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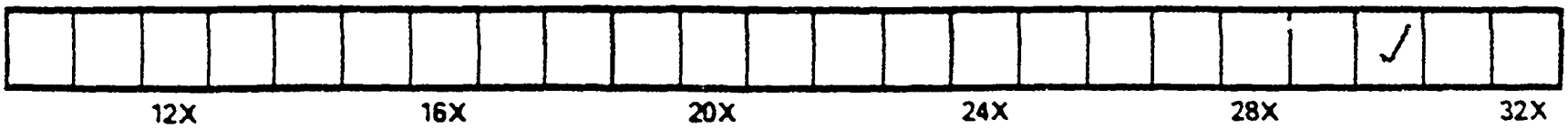

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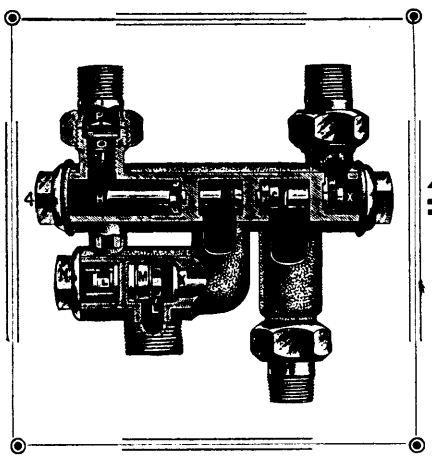

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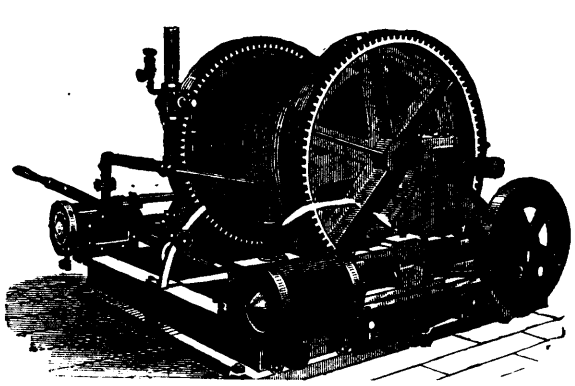

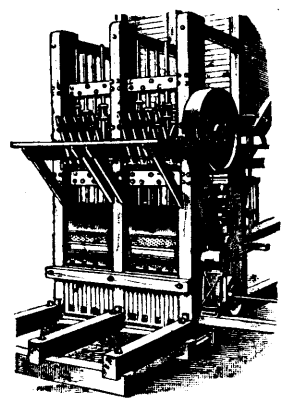

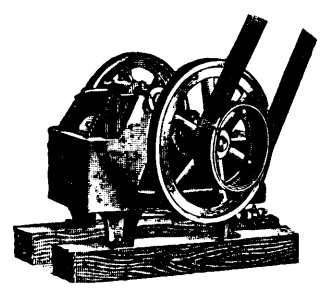

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THE MINES OF BRITISH COLUMBIA HAVE PRODUCED OVER $100,000,000.

AMOUNT AND VALUE OF MATERIALS PRODUCED 1895 AND 1896.

	Customary Measures.	1895. Quantity.	1895. Value.	1896. Quantity.	1896. Value.
Gold, Placer	Oz.	24,084	$ 481,683	27,201	$ 544,026
" Quartz	Oz.	39,264	785,271	62,259	1,244,180
Silver	Oz.	1,496,522	977,229	3,135,343	2,100,689
Copper	Lbs.	952,840	47,642	3,818,556	190,926
Lead	Lbs.	16,475,464	532,255	24,199,977	721,384
Coal	Tons	939,654	2,818,962	846,235	2,327,145
Coke	Tons	452	2,260	615	3,075
Other materials			10,000		15,000
			$5,655,302		$7,146,425

Production for 1890, $2,608,608; for 1896, $7,146,425.

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, $675,000 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 LILLOOET, 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 will much exceed that of 1896, as such mines as the "Slocan Star," "Payne," "Ruth," "Whitewater" and other mines increase 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, ILLECILLEWAET 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 constructde. 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.

For information, Reports, Bulletins, etc., address

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Under the provisions of chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

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Established 1882

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VOL. XVII., No. 4. APRIL, 1898. VOL. XVII., No. 4.

Three Documents.

Three pamphlets, which lie before us at this moment, suggest some interesting reflections concerning the past and future of the Yukon District. The first is the Klondike Official Guide, prepared by William Ogilvie, Dominion Land Surveyor and Explorer. The second is a copy of the latest regulations (approved January 18, 1898) governing placer mining and the issue of dredging leases in the provisional district of the Yukon. The third is a little book of 128 pages, just issued and entitled "Appeal of Yukon Miners to the Dominion of Canada, and Incidentally some Account of the Mines and Mining of Alaska, and the Provisional District of Yukon." It is addressed to the Governor-General, the Privy Council, and Parliament, by three representatives of a committee chosen by a mass-meeting of the Yukon miners held at Dawson.

