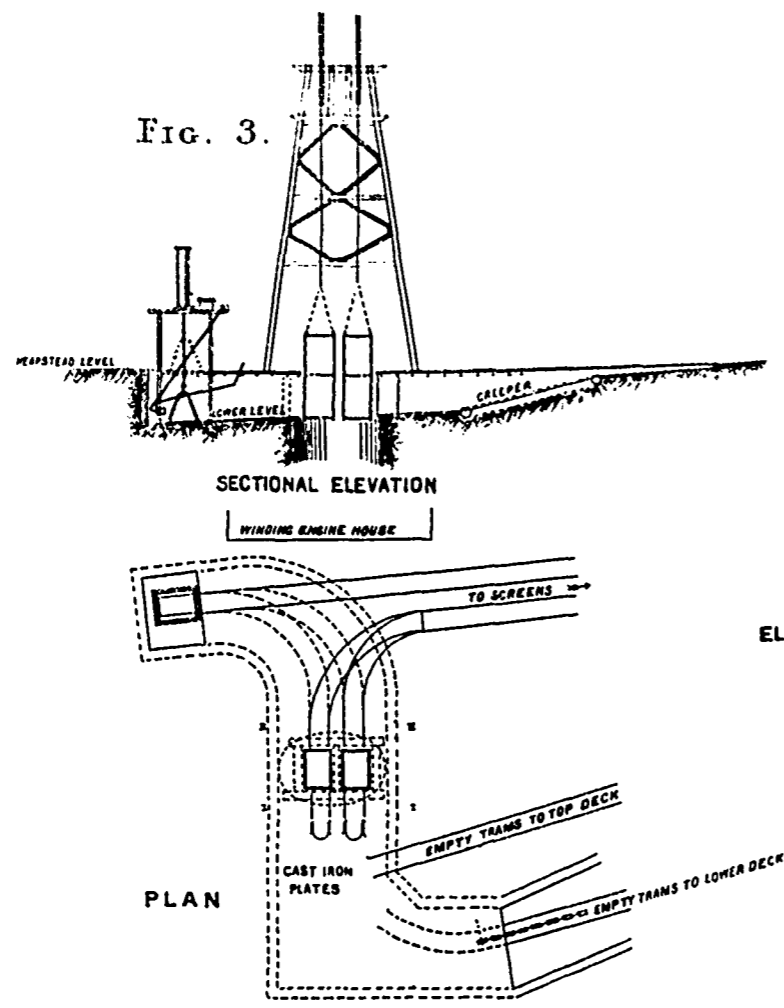
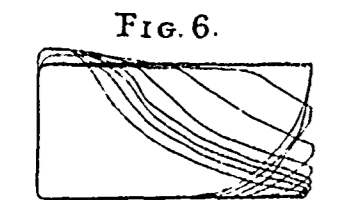
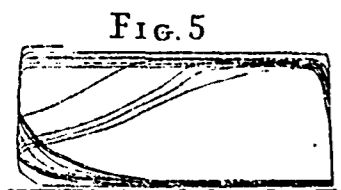
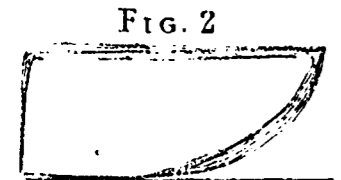
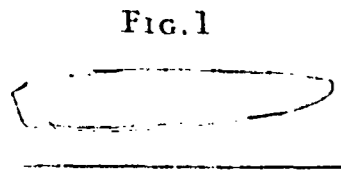
## CORRESPONDENCE.

### The Mining Policy of the B. C. Government.

The Editor:—

We are now in the throes of a Provincial election, the result of which will probably be known soon after these lines appear in print, and in consequence political matters take precedence over all others. People in the mining districts are asking themselves the question what have the Government done during the last four years to encourage and develop our leading industry, and what have they left undone that might reasonably have been effected. It would be out of place for me to go into the subject fully in a strictly non-political journal, but to examine a few of the main features which directly concern us as mining men might not be inopportune at this juncture. The object of all legislation in the matter, I take it, is to develop the mineral resources of the Province to the fullest extent whilst safeguarding at the same time the interests of the working miner and prospector. Many things are necessary before capital can be induced to enter a country on business bent; first and foremost the mineral resources need to be worth developing, a condition of affairs with regard to British Columbia which I do not propose to discuss at the eleventh hour. This however, will accomplish little unless

DIAGRAMS.  
 Accompanying Mr. E. M. Hann's Paper on  
**IMPROVEMENTS IN WINDING APPLIANCES.**





these matters are brought to the attention of investors, which you will all admit has been pretty thoroughly done by this time. It is evident that the Government is not alone or even primarily to thank for all this, private enterprise is very largely responsible, although in some respects the Government have advertised our resources in a manner if anything a little too forcible. I must say that personally without political bias of any kind I think it looks the reverse of inviting to see a premier on the governing board of any mining company operating in the Province. I am not insinuating that there is necessarily anything radically wrong about it, but to say the least it looks suspicious and for the honor of the Province should be discouraged as much as possible. The same may be said of our agent-general in London, it is to the discredit of British Columbia and the Turner administration that our agent-general shares with the same official from Tasmania the unenviable distinction of being the only colonial representatives to use their official positions for personal gain. We should like too to hear a little more of our agent, what he is doing in London for his salary? When I was there last the British Columbia office was a disgrace to the colony instead of a help, and according to all accounts it is little, if any, better at the present time. Then again the opportunity of interesting capital is provided at the Imperial Institute, but so far the Government has certainly not availed itself to any extent of this, although it appears to be one of the schemes for the near future, but why has it been so long neglected? The first question of the capitalist on introduction to a new country is as to the liberality or otherwise of the mining laws. I do not think we shall be far off the mark in saying that the provisions in British Columbia as they stand at present are about as liberal as those of any country in the world generally speaking, in fact, one of the charges against the Government in the past has been that they are a little too much in this direction. The only clause that I observe which is really detrimental to the introduction of capital, is the mineral tax of one per cent on all ore raised, looked at in the right light this ought to prove a boon if properly directed, as it provides the revenue necessary to the proper administration of justice and the opening up of new territory by the construction of roads and trails. The tax itself appears to be a small matter when the high value of much of the ore is taken into account, but the real object should be to ensure the permanency of our mines by developing not merely the rich ores but the almost inexhaustible quantities of lower grade as well. There is one thing that we cannot allow to pass without a protest, and that is the discrimination shown the coal and hydraulic miner as against the distinctly metal miner, the injustice of taxing the working miner five dollars a year in metalliferous mines has been pointed out so often that I do not propose to make further comment, but added to this the output from the metal mines is taxed, while that from the coal mines which are more firmly established and equally able in every respect to bear the burden go free of all taxation. Similarly the hydraulic miner is asked to contribute nothing to the Provincial treasury, a condition of affairs which is very naturally resented by those who are. It is obviously impossible in a short article to go into the various amendments to the Mineral Act which have been brought forward and many of which have become law since the last election, but among the notable suggestions for the protection of the miner we observe the repeated but happily futile efforts made to reserve the rights of location to British subjects only. This policy although at the time having apparently much to commend it would assuredly prove very short sighted in the end, and the Province is to be congratulated at the display of broad-mindedness by our legislators in its rejection.

Another matter of prime importance to the miner which received attention was the exclusion of oriental labor from underground workings, this being without doubt one of the most popular acts of the Government. The suggestion made by Mr. Carlyle, that prospectors be compelled to complete their first assessment ninety days from the date of location, although a most excellent one did not meet with that universal approval which was necessary for its successful adoption, and the Government wisely decided to take no steps until further testimony was forthcoming in favor of such a move. I have merely touched on a few of the most noticeable features since ninety-four, others of almost equal importance have had to be left out for want of time and space.

HOWARD WEST.