Summarily characterized, the first of these books "booms the Klondike"; the second sets forth the Government's plan for squeezing the industry thus stimulated; and the third punctures the "boom" and protests against the "squeeze." The sense in which we make this general comment will become clearer upon a more detailed examination of the documents.

Mr. Ogilvie is an excellent fellow, no doubt, and an energetic and intelligent explorer, but neither a miner nor qualified in any way to judge of the extent or value of undeveloped mineral territory, or to estimate the actual results of developments in progress, or critically to weigh the stories on the subject told by others. His professional knowledge as a surveyor has very little to do with the matter, and has not preserved him from accepting and repeating the most extravagant exaggerations and inventions. True, he does not profess, in such instances, to know personally whereof he speaks, and his ignorance is no crime; nor would we critize it severely if it had not been mischievously used. But when the Government adopts his reports, and issues official versions of them, the responsibility of ignorance is heavy. In such a case, it is not enough for the reporter to say that so and-so reports such-and-such a fabulous treasure; he ought to know enough to add that the report is clearly fabulous, and he ought to mention it, if at all, only to condemn it. Mr. Ogilvie, no doubt with the best intentions, has done (through the ill-advised recognition by the Government of his crude and untrustworthy estimates) more to create a foolish "boom" of the new gold-region than any other one person.

This unwarranted excitement is going, no doubt, to produce much disappointment and distress among individual adventurers hereafter. But its more immediate result has been a series of blunders in the Government administration of the Yukon district. For of all those whose credulity has been impressed by the sanguine estimates in circulation, the most credulous appear to be our Dominion officials, who have evidently conceived, from the first, that Providence had here revealed to them an inexhaustible horde of wealth, available for immediate revenue. To their imagination, it was scarcely even the historic case of the goose laying golden eggs. The eggs were already laid; the goose could not be killed; it was only necessary to claim every alternate egg for the Government and make those eager indivi duals who rushed to pick up the intervening eggs hand over the yolks as tribute.

The "Official Guide" is far less extravagant in its statements than were some of the earlier reports of Mr. Ogilvie to the Minister of the Interior. In December, 1896, for instance, he wrote concerning Bonanza Creek:

"One man told me yesterday that he had washed out a single pan of dirt on one of the claims on Bonanza, and found $14.25. Of course that may be an exceptionally rich pan, but $5 to $7 is the average on that claim, it is reported, with 5 feet of pay dirt and the width yet undetermined, but it is known to be 30 feet. Even at that, figure the result at nine or ten pans to the cubic foot and 500 feet long — nearly $4,000,000 at $5 per pan. One-fourth of this would be enormous."

This is the familiar style of prospectus. "Value, $14 odd per pan — to be safe, say $5 to $7; to be *very* safe say $5. Depth 5 feet, width more than 30, say 30 for safety; 9 or 10 pans to the cubic foot — say 10. (This was wrong Mr. O., to be 'safe' you should say 9; length of claim, 500 feet; total contents, 75,000 cubic feet; worth at $5 per pan, $3,750,000 — say nearly $4,000,000. And now, divided by nearly four for *complete* safety, we have $1,000,000, which, though over-cautious, is still immense."

Mr. Ogilvie has wisely abandoned this sort of calculation to a considerable degree, at least. But his late "Official Guide," sandwiched throughout with advertisements of routes to the Klondike, reveals the official impression, based on his earlier utterances, that the world only waits to know how to get there before rushing in, to fill with taxpayers the sub-Artic vacuum. Unfortunately that will be the effect of such publications upon a goodly number of foolish adventurers. Yet the "Guide" itself, carefully examined, contains very little information upon which a prudent adventurer could base a definite expectation. As a whole, it does no more than confirm the statement of the geography, that a vast area in the north-west remains unknown and unexplored, and that the conditions attending its exploration are severly forbidding. A more intelligent picture of the actual situation is afforded by the "Appeal," of which we shall presently speak.

The latest regulations are in some respects less onerous than those

resulting from the preceding amendment; but they still show the same ignorance of the facts, and the same disposition to lay upon a new and precarious industry burdens which it cannot bear. After the flood of temporary population produced by the present excitement shall have poured into the region with tumultuous hope and poured out again with tumultuous disgust, it may be too late to revive public interest by offering more liberal terms. The present opportunity should be utilized to secure, above all, not so much an immediate revenue as a thorough exploration and development of the country. This the present regulations fail to do. They are such as might be imposed upon an established industry in a settled country — and even in such a case, they would be open to objection, as levying from one business only the contribution properly due from the whole community. The way in which the Dominion authorities have blundered in this matter from the beginning is pitiable and ludicrous. They found in existence a miners' code of customs based on experience. This they replaced with regulations so severe as to require successive amendments in the direction of greater liberality; but liberality has not been reached after all; and the repeated concessions have exhibited only weakness, not wisdom.