New Denver, B.C., 18th June, 1898.

### Klondyke Letter.

LAKE LINDERMAN, June 3rd, 1898.

A few facts about the way to Dawson may be useful. Avoid the Wrangell and Teslin route by all means; it has nothing to recommend it as yet. Choosing between the Skagway or White Pass trail and the Dyea or Chilcoot, I should adopt the latter, now that the Chilcoot tramway is running. Until it builds a railway, the White Pass route cannot compete with the Chilcoot. Both are difficult in summer, but the Chilcoot is shorter and has more artificial help for one in its tramway, and in the fact that about ten of the sixteen miles beyond the summit to Bennett are done in ferry boats (fare one dollar each lake) across Lakes Crater, Long, Deep and Linderman. Sail from Vancouver by a boat which lands at Dyea (only a few do so and none of the big ones) for so you avoid customs and wharfage and ferry charges at Skagway. The Hotel Olympic at Dyea is very fair at two dollars a day. Outfit, if you must, at Dyea, better at Dawson. The Chilcoot Tramway Co., will put your goods just beyond the summit of the Chilcoot for about 3 cents a pound. There you can contract with freighters to put your goods through to Bennett for 6½ cents per pound. Stay by your stuff all the time you possibly can. The Chilcoot trail includes 9 miles of waggon road of the worst kind from Dyea to Canyon City, 5½ miles of easy uphill work from there to Sheep Camp, about 3½ miles of rough uphill work from there to "The Scales," about a mile, in places, of steep work from there to the summit, about 9 miles of rough downhill work to Linderman (but four of the miles can be done by ferry), six or seven miles by ferry to Bennett where you buy a boat for about a hundred dollars or less (I have given eighty for a good boat for my party of five), or you take one of three lines of steamers ready to put you down. There is no great difficulty for an active man or

woman in any part of the Chilcoot trail unless a pack be carried. High leather boots up to the calf should be worn, and it is best to take along one's own tent and avoid the bunk-houses. Food can be got at Canyon City, Sheep Camp, the Summit, Long Lake and Linderman. The trail to Bennett can be done in one day, but hardly if you stay with your stuff which will not get through in less than two or three days. The tramway runs from Canyon City to just beyond the Summit. The White Pass is capable at any time of becoming practically impassable in about three places, and in any case it is several miles longer and involves more walking; still money is being spent on it and it will be made passable before the Fall. If you decide to go by it, you can contract at Skagway (where you can outfit) to get your stuff put through to Bennett in about three or four days at about 13 cents a pound or a little less. If you outfit in Dyea or Skagway you must pay duty on passing the Canadian frontier at the summit. If you outfit at a Canadian port like Vancouver, you have the privilege of bonding your goods through American territory, but of course, you pay freight on your goods from Vancouver to Dyea. Still freight charges usually seem to come to less than custom's charges, so if you insist on outfitting before you reach Dawson, outfit at Vancouver. All talk about danger from precipices, etc., on the trails is idle; there is no real danger and very little steep work; therefore bring no rope for climbing purposes! Come, if at all, well shod and with friends. Wear warm underclothing, for the nights are chilly. I have seen Linderman and Bennett contain about 5,000 people each, and have not seen a drunken man in them; all is orderly; the rule of the Mounted Police is splendid. I have never seen such order in any town. There has been *one* bad case of stealing and it was severely dealt with (two year's hard labour). Hardship on the trail no longer exists, unless you pack your own stuff. The rates for passengers with stuff from Bennett to Dawson vary from \$25 on a scow (very uncertain quantity) to \$75 or \$100, (not yet fixed) on the steamers which begin to run about June 13th. Three companies have five boats ready now between them. A meal costs a dollar at most points on the trail, a bunk (but avoid them although they are clean) costs half a dollar or a dollar. Be sure to make for Bennett and not Linderman as your point of departure for Dawson; the steamers run from Bennett; the Bell River Rapids between Lakes Linderman and Bennett are very dangerous indeed; so avoid having to get your boats through them. There are post offices at intervals all the way to Dawson.

DYEA, June 1st, 1898.

Probably most men believe Wrangell to be a growing seaport on the Stickine. It is not on the Stickine, it is on a little marshy inlet of the sea and the Stickine flows round the corner, so to speak, missing Wrangell which otherwise might get rid of its evil odors. Wrangell does indeed need a good washing. In spite of abundant rain (there had been 72 hours rain on and at the time of my arrival on May 29th), its dirt and stinks and lies stick to it. Wrangell has been booming itself lately as a point of departure for the Yukon. This spring has shown that it cannot be such except in the few summer months when the Stickine is navigable. The winter trail up the Stickine is too difficult for use. Thus the Teslin route involves a continuation of the projected railroad southward from Glenora to some accessible point on the coast or in the interior of British Columbia, if it is to be of any real use all the year round. The future of Wrangell then would seem to be very highly speculative; for Wrangell lies off the line of the really useful railroad.

I looked in vain for the many wharves promised as gold mines by prospectuses issued in London during the last winter. The very few new wharves are quite sufficient for all the traffic to Wrangell. There are plenty of little stores and Indians and low-class saloons. There is one decent hotel. The totem-poles are numerous and interesting. They seem doomed by Christianity and the hungry collector; only a few are kept fresh with gay paint. It would be a pity for them to perish quite; for they bear testimony on the spot to a feature of Indian life usually unnoticed; they show an uncouth art, but still art, struggling to express the ideal, sadly limited in this case, as can well be imagined, by the actual or real, to wit, the sleepy owlish faces of the Wrangell Indians. Still there is merit in the work of these Indian carvers, especially in their representations of animals; in these they approach truth in many essential features.

A drunken man would not live long in Wrangell, for the town in general and the sidewalks in particular are built on piles and to step off would be death in many cases. I saw one clever thing there:—A wag had set up on two iron tram-rails a stove with its stove-pipe for a locomotive and behind it two boxes for cars; over the whole he had fixed up a sign board on which he had written in fine contempt "Yukon Railway." This was the chief ornament of the main street! Messrs. Mackenzie and Mann ought to conduct the Canadian law-makers on a pilgrimage to this quaint shrine? But they must go in gum-boots and oilskins, for there is real rain at Wrangell. Wrangell is picturesque and not much more. I liked it best from the boat,—on leaving it.

T.

### Improvements in Winding Appliances.

By Mr. E. H. HANN, M. Inst. C. E.\*

The writer has no intention of entering into a history of winding engines, or an exhaustive account of progress made, but merely purposes shortly to describe some practical improvements made in existing plants, which were of a very imperfect character; and also to make one or two suggestions for further improvements which he would like to have discussed.

The first case is one of a pair of 27 in. by 5 ft. stroke Cornish valve winding engines, which used to give a diagram shown by fig. 1, plate 14. The waste was largely due to small valves and insufficient lift of the valves, amendments in the latter respect produced the diagram, fig. 2; but this does not show the full value of the improvement, as the diagram, fig. 1, was taken while the engine required 32 seconds to make a wind, with 40 lbs. of steam, and fig. 2 when it could do it in 21 seconds, but with 50 lbs. of steam; the depth in

\*Paper read before the South Wales Institute of Engineers.

both cases being 220 yards, and the diameter of the cylindrical drum 13 ft., with a live or useful load of 26 cwt. There was no expansion gear on this engine.

It being desired to increase the output of the pit beyond what the engine could do at the improved speed, calculations were made to see whether a new engine was necessary, or whether some modifications could not be made to effect the desired end. It was then found that by using a spiral drum, the power requisite to lift a two tram cage, at the start, would be very little greater than when one was raised on a plain drum; and this was done, being considered in the end, under the circumstances of this particular case, preferable to a condensing arrangement, or a balance rope, although it was quite open to introduce either or both of these later on, if found desirable. The result was that the engine could raise two loaded trams in 28 seconds.