It is refreshing to turn from these betrayals of ignorance and folly to the clear and forcible "Appeal" of the Yukon miners. Three gentlemen are its responsible authors: Mr. M. Landerville, a practical miner, originally from Quebec; Dr. A. E. Wills, at one time connected with the North-West Mounted Police, and himself interested in mining; and Mr. Edward J. Livernash, a lawyer, to whom, perhaps, we may credit the exceedingly effective arrangement and argument of the "Appeal," and its abundant references to authorities and proofs, such as only a legal training, coupled with industrious research and literary skill, would make possible.

The preface contains the petition addressed last December to the Governor-General in Council by 2,500 Yukon miners. As the statements and requests of this document are more elaborately repeated in the twenty-two chapters which follow, we pass it here without further comment, saying only that it completely confirms the declarations of the later "Appeal," and gives to it the weighty authority of unanimous public approval.

The key-note of the "Appeal" is struck in the first chapter, which sets forth "that scarcely anything is known of the vast region wherein Circle City and Dawson sit shivering," and that, "when anybody tells the boundaries of a so-called mineral belt there, it is safe to assume that he is guessing."

After mentioning (Chapter II.) the mines about Juneau, in Alaska, which have produced, chiefly from very low-grade quartz, about $12,000,000, the authors epitomize in Chapter III. the latest information concerning the placers of four tributaries of Cook Inlet, where (in spite of occasional rich yields) the results have not been largely profitable to those who employed labor at only $4.00 a day. Last year's total out-put was $200,000. On Ungo Island about $30,000 per month was produced through 1896 and 1897 from a 40 stamp quartz-mill.

Chapter IV. shows that almost nothing is known of Northern Alaska, and Chapter V. begins with an exposure of the baselessness of sanguine reports about the Tanana. All that seems to be really true in them is that a score of prospectors have gone there, induced by the stories of Indians about "marvellous richness." In this connection we venture to say that the picture of the Indian tribes drawn by all explorers in that country does not inspire us with confidence in their stories, particularly when circumstantial corroboration is lacking. And there is one such item of corroboration which seems to be wanting here. So far as we know, every explorer in a country containing rich placers has found gold in the hands of the natives. But we do not remember any report of gold carried by the Indians of Alaska north of the Yukon. The absence of such a sign, if not specially explained, is certainly unfavorable.

Proceeding to Porcupine River we are told that Mr. Ogilvie explored its headwaters in 1888, and that his report of that exploration contains no suggestion of gold. But in the "Offical Guide," Mr. Ogilvie now reports that somebody else found gold there as early as 1873. The accounts from other sources are distinctly discouraging.

Chapter VI. brings us to the Birch Creek District, the total output of which, with its tributaries, has been about $2,000,000, and Forty-Mile Creek, the better part of which is in Alaska, and which has yielded about $1,000,000, but is now nearly deserted by reason of a stampede to the Klondike. This completes all that is known of Alaskan gold fields.

Turning now to the Canadian territory, we have in Chapter VII. a pretty illustration of Mr. Ogilvie's work. Speaking of Moose-Hide Creek, which falls into the Yukon a couple of miles below Dawson, he says in his "Official Guide" that "rumor asserts" 4 to 6 feet of pay-dirt (no width determined) ranging from 8 to 80 cents per pan, and adds oracularly: "With this depth of richness and a reasonable width, say from 40 feet upwards, this creek is good enough to rank with the best." Yet, noting that it comes out of a range of recent limestone, containing no gold, he wisely adds that, in his opinion, not more than a few miles at the mouth will be found gold-bearing. The "rumors" were untrue; and the creek does not "rank" at all.

The next chapter deals with the Klondike and Indian Rivers, showing that, even in these mining divisions, the extent of development is still small, and the total yield much below the current estimates, while the yield per claim or per foot or pan or man has been by no means equal to that of the principal famous gulches of the Sierra Nevada and the Rocky Mountains in the United States. In other words, no large area in the Klondike country has yet proved exceptionally rich; and only people unfamiliar with the history of placer-mining on this continent could have put forward such a claim for it.

The authors estimate that up to the beginning of summer work in 1897 all the Klondike and Indian River placers had yielded not more than $2,000,000; that the yield of that summer was less than $1,500,000; and that the winter's work will produce probably about $5,000,000. These figures, taken with the number of men at work, do not indicate (or more exactly speaking, they *do* indicate) a "fabulously" profitable industry. The inhabitants at large cannot be earning more than wages. If a few are getting rich, others must be spending more than they produce. Mr. Alexander Macdonald, the principal individual mine-owner and the best authority in the Klondike, estimates that "when Eldorado and Bonanza and their tributaries are exhausted, rim to rim, and summit to base, their aggregate yield will have been about $50,000,000."

Sixty-Mile Creek, Stewart River, the Pelly, Little Salmon and Big Salmon, Lewes, Hootalinqua, Liard, Frances, and Finlayson Rivers are rapidly considered, with the same general verdict as to all these valleys, that they are little known. One reflection suggested by this survey is, that the chances of the prospector are as likely to be good on the American as on the Canadian side of the 141st meridian, which constitutes an arbitrary boundary, and therefore that, if the Dominion continues to exact more onerous terms than the United States, Alaska will be sooner and more vigorously explored than the Yukon District.

A striking picture of the difficulty and expense of gravel-mining in that district is presented in a few significant pages. A climate

ranging from 100 degrees above to 70 degress below zero, Fahr.; ground frozen the year round, from the roots of the moss which everywhere covers the surface to the greatest depth yet attained by digging (60 feet); "summer-work" confined to July and August, with uncertain portions of June and September; "winter-works" for the rest of the year, consisting in prospecting the frozen ground and in drift-mining; the necessity of using fire to thaw the frozen gravel mined, or of letting it lie until the brief summer shall thaw it; the absence of roads and communications; the high cost of labor and supplies — these and other elements combine to render both prospecting and mining exceptionally expensive and laborious. Some of the unfavorable conditions may be ameliorated hereafter, but the natural environment will not change; and this region is bound to remain always the most disadvantageously situated of all the important gold-fields of the world. It ought to be by the Government burdened less, instead of more, than California, Australia or South Africa.

The "Appeal" shows very clearly the mischievous effect of limiting placer-claims to a length of 100 feet (as was done last year or 250 feet, (as now has been done), instead of granting 500 feet, as the miners' custom in Alaska, and at first, in the Yukon District did. A shorter claim cannot be properly worked there, by reason of the flatness of the stream-channels. The niggardly treatment of the working miners by the Government, in this respect, is vigorously contrasted with the liberality with which grants of dredging-rights, timber, etc., may, under the Regulations, be made at Ottawa, and the enormous bonus in land proposed to be bestowed upon a very questionable railway scheme. As the "Appeal" says:

"At a time when men who have never seen the Yukon are obtaining river-channels in five-mile lengths, and as many lengths as they please, and when other men are asking the fee simple to blocks of placer-territory, each 18 square miles in area, and enough of them to make a pretentious empire, it may not seem unreasonable to plead that the real miner be given ground enough to hold his cabin and his sluices. The regulations as they stand deny him this poor boon."

We regret that space does not permit us to give at length the indignant and irresistible argument of the "Appeal" against the multiplex, hurtful and odious system of taxation imposed upon the struggling pioneers of the Yukon District. Our officials are not tyrants; but well-meaning ignorance can produce all the results of the most malicious tyranny. The Dominion officials in the Yukon District, however, are fully aware of the unjust and unwise character of the regulations they have been sent to execute. It is in the Department of the Interior at Ottawa that the trouble lies.

Of the list of petitions presented by these representatives of the Yukon miners, not one is without some reasonable basis in principal, and almost without exception, they are moderate in extent. These men ask direct representation in Parliament; a practical degree of home rule; authority to organize municipal government; transportation facilities; a decent postal service; freedom from unnecessary officials; equitable taxation in lieu of onerous royalties and fees; mining-claims long enough to be workable, and no revision of placer-claims from location; fair regulations as to timber, water-rights and dredging-rights, and no more leasing of miles of Yukon Rivers for dredging until it has been shown that the frozen ground of their beds can really be so handled.

We congratulate the Yukon miners upon their choice of a committee to present their case. Our perusal of their most effective "Appeal" has not left us very proud of the Government, but it has impressed us with profound respect for some of its citizens.

A Year's Progress in British Columbia.

The report of the Minister of Mines for the Province of British Columbia has come to hand during the past month, and is noteworthy, as in 1897, for the valuable information contained and for the presentation of that matter in good form. Though issued a month later than last year, it is yet a shining example of promptness to the other Provincial Governments and the Dominion Government as well.

In looking into the sources of the value of the $10,500,000 which was the production of the Province for the year 1897, we have noted a few occurrences which perhaps are worthy of mention; for example, we note that the production of placer gold has decreased some $30,000 throughout the whole Province, but that in Cariboo district (the first, the most famous and the principal district for placer gold in the Province) the decrease amounted to $59,000; Cassiar shows an increase of $16,060.

The most striking figures, however, are those pertaining to the production of lode mines; the increase over 1896 being $2,795252, or 65 per cent.

All the metals produced by lode mining show a decided increase; the percentages of increase (according to *values*) being as follows:— Gold, 70 per cent. ($878,640 increase); silver, 56 per cent. ($1,192,147 increase); lead 92 per cent. ($669,133 increase); Copper, 39 per cent. ($75, 332 increase).