To avoid loss of time in changing decks, an arrangement was made at the top and bottom of the pit for loading and unloading both decks simultaneously; sketches of those arrangements are shown by figs. 3 and 4 respectively. At the surface, the trams are let down to the bottom deck of the cage by a self-acting chain creeper, set at an inclination of 9 inches per yard; one tram is sufficient to work it, and the man who attends to the lower deck has a brake with which he can control it, and keep himself supplied with empty trams. The empty trams are then placed upon tilting tables which are inclined by the action of the cage dropping on to the keps, and the empties then run into the cage simultaneously at each deck. Both decks of the cage are tilted by the cage dropping on to the keps, and the full trams in the cage are also released from the catches by the cage coming on the keps, and the lower one runs into a steam lift (shown in fig. 3) which is self-acting, and which raises the tram to the pit top level, where it automatically discharges itself, the tram upon running out striking a balanced lever which causes the lift to be lowered ready for another tram.

At the pit bottom the gradients are so arranged that the whole of the coal from the west side gravitates to the bottom deck, but are against the coal gravitating to the upper deck. The deficiency of coal from the west side is made up by lowering trams from the east side by hydraulic lifts. This pit bottom was of the old-fashioned double-sided description, and made hitching rather heavy work, and one advantage gained by the arrangement is avoiding the necessity of taking coal in at both sides; a satisfactory solution of the difficulties of which arrangement the writer would like to see. The cage bottoms are tilted when resting on the bottom, and the empty trams run out themselves; those from the bottom deck into hydraulic lifts, by which they are raised to the upper level while the cages are running. For sketch of this arrangement, see fig. 4. The four lifts are each quite independent, and the water is had from a higher level, and after being used runs away to the pumping engine, to which it would in any event go.

It has been found as easy to raise 220 trams per hour by this arrangement as 130, which was the maximum with the old one. The writer wishes it to be understood that there is scarcely any portion of the appliances which was new, but the arrangement as a whole is probably different to any other. It may be well to name for the special benefit of younger members that some good examples of simultaneous loading of different decks can be seen at the Harton Collieries in South Shields, Denaby Main Colliery, Hucknall Torhood Colliery, Newstead Colliery, and Harris' Navigation.

The next case is only named as an actual instance of the increased speed attainable by the use of a balance rope. The winding engine is a pair of 36-inch by 72-inch horizontal Cornish valve engines, with a 21-ft. cylindrical drum, winding two trams from a depth of 440 yards; the time of winding was originally 55 seconds, but by putting on new and larger valves, and an automatic cut-off, this was reduced to 46 seconds, and, upon the balance rope (which is only an old winding rope) being put on, this was reduced to 39 seconds, everything else remaining precisely the same. The cut-off comes into operation at the end of the third stroke with the balance rope on, and not till the fifth or sixth when running without it. The balance rope, in this case, is passed round a sheave at the bottom, working in channel iron guides, to allow of the necessary movement.

The results with this engine led the writer to advise and adopt an increase in the lift of double-beat valves beyond the usual engineering rules, in fact to double it by allowing  $\frac{1}{4}$ -inch lift per inch in diameter, the object being to admit steam quicker. The result is shown by diagrams, figs. 5 and 6, from pairs of 36-inch and 42-inch engines respectively. Of course the practical result is that the steam valve obtains its full opening to  $\frac{1}{8}$ -inch per inch in diameter in half the time, and gives a better effect upon the piston, and the exhaust valve similarly releases the steam more quickly.

The third case is one of a pair of 45-inch by 72-inch engines, winding two trams holding 27 cwt. each, from a depth of 527 yards, with flat ropes  $4\frac{3}{8}$  inches by  $\frac{7}{8}$  inch, on rolls 19 feet diameter; the time of winding was 45 seconds, at the best, with 55 lbs. of steam. The cage having two decks, the difference in the diameter of the rope rolls made the changing of decks very slow, often occupying 30 seconds, and the maximum number of winds per hour was 44. This being far below what was required, and the cost of flat ropes being very much in excess of the usual rate for ropes, a change to round ropes was determined upon.

The distance between the centre of the drum shaft and the winding pulleys being only 61 feet, and the width between the engine beds having been arranged for flat ropes only, and narrower than usual, it was found necessary to groove the drum, so as to make the space sufficient to accommodate the requisite number of laps. As the pit was about to be deepened to 588 yards, a drum with a diameter of 22 feet was decided upon, requiring 25.5 laps. The ropes used are  $5\frac{1}{4}$ -inch circumference, and weigh  $26\frac{3}{4}$  lbs. per fathom, against 40 lbs. per fathom on the flat ropes; total weights, 63 cwt. and 94 cwt. respectively. The results in wear and cost are that the average life, winding from 527 yards, has increased from 7 to 15 months, and the cost was reduced to one-sixth of the previous result.

No inconsiderable part of the saving is due, in the writer's opinion, to the grooving of the drum, which was only adopted here from necessity, but which he intends to adopt in all future cases. The time of winding was only slightly reduced, owing to the increased diameter of the drum; there was, however, a saving of time in changing, by not requiring to pass the top cage below the keps and back again, and altogether about 4 winds per hour were gained.

A new pit bottom 60 yards deeper having been made, and the simultaneous loading and unloading of both decks put to work, the time of changing was reduced to 6 or 7 seconds, and the number of winds per hour is now 58, with the assistance of a balance rope. This balance rope is one made specially

flexible to allow of its bending in a circle only 5 ft. 3 inches diameter, and is one of the flattened strand construction, so as to avoid twisting, and it is found that this rope runs quite steadily without any sheave at the bottom.

The arrangements at the surface differ from those previously described, as want of space prevented a lowering creeper being used, and recourse was had to a lift which is almost entirely self-acting. And the same cause obliged the lift for the full trams to be on the same line as the road for the upper deck trams, both of which the writer regards as distinct disadvantages.

The pit bottom arrangements also differ in the following respects from the previous case, the lifts work in pairs of one full and one empty lift working each other by balance, that is, the weight of the full tram in one lift brings up the empty tram in the other, and when both are discharged they are so weighted as to return to their positions for reloading. The operation of the cage scotches, in this case, is that the tilting of the cage bottom acts by a lever so as to depress the scotch (see sketch fig. 7), whilst in the case first named the scotch is released by a lever coming on to the keps (see fig. 8). Also another difference is that, whilst in this instance the rails on which empty trams stand are tilted by a lever worked by hand, those in the other case are, as previously mentioned, tilted by the cage coming upon the fans. The construction of these tables is shown by sketches in figs. 7 and 8 respectively. The latter is hinged and balanced, so that when empty it stands level, in which position it can be kept by an eccentric cam on a shaft underneath; when a tram is put upon it the weight is forward, and as soon as the handle of the cam shaft is turned the table tilts, releases the scotch, and the tram runs into the cage, the table then returns to a level position, and again secured by the eccentric cam ready for another tram, otherwise the arrangements are almost identical with those described in the first case.

Probably there are still a considerable number of old engines with flat rope drums with very short leads; the writer has a case with only  $28\frac{1}{2}$  ft. distance between centre of drum and centre of pulley, but thinks that round ropes even coiling back on themselves will be safer and more economical than flat ropes, and is about to adopt it, probably using locked coil ropes in the first place. The depth is about 350 yards, therefore a 15-foot drum 18 inches wide will allow it to be done, the rope not quite coming back to the side it commences from.

In considering the practical problem of the best winding engine for a pit 600 yards, or over, in depth, and keeping in view what are the chief advantages and disadvantages of various arrangements, such as the extremely uneconomical character of a simple winding engine even when provided with cut-off gear, the slow starting of a compound engine, and the enormous weight of spiral drums, the writer was led to consider whether a combination of compound engine with a drum specially designed to give an easy start would not be the best, thus by using a drum doubling its diameter in four strokes a compound engine would get a better start away, and have got into speed and the full pressure on all pistons, before its maximum load comes on; whilst by using cylinders of somewhat larger diameter and shorter stroke than the most usual proportions, the diameter of drum might be kept down without detriment to the speed of winding and with economy of steam; a drum thus proportioned could be constructed, without the usual enormous additional weight, by strutting the spiral portions from the outside bosses in the manner shown by fig. 9.

The statical load of such a winding engine for a depth of 630 yards, diameter of drum from 14 ft. to 24 ft., making 26 revolutions per wind, is shown by diagram, fig. 10, but the sharp angles there shown would have no real existence, because they are caused by treating each revolution of the engine as a separate period, whereas the change in the diameter of the drum, which is almost solely the cause of the rapid rise in the load line, is really perfectly even, and the engine would during this period be quickly increasing in speed, also at the end of the winding the empty load commences to slow down rapidly, and thus helps to arrest the engine, and reduce the amount of power to be wasted by the brake.

## Notes on Sinking.

### METHODS OF DEALINGS WITH THE WATER.

(Continued from last Month.)

Generally a sinking set lifts the water, so that in case of the pump being temporarily overpowered and the bucket having to be changed, it can be drawn up the pipes, which are made 1 in. larger than the working barrel, the clack also can be withdrawn the same way by a fish head.

Generally, too, the whole lift has to be hung on the crab ropes, and the pumps and spear rods changed at top throughout, the Hogger pump being removed each time.

When a depth of some 70 or 80 yards is reached, it is probable that a cistern will be fixed if possible, and the pumps made good to that point with buntions and collarings of a more permanent nature.

A second set of spear rods will be carried down the shaft to a second lift, and the ground spears shifted to these pumps, which will deliver into the cistern.

The disadvantages of this system are many—

It is cumbersome and fills a large part of the shaft, while adding largely to the dangers of a sinking. This is specially true of a heavy sinking with three or more sets of large pumps and spear rods and without guides.

It entails a large capital expenditure, while should the pumps not be required on the completion of the sinking, scrap-iron price only will be obtained for them.

The great weight and heavy strains on all the working parts, and the many working parts, cause many breakdowns which are generally of a very expensive character.

Much valuable time is lost in adding pipes and rods, and the necessary buntions, cross-blocking, cisterns, etc. On the other hand, such pumps as the Denaby, Evans', Cornish and others, have none of these disadvantages. Their first cost is small; they require no expensive foundations, take up little shaft room, work independently of one another, require no stages, have few working parts and those of simple construction, are easily repaired in case of accident, are easily controlled from the surface and started from any position, easily raised and lowered, can work out of perpendicular, and the Denaby pump at least will work with wet steam if submerged. They are, however, very wasteful of steam, but the writer considers this a comparatively small disadvantage. A few examples of these two systems may be of interest.

The recent Clara Vale sinking, near Wylam-on-Tyne, took three years to sink 132 yards, owing to the heavy feeders met with, for which, relying upon careful inquiries, they were unprepared.

A 6 in. by 2 ft. special pump, an 18 in. by 6 ft. lifting set geared to the winding engine, a 14½ in. by 3 ft. special pump, and a 24 in. bucket lift, which, during the sinking, was made into the permanent pump, with two 22 in. rams by 10 ft. stroke, with an 18 in. tail bucket to deal with the bottom water, were all used in dealing with various feeders of water, amounting at the highest to 120,000 gals. per hour, from a depth of 109 yards.

At the Cadeby sinking, through the magnesium limestone, after using temporarily a No. 9 and a No. 10 Pulsometer, the Denaby pump was designed. The first had a 22 in. steam cylinder by 27 in. stroke, 18 in. suction, and two 8¾ in. delivery plungers, and lifted 50,000 gals. per hour a height of 52 yards at 35 strokes a minute.

Seven other pumps of similar size, but with 3 ft. stroke, were afterwards added. Six of these pumps forced over 400,000 galls. per hour a height of 66 yards. All were slung on crab ropes, and one lad attended to all of them by regulating the feed valves at top.

At the neighbouring Canklow sinking, three sets of three No. 10 pulsometers were similarly used, suspended by heavy chains from balks at top, and dealt with 150,000 galls. per hour from a depth of 84 yards.

*Winding and Disposing of the Debris.*—If the kibble be self-tipping, two will be required, together with a spring hook, safety hook, winding ropes, guides, winding engine, boilers, etc. Should, however, the kibble be not self-tipping, three will be required, unless some such arrangement as follows be made for discharging it. To the kibble is fastened a ring, and to the headgear a chain with hook. On reaching the surface the banksman hooks this chain into the ring, and on the engine being quickly reversed the contents of the kibble are discharged into the tip, waggon, or shoot leading to it.

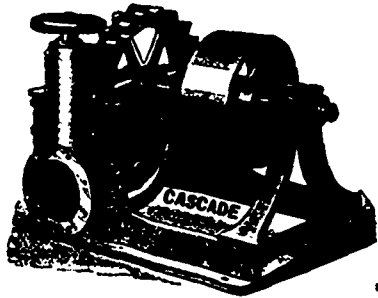
*The spring hook* has this advantage over an ordinary hook—that it ensures the safe attachment of the kibble. The inclusion of a safety hook is important, as the temporary headgear is generally low—say 40 ft.—to allow of the erection of the permanent one above it; moreover, the constant alteration in the length of the ropes is puzzling to the engineman, and high speed is necessary in a large shaft and when winding from great depths.

*The winding rope* should be such that it will not spin. The Elliot locked coil is considered by many the best for this purpose.

*Guides.*—Two wire-rope guides are now generally adopted except in small sinkings, especially if the depth to be sunk be considerable.

The lower end of these can be passed through two buntions fixed in the walling about 20 yards off the pit bottom and fastened by clams, while the other end is carried over pulleys at the surface and wound on two drums of a crab engine. In many large sinkings, in place of the old form of walling stage, consisting of a central part and two wings fastened together with bolts, and connected to a crab rope, or to two crab ropes, by two sets of three chains, or suspended from two balks fixed in the shaft, with a dozen or more strong bolts resting in the walling, the *Galway walling stage* is now used. This consists of a floor and roof connected together by four vertical pieces of angle steel 5 in. by 5 in. by ¾ in. The frame of both floor and roof consists of four pieces of angle steel 5 in. by 5 in. by ¾ in. crossing one another at right angles, and of a circular band of steel 4 in. by 4 in. by ½ in. covered with 5 in. planks, and with a hinged door which is lifted when passing the buntions, and which has an opening for the air pipes. The frame of the roof is covered with ¾ in. steel plates, and is slightly less in diameter than the floor.

Openings are left in both for the passage of the kibble, and, if necessary, for a water barrel, and in the roof for a mason's kibble; all openings being well fenced.