It is worth while noting in this connection that the percentages according to *quantity* present quite different figures to those of *value*, in the case of silver and lead.

While the increase in value of the silver mined is only 56 per cent, the increase in quantity is 75 per cent., the average sum obtained per ounce having fallen from 67 cents to 60 cents, similarly, but in inverse ratio, while the increase in value of lead mined has been over 92 per cent., the increase in quantity has been only 65 per cent., a better price for lead having ruled during 1897.

The increase or decrease by districts is shown in the following figures:

Cariboo	$ 59,056	Decrease.
Cassiar	16,060	Increase.
East Kootenay	9,369	"
West Kootenay	2,752,968	"
Lillooet	6,175	"
Yale	20,684	"

Of the whole increase of $2,798,252, West Kootenay contributed $2,752,968, or practically all.

The divisions in West Kootenay present the following figures of increase:

Ainsworth	$ 94,919	or 29 per cent.
Nelson	243,686	or 44 "
Slocan	1,426,675	or 77 "
Trail	853,920	or 67½ "

In 1896 Ainsworth showed a *decrease*, while Nelson increased 750 per cent., Slocan increased 75 per cent., and Trail increased 77 per cent.

These figures show that while the Slocan has slightly gained on its former percentage of increase the Trail division has fallen off somewhat in its ratio of increase. The phenomenal gain of the Nelson division in 1896, was due, as is well known, to the starting of the Hall Mines as a fully equipped concern, and the gain of 44 per cent. for this division in 1897, must be regarded as very satisfactory, since less than 20 per cent. of the increase can be traced to the product of new mines.

The Slocan division continues to lead the Province in the total value of the output and in percentage of progress made

The Trail division has, however, made a good showing, when it is remembered that the "War Eagle" practically ceased shipments in July,

and that 92 per cent. of the camp's total output was the product of one mine, the "Le Roi." What the forthcoming year will produce in this division, with the change in conditions inaugurated by the purchase of the plant of the B. C. Smelting and Refining Co.'s by the C.P. R Co., no one can predict, but, judging from the present indications, the production of the Trail Creek division should be very much greater in 1898 than it has ever been yet.

We note that the Provincial Mineralogist still maintains his optimistic views regarding this camp, and in view of the large purchases made here by the B. A. Corporation, there will be every chance given to demonstrate the existence elsewhere than in the "Le Roi" of that "little pinch of gold" referred to by Mr. Ordway in a former article in the REVIEW.

As to the various districts and individual enterprises which commanded so much space in some journals during the year past, one looks in vain in this report for confirmatory evidence.

The free milling boom of the "Golden Cache" group has produced an increase in the Lillooet district of only $6,000. The highly speculative "Tin Horn" property at Fairview, produced only "results that were very disappointing." Developments along the coast have not been of sufficient importance to add to the production.

Again we recommend the form, matter and promptness of this Report to the attention of the three other mining Provinces of Ontario, Quebec, and Nova Scotia.

CORRESPONDENCE.

Increased Duty on Lead.

One of the greatest possibilities for industrial Canadian advancement is the smelting and refining of the ores produced in British Columbia within the limits of Canadian soil. Any means to accomplish this end, and not conflicting with any other interests, should obviously be supported.

Through the slight encouragement offered by the Dominion Government, and the rapid growth of the mining industry in British Columbia, there are at present in *operation* in that Province two smelters one of which is *idle*. The two in operation are matteing plants, smelting with copper base; the one idle plant is essentially a lead smelter. Does this not seem a pregnant fact?

Some of the reasons that British Columbia ores are not smelted at home and why they should be now smelted there, are:

The United States smelters pay a premium—so to speak—for lead ore of the character produced in British Columbia, but it should be understood that should smelters spring up in British Columbia the supply for these United States smelters being smaller, they would the more keenly compete for these ores; thus would the lead miner be much the gainer by lower treatment charges.

Until recently there has been comparatively little "dry ore" produced, thus making the "Precipitation process" of smelting these ores unprofitable. During the past year this "dry ore" production has exceeded 100,000 tons. Thus it is seen that the conditions are ripe for the operation of smelters on the Canadian side, except that the United States Government have so arranged the Customs Tariff on lead in ore and pig lead, that should lead ore be smelted in British Columbia, a higher duty would be levied on the resultant lead if shipped into the United States market; and again the lack of a home market, by reason of an insufficient import duty on lead and lead manufactures into Canada. Furthermore it should be borne in mind that the mining industry is hampered by this present state of affairs.

Production of lead in Canada, 1897	19,509	tons.
Consumption all lead products in Canada, 1897	9,670	"
Imports lead products in China, 1891	9,848	"
Imports lead in Japan, 1893	3,547	"
Imports lead in Korea, 1893	142	"

Making a total consumption in these markets easily reached by British Columbia lead considerably exceeding the Canadian production, and with the ocean freight from the British Columbia Pacific Coast the lead could be marketed in the Orient, cheaper than from the United States or England.