## WATER WHEEL

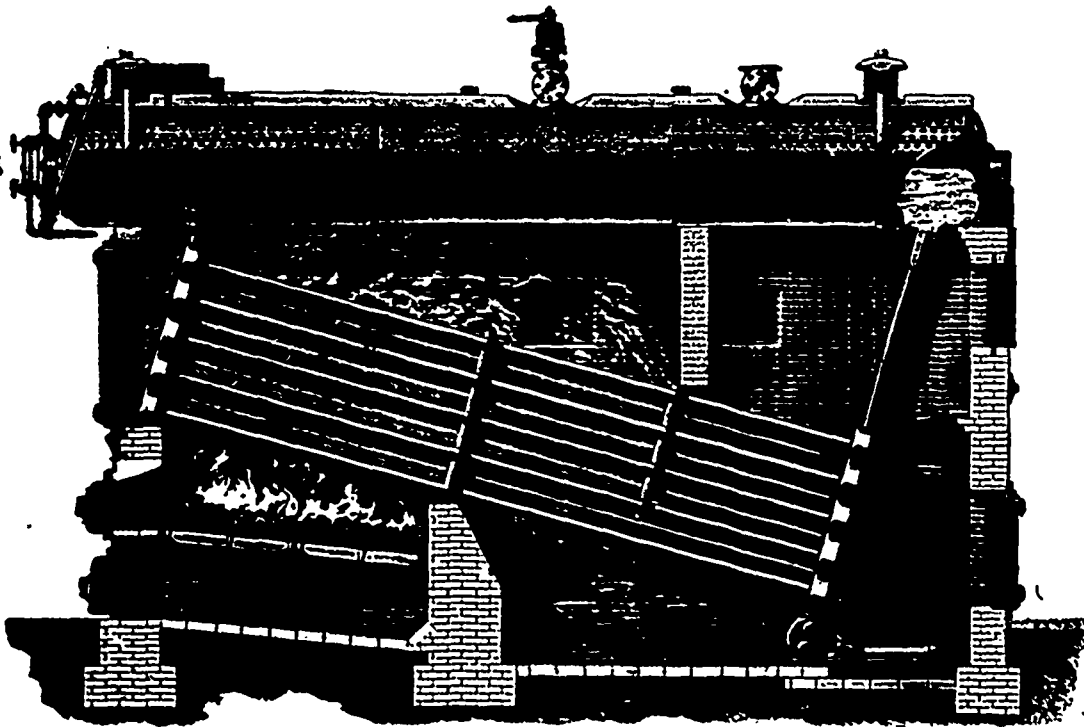
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The idea is that both walling and sinking may go on together, and by its means also water holds can be made in the shaft sides while sinking continues. When not in use it will be kept some 20 yards from the pit bottom, just out of reach of the shots, and will form a great protection to the sinkers, while it is said to save one-sixth of the usual time of sinking. It is generally suspended by two ropes attached to balks at the top and brought down the shaft, passed round large pulleys attached to the roof, and carried up the shaft again and over other pulleys to two drums on the crab engine.

These ropes are frequently used as guide ropes, a rider consisting of a cross-bar with two legs clipping the rope at four points being used.

In the cross-piece an opening is left for the passage of the rope, which has an india-rubber buffer attached to it above the capping.

The kibble as it ascends from the pit bottom and passes through the stage lifts the rider which was left on the journey down, and the rope suffers no injury. On its return the rider is again left on the stage roof, india-rubber pads being fixed to take the blow of the legs. Previous to the introduction of guides at the Harris' Navigation sinking, the time of winding, changing, etc., from a depth of 475 yards, was 4 minutes 49 seconds; after the adoption of guides this fell to 3 minutes 26 seconds, although the depth was increased to 530 yards.

The top of the shaft is either covered with planking and two balanced doors, or by a platform running on rails laid on balks across the shaft top. In the former case on the loaded kibble reaching the surface the banksman closes the doors — which may be done in one operation by an arrangement of levers and counterbalances designed by Prof. Galloway, and a continuation of the rails from the rubbish tips being fastened to the upper side of the doors, a tipping waggon is run over the pit and the kibble discharged into it. On its removal the doors are again opened and the kibble descends. In the other case the platform is run over the pit and the full kibble replaced by an empty one brought forward on the platform. The former arrangement is preferable.

**Sinking engine.** This, if the shaft be a small one and the depth moderate, will probably consist of a Robey portable with drum attached. If a large shaft and of considerable depth, a pair of horizontal engines will be put down of such a size that, while suitable for sinking purposes, they can afterwards be used for driving haulage ropes from the top. They should be so placed that they do not interfere with the erection of the permanent winding engines, which may be used later on in the sinking.

**Boilers.** — At Llanbradach, only one Lancashire boiler, 30 ft. by 8 ft., worked at a pressure of 150 lb. per square inch, and fixed by forced draught, was used for the greater part of the sinking. This was afterwards temporarily supplemented by an old locomotive boiler until a second Lancashire boiler of similar dimensions and arrangements could be erected. More boiler power than this is generally required when high-pressure pumps are slung in the shaft and heavy feeders of water have to be dealt with; probably from five to eight Lancashire boilers will be required, worked at a pressure of from 70 to 80 pounds.

**Ventilation.** — The old method of coupling up a range of pipes to the boiler chimney, or to a special chimney with furnace, has been largely abandoned in favor of small high-speed fans which are now generally Schiele or Capell, and may be forcing or exhausting. The pipes are generally 15, 20 or 24 inches in diameter, of sheet iron, coupled together with bolts, and fastened at intervals to buntons by clips passed under lugs attached to the pipes.

**Lighting.** — A cluster of electric lamps enclosed in a strong glass case, is now generally adopted; in place of the same form of petroleum or naphtha lamp, of which the Wells lamp is the best. A concentric cable is connected to this lamp, wound on a small drum, and so arranged that it can be raised or lowered as required.

#### THE VARIOUS METHODS OF SINKING.

**In Strata requiring little or no temporary support.** — In sinking to the stone head, as the solid strata is called, the shaft will first be marked out of the full diameter, plus width of walling, plus a little room for packing, say 6 inches either side, and a depth of 6 feet or so excavated with mattocks and shovels.

A wooden curb 6 in. by 4 in., or 6 in. by 6 in., will then be laid level on the bottom, and another placed 3 ft. above this, supported on short upright timbers, called punch props. Lagging will then be placed behind this 1 in. thick by 6 in. wide and 9 ft. long, and well wedged up. Two fresh curbs with punch props between each, will be fixed above the second, and all four fastened together by stringing deals 6 in. or 7 in. wide by 1 in. thick and 9 ft. long, spiked to the inside faces of the curbs. The sinking will then be continued in the same way to the stone head, a length of 3 ft. or 6 ft. being taken out at a time, and the sides then secured as before described.

The curb is 6 in. by 4 in., or 6 in. by 6 in., cut to the circle of the shaft, six or eight segments forming the circle. These are either joined with a half-lap joint and fastened together by one or two bolts, or have cleats fastened over the top and bottom of the joint. Frequently now iron curbs or rings are used, in 3 in. to 4 in. deep by ½ in. to ¾ in., bolted together in segments turned to the circle of the shaft and connected together by means of a lap joint and bolts, a butt joint and fish plate, or by turning knees and passing bolts through these. In this case laggings only are driven down behind them and wedged up, but where necessary the iron rings are connected by iron rods of ½ square iron, with hooks at each end to hook into the curbs.

Four long pitch-pine balks, crossing one another at right angles, will be placed across the shaft on the surface, to which, should the ground be bad, the whole structure will be hung by chains or iron bolts, in addition to the simple stringing planks.

In Lancashire a system called "back-casing" is frequently adopted. This consists in filling in the space between the curbs with dry brickwork in place of punch props and lagging, and connecting the curbs by stringing planks. As walling is carried up inside this, it entails a larger diameter.

In bad ground it may be necessary to add to the section of the curbs, and in any case to place them closer together, 2 ft. or possibly even 1 ft. only being allowed between them.

On the stone head being reached, a walling curb will be laid, and the walling carried up to the surface, and to such a height above the railway level as will be convenient for screening.

The bed upon which the walling curb is laid is first dressed and truly levelled. A lare of ½ inch pine sheeting is placed on this, and either a wooden or an iron curb. The former will be similar in form to the wood sinking curb, but of stronger section, 12 in. or, say, 14 in. by 6 in. for 9 to 12 in. walling. As wood decays, cast-iron curbs have been used by the writer, cast in 6 or 8

segments to the circle and the segments connected together by a couple of bolts passed through the flanges. Either stone or brick is used for walling; the latter is the cheaper, as the bricks or lumps are generally specially made and moulded to the shape of the shaft. The heavy expense of dressing and fitting the stones is thus saved.

Space must be left behind the walling, which should be packed with sand, ashes or coke dust; 9 in. work is sufficient in good ground, 14 in. or more is required in bad ground.

Small feeders of water that percolate through the masonry are collected in "water" rings, which should be of cast iron, and the water is carried down from these in wooden troughs, or iron pipes, to the nearest water hold or the pit bottom. The brickwork is thrown back for a few courses above the ring, to lead the water down into the rings, and to enable the water rings to be cleaned out.

For larger quantities of water, the back of the masonry is often pigeon-holed for a short distance to readily drain the water.

In setting the walling curb, the centre line must first be dropped over a hinged arm, or by Foulstone's apparatus, and a radius rod put on all round. After the first length of walling, eight or ten lines are dropped from the upper curb, and the new walling curb set to these and checked with the centre line and radius rod. For three feet or so below a walling curb the shaft must be continued down of the same diameter as the inside of the shaft, in order to support the curb, and then be cut back to its full size. After reaching the stone head, explosives will be required. In bad ground walling curbs are supported on steel plugs.

#### IN SANDY OR RUNNING STRATA.

**Piling.** — Should the borings show that quicksands are to be expected near the surface, this is the system generally adopted. If their thickness be known, 1 ft. 6 in. must be added to the diameter of the shaft, before walling, for every four yards of quicksand. The shaft having been marked out of this size, piles 15 ft. long by 6 in. wide by 3 in. thick, shod at bottom, hooped at top, and planed to the radius of the shaft, are driven down for some four or five feet round a 6 in. by 6 in. wooden curb. A depth of three feet or less is then excavated, another curb or two curbs added, and supported by punch props, and the piles again driven down.

The process is repeated until the piles are driven down their full length; some 1 ft. 6 in. from the bottom, a second curb, 1 ft. 6 in. less in diameter than the previous ones, is now added, and a fresh circle of piles driven down in exactly the same way. It is important that the edges of the piles should fit closely together to keep out the sand or other loose strata.

(TO BE CONTINUED.)



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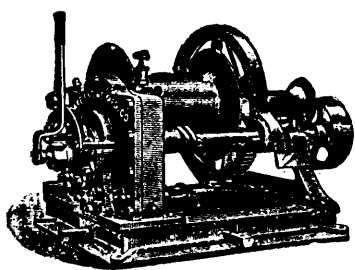
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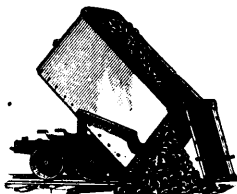
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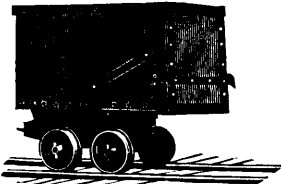
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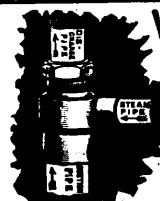
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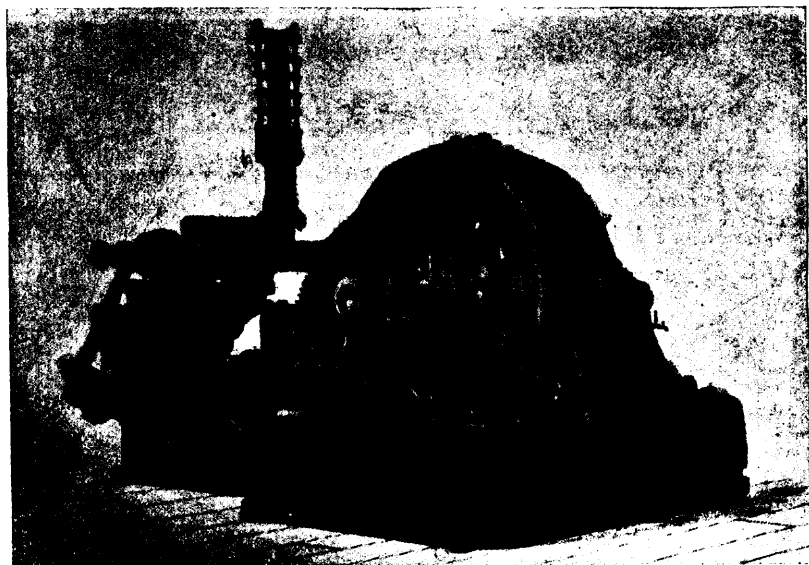
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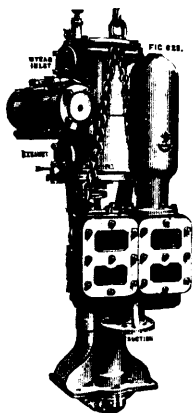


Fig. 620—"Griff"  
Sinking Pump.

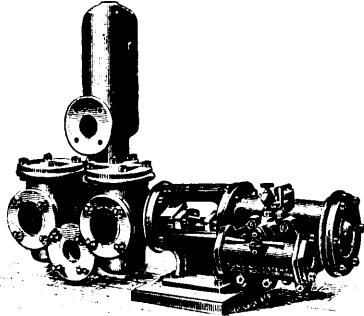


Fig. 598—"Cornish" Steam Pump  
for Boiler Feeding, etc.

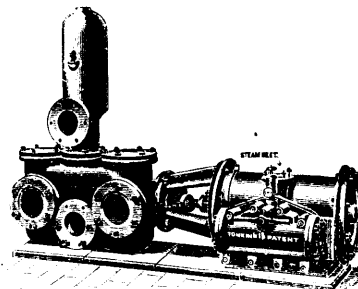


Fig. 600—"Cornish" Steam Pump  
for General Purposes.

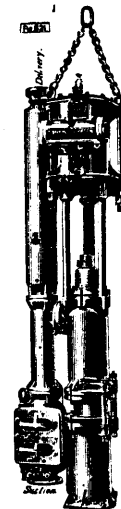


Fig. 621—"Cornish" Sinking Pump (Ram Type).