The Canadian market at present is supplied largely by Mexican lead refined in the United States and Great Britain. Canadian lead cannot compete against such cheap labor with the present duty of only 15 per cent. on pig lead and 5 per cent. on white lead. Let the duty be of a retaliatory nature to that imposed by the United States, and ores will be smelted and refined within a few miles of the mines. Any reciprocal arrangement with the United States would be long drawn out and Canada has already been rebuffed in this line.

A proper method to remedy this condition whereby such a compound tax on the lead ore miner of British Columbia and indirectly on the people of Canada, is therefore needed. It is surely an unsatisfactory state of affairs, when the mines of Canada produce more than sufficient lead within her own limits to supply her consumption, and as shown above, imports every pound used.

It is simply indubitable that were a prohibitory import tariff placed on lead by the Dominion Government, Canada would be benefited in many ways, with no single interest to suffer.

The lead mining would receive an impetus by having a market for their ores close at hand.

The smelting and refining industry would be established on Canadian soil, thus benefiting railways, merchants and laboring classes.

By establishing a large market for the Canadian coal and coke.

Of the several tons of lead manufactures now being imported, these industries would spring up and thrive in Canada.

The miner would still have the same market and keener competition for his ores, which conditions would not be true under the provision for an export duty on ores, which measure the Government was ready to support if shown to answer the purposes which a prohibitory import duty on lead &c., is shown to answer.

The consumers would have a home market for a supply, better assuring thereby more equitable prices than now.

Thus is shown the wide range of usefulness such a prohibitory tariff (similar to the one levied by the United States) would have, as being the means of marketing British Columbia lead in Canada, and thereby establishing a highly important smelting, refining and manufacturing industry in Canada.

W. BRADEN.

PILOT BAY, B.C., 6th April, 1898.

Mineral Revenue of Nova Scotia.

The following statement showing the amounts received from the various sources of revenue in connection with the "Department of Mines," Province of Nova Scotia, during the year ended September 30th, 1897, has been furnished by courtesy of Mr. Brown, Accountant of the Department:—

Prospecting Licenses Gold	$17,168	00
Rents (Lease Applns) "	2,600	00
Rentals "	3,725	00
Royalty "	10,255	51
Licenses to search "Minerals other than Gold & Silver"	4,110	00
Leases " " " "	900	00
Rentals " " " "	6,840	00
Royalties "Coal"	224,331	24
Fees	457	25
	$270,387	00

Memo. showing by counties the amounts received in connection with "Gold" by the Department of Mines, for the year ended September 30th, 1897:

Prospecting Licenses.

Halifax	$7,140 50
Guysboro	3,134 00
Inverness	1,989 00
Lunenburg	1,670 00
Hants	1,384 00
Queens	1,062 50
Other counties	788 00
	$17,168 00

During the year ended September 30th, 1896, there were 18,672 areas taken under Prospecting Licenses, while for the year ended September 30th 1897, there were granted under License 34,336 areas or almost double that of the previous year.

Rents, "Gold Lease Applications."

Halifax	$938 00
Guysboro	676 00
Lunenburg	396 00
Hants	278 00
Queens	244 00
Other counties	68 00
	$2,600 00

During 1896 Leases for 4,516 areas were applied for, while for the year 1897, they numbered 5,200 areas.

Gold Rentals.

Guysboro	$1,087 00
Halifax	975 00
Queens	554 00
Hants	527 50
Lunenburg	359 00
Other counties	222 50
	$3,725 00

Gold Royalties.

Guysboro	$3,985 07
Halifax	3,929 46
Hants	1,023 86
Queens	962 47
Lunenburg	341 78
Yarmouth	12 87
	$10,255 51

Memo. showing amounts received by the "Department of Mines," Nova Scotia, during year ended September 30th, 1897, from the various sources in connection with "Minerals other than Gold and Silver," in under named counties:

Licenses to Search.

Cumberland	$1,320 00
Cape Breton	930 00
Inverness	570 00
Richmond	450 00
Pictou	240 00
Halifax	150 00
Colchester	150 00
Victoria	90 00
Kings	60 00
Hants	30 00
Guysboro	30 00
Digby	30 00
Annapolis	30 00
Lunenburg	30 00
	$4,110 00

Leases—"Minerals other than Gold and Silver."

Cape Breton	$ 450 00
Cumberland	150 00
Inverness	150 00
Richmond	100 00
Pictou	50 00
	$ 900 00

Rentals—"Minerals other than Silver and Gold."

Cape Breton	$2,550 00
Cumberland	2,400 00
Pictou	870 00
Inverness	660 00
Richmond	210 00
Guysboro	60 00
Colchester	30 00
Hants	30 00
Halifax	30 00
	$6,840 00

"Coal Royalties."

Cape Breton	$155,988 79
Cumberland	34,442 86
Pictou	33,825 08
Other counties	74 51
	$224,331 24

Mining in Quebec.

By J. OBALSKI, M.E.

The state of the mining industry in the Province of Quebec, during 1897, is shown by the following notes:—

I would mention copper, asbestos mining, and charcoal iron making as very important industries, with mica and chrome coming after.

IRON.

The Radnor forges furnace was in operation during the whole year, and the Drummondville one since July. They have produced 8,386 gross tons of pig iron, 680 men being employed by this industry.

The consumption of raw material has been 19,766 gross tons of bog ore; 2,545 gross tons of limestone; 10,318,000 bushels of charcoal.

The quality of the product need not be mentioned; it is a credit to our country; in fact, it is highly praised, not only in Canada, but in the United States and Europe, competing with the best brands on either of the continents.

CHROME.

This year's shipment has been 2,340 gross tons, mainly to the United States, and we have still in hand 2,000 tons; about 60 men being employed. Our ore is mostly high grade, but I consider that with concentrating plants, we could use our low grade ore and the refuse of the mines, and considerably increase our shipments. This industry is in its infancy, but nevertheless, with only hand working, we have taken out, since 1894, over 10,000 tons, representing an approximate value of $140,000, of which 8,183 tons have been shipped. I refer to a pamphlet I am just publishing on the subject.

TITANIC IRON.

I would make mention of the discovery of important deposits in the Lake St. John district. People have also an eye on our magnetic sand on the north shore, which may eventually become profitable to handle.

OCHRE.

Is prepared as in the past, by two companies in the vicinity of Three Rivers, with a production of 1,239 short tons of burnt ochre, which has been used in Canada, or shipped to the United States; 50 men being employed.

COPPER.

Our low grade ores have been worked as usual at Capelton, the product being 36,815 gross tons, of which 29,512 were shipped to the States, a small cargo to England, and the balance used on the spot for sulphuric acid manufacturing; 270 men being employed.

At Harvey Hill some work has been done, but only 20 tons of high grade ore shipped.

Several prospects have been made at a few points in the Eastern Townships, and the time may come when this industry will be one of the most important of this Province, if we take into consideration the numerous good mines actually idle.

LEAD, ZINC AND SILVER.

On the Calumet Island several good prospects have been made, showing the existence of an important mineral belt, containing zinc-blend and rich galena, carrying sometimes 200 ounces of silver to the ton. The Lake Temiscamingue mine has also been worked to some extent, but no shipping done, and we may say that last year's out-put has been 430 tons of zinc blende, and 5,000 tons of galena ; 45 men being employed.

GOLD.

Prospecting was going on in the Beauce district, on the Gilbert, on the Du Loup, and in Dudswell district. There were also some finds reported in the vicinity of Sherbrooke. Besides those we know of, every summer small parties find their living by washing in the rivers of our gold district. So e preparatory work was done last fall on the old diggings of the G. bert River, and according to recent information, gold in paying quantities has been struck.

I estimate approximatively that not more than $900 of gold has been taken out during the year.

The question of the Beauce district has been discussed at length at previous meetings, and although not yet satisfactorily settled, I personally am fully confident in the final succes- f that region.

GRAPHITE.

The graphite industry is one of the most difficult to operate advantageously in Canada, as we have to compete with old establishments in the United States, taking easily their supply from Ceylon.

In the Buckingham district we have three companies with well equipped mills — two using the wet and one the dry process — and it appears to me that their product is as good as any other one, and all that we require is a regular market for it. But little work was done ast year and we have not the account of the production.

ASBESTOS.

The market for asbestos has been fair ; three companies at Thetford and one at Danville, employing altogether 800 men, have been in operation for the whole year, having shipped 12,565 tons, of fibre; about 42,000 gross tons of the new product called asbestic, have also been prepared, of which a very large quantity has been shipped, and the contracts made for the coming year will, it is expected by the company, take the entire out-put. Shipments have been made to England, Germany, Australia, South Africa, besides the United States and Canada.

The Black Lake Mines have not been in operation this year, and the production of two Companies, having their mill in the Laurentian district, near Ottawa, was small, little work being done.

PHOSPHATE.

About 1,000 tons shipped.

MICA.

Several prospects were made in the Gatineau district, but of small importance. In the vicinity of Perkin's Mills, in Templeton, three important Companies have worked regularly, and taken out a large quantity of mica well adapted for electrical purposes, of which a good part has been sold in Canada and in the United States. It is very difficult to give exact figures regarding this mineral, on account of the numerous qualities and sizes, representing as many different prices, but according to the best informations, I estimate that about 200 short tons of thumb trimmed mica have been taken out, 90 men being employed. I understand that the demand is less than previously, on account of the high duty in the United States, and that only the best grade of electrical mica is wanted.