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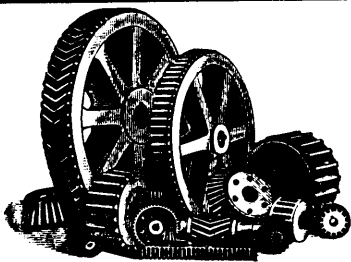
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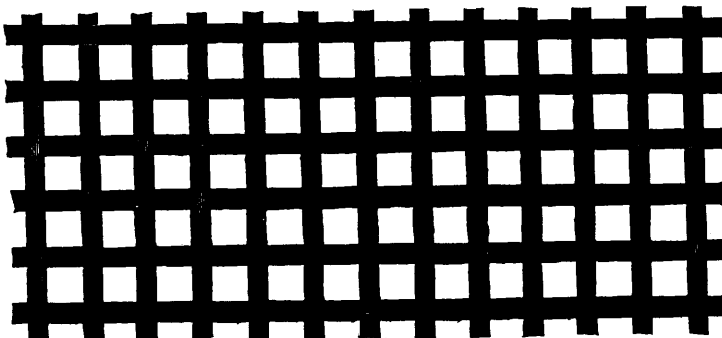
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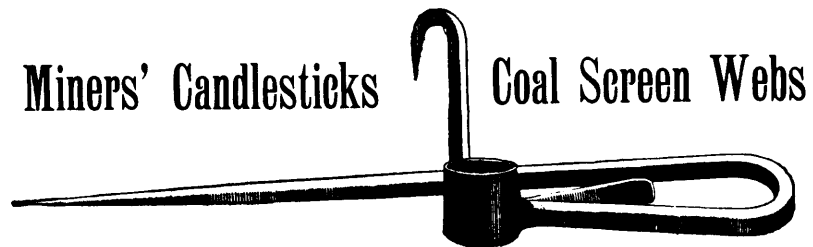
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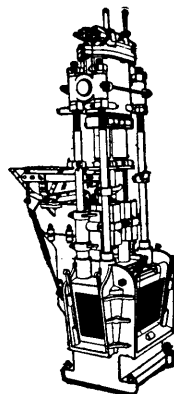
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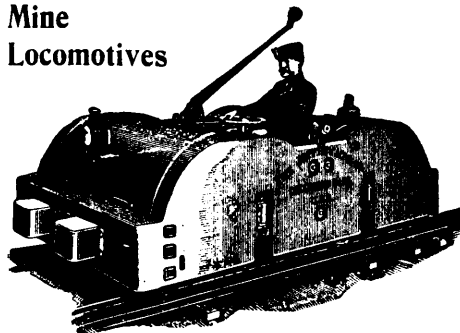
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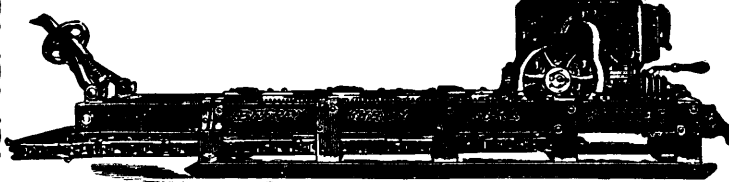
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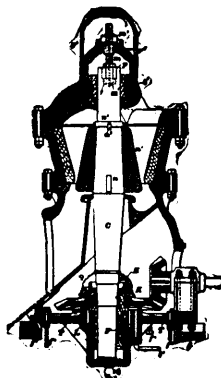
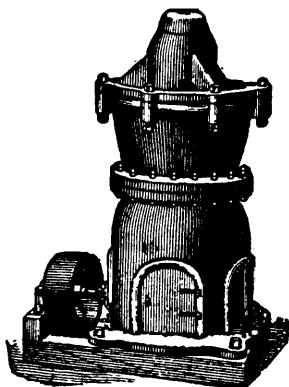
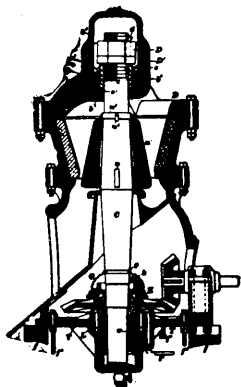
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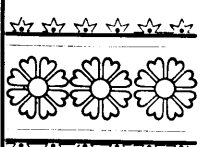
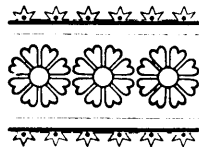
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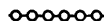
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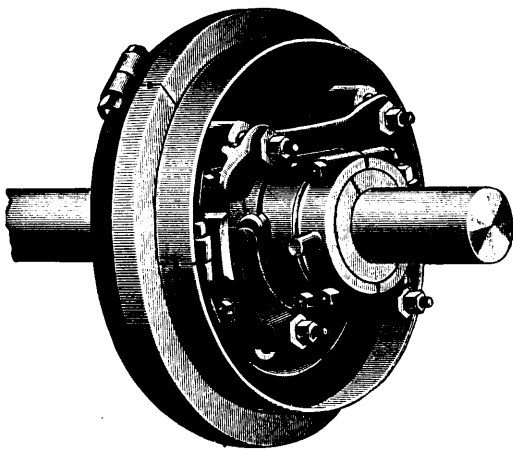
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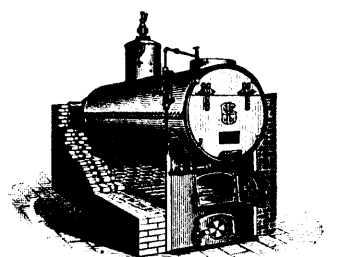
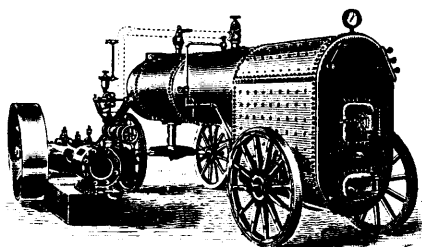
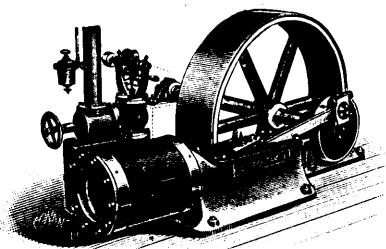
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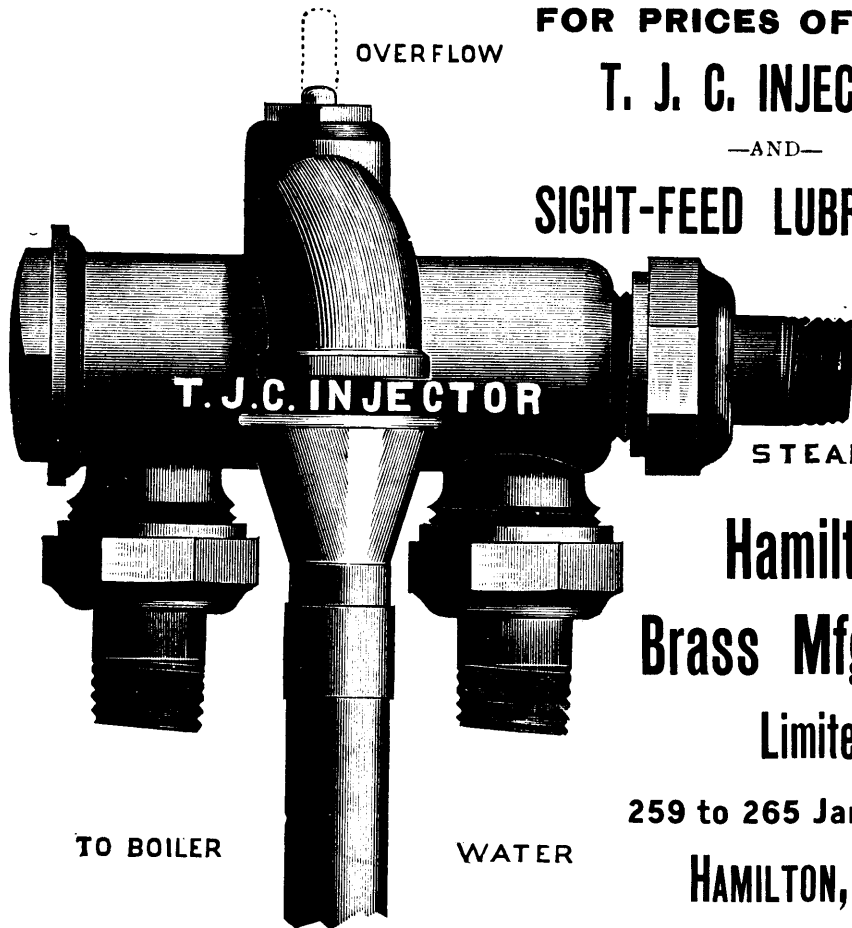


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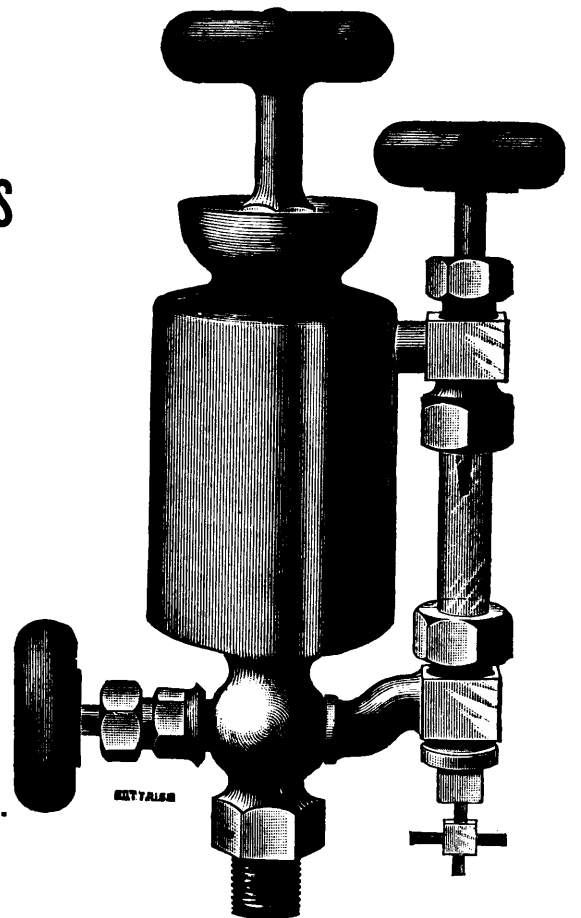
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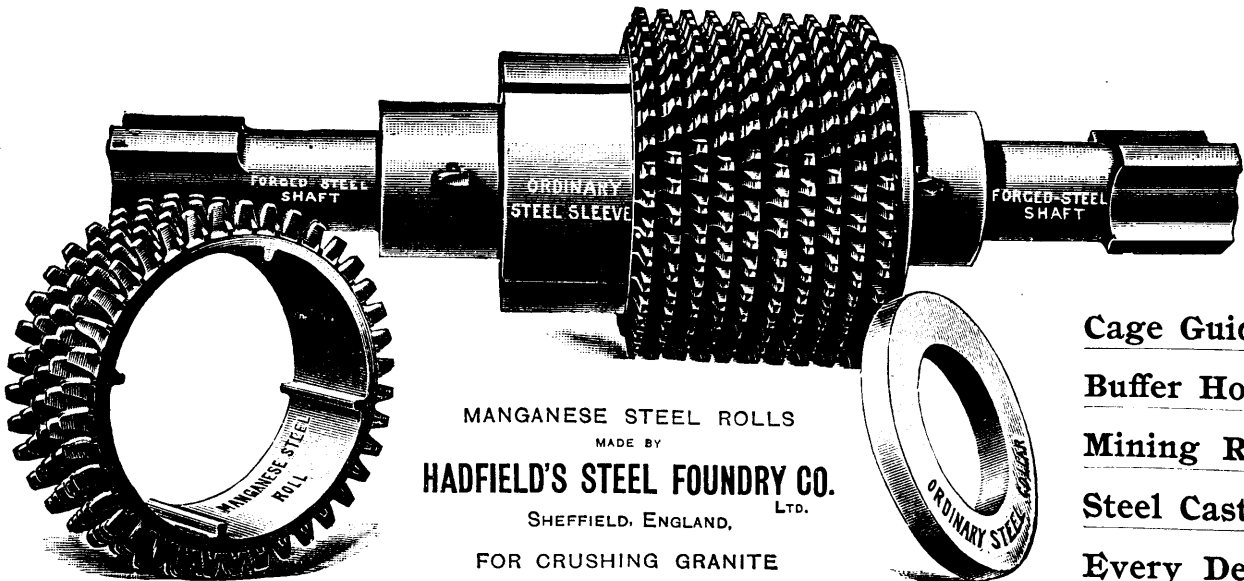


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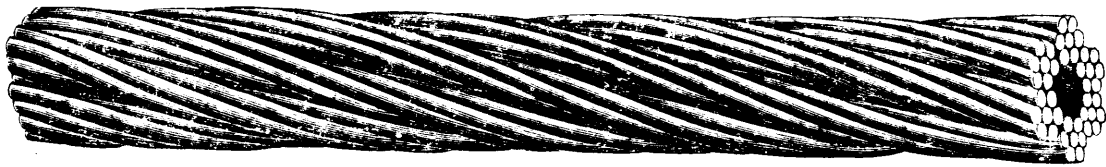
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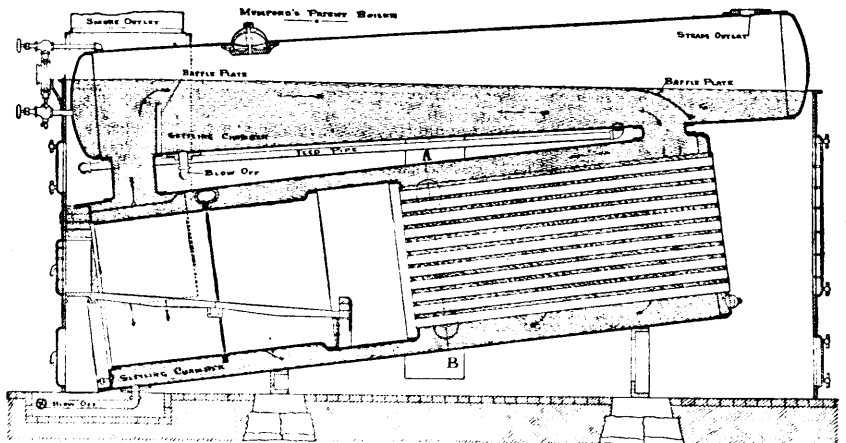
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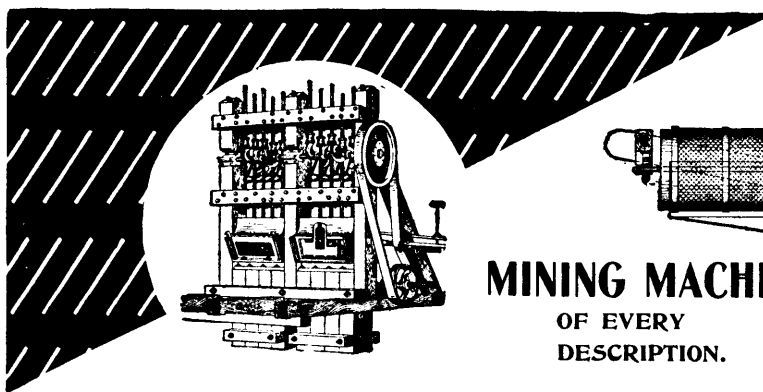
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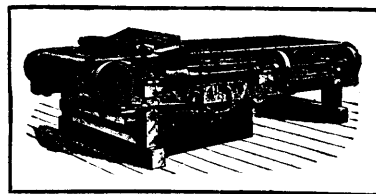
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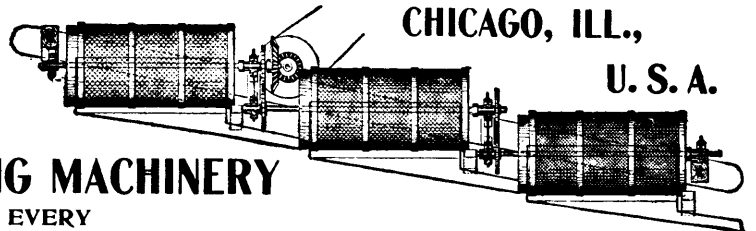
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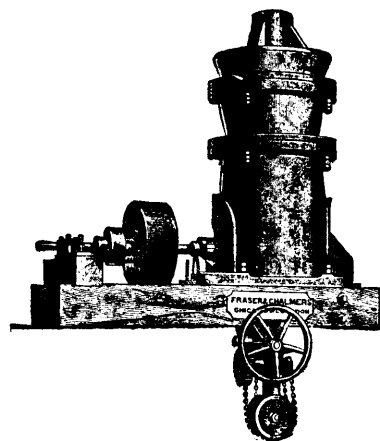
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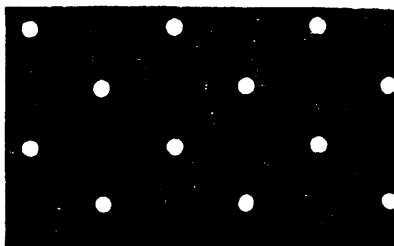
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