No mine of white mica was worked last summer.

PETROLEUM.

Prospecting and boring are going on as usual in the vicinity of Gaspe. Last season, some excitement prevailed on account of a larger quantity of oil being struck in one of the wells which, in fact, has been flowing for some time. Nevertheless, nothing very definite has yet been ascertained. About 30 wells have been bored, some of them having struck oil in greater or less quantity. I am confident in the future of this district, as an oil bearing one, but the country is large, and its stratigraphical structure not very well known.

We don't know that any shipment of oil has been made, so far except some barrels as specimens, and in fact, there is not yet regular pumping done.

FELDSPAR.

In the vicinity of East Templeton Station, a quarry of feldspar has been worked with 15 men, for the whole season, the quantity shipped being 1,260 short tons. The material appears to be of a good quality, and is sent to the United States, for ceramic purposes.

A few other deposits, some of them connected with white mica mines, exist, but are not worked.

KAOLIN.

I want to make a special mention of the discovery of this material, in our Province. In 1894, I visited the township of Amherst (Labelle), and my attention was called to a white material which, after testing, I was able to pronounce to be a genuine Kaolin. The indication was a small one, but may lead to the discovery of an extensive field of said material. Subsequently, Mr. R. Lanigan, from Calumet, secured some property there, made some prospects, and came to the conclusion that workable deposits existed. He also sent specimens to porcelain works, and received high testimony, regarding the quality. I submit herewith some specimens of the finished product. The " Imperial Porcelain Works," of Trenton, United States, have pronounced it of a superior quality.

The district above mentioned is 5 miles far from the Monfort R.R., which connects with the C. P. R.

MOLYBDENITE.

We have inquiries from a party in England, about this mineral which I understand has some new use as an alloy, but the price offered (14 cents per lb.) does not give much chance for the opening of our small deposits, which, besides, not being developed, are rather far from ordinary communication. We know of only three deposits giving indications of some importance, one on the north shore of the St. Lawrence, and the other in the Gatineau valley. The latter was discovered in Egan township, about 110 miles from Ottawa, the surface indications would warrant further developments.

BUILDING MATERIAL.

There is nothing special to mention in this line. We have shipped 3,208 tons of 2,000 lbs. of slate, 90 men being employed, and also 1,072 tons of flag stones.

I am not prepared to give any figure on the building stones, notwithstanding its importance.

Re granite, the Stanstead, Whitton, and Lake St. John quarries have been in operation, as usual, the latter only for local supply.

The limestone quarries, on the Trenton belt, between Quebec and Ottawa, have been extensively worked.

We record, for 1897, a production of 14,000 barrels of Cement.

but new Companies are in process of formation, and preparations are made to considerably increase it for the coming year.

If we consider the large consumption of such material, in our country, which is partly supplied by an importation of over 200,000 barrels, we may look for a good future for this industry.

The established lime kilns and brick yards are going on as usual. It is not easy to give exact figures regarding the same, as they are scattered all through the Province, but by careful research, I am able to give the following:—

Lime.—Approximatively, we have, in round numbers, 300 lime kilns, producing one million of bushels of lime, of a value of $140,000, with 250 men employed all the year round.

Bricks.—In round numbers also, we count 150 brick yards, employing 1,200 men, for the summer season, and producing 120 millions of bricks, of a value of $600,000.

In conclusion, I may say that the raw value, at the mine, of the minerals taken out from this Province, represents about $1,800,000, including the building material, the number of men employed the most part of year being about 4,000.

Note on a Mineral of the Columbite Group.

By Dr. W. L. Goodwin, and Prof. W. G. Miller.

I had hoped, when I gave notice of this short paper, to be able to complete an analysis of this interesting mineral. But unexpected difficulties arose in the separations, owing to the presence of an unusually large number of the rare elements. The time has been too short to dispose of these difficulties, and I am therefore obliged to lay before you an analysis which is still very incomplete. For several years some of us have been on the watch for minerals containing the rare earths, judging that they would be likely to be found in the crystalline rocks of Eastern Ontario. Last summer, Professor Miller found the mineral under consideration, of which he gives the following description:—

"The mineral was obtained from a deposit in the Township of Lyndoch, Renfrew County, Ontario. The occurrence is on the side of a hill and the exposure is rather small. There is little chance for determining the character and relations of the deposit, on account of the immediately surrounding rocks being covered.

"The rock in which the mineral occurs is made up chiefly of quartz and felspar, and it is therefore of the composition of a pegmatite. Both of these minerals occur in pieces of a large size. The quartz is more or less smokey in appearance. The felspar is partly pink and partly green. In thin sections under the microscope it is seen to be a perthite having a basis of microcline, through which is set another plagioclase.

The mineral under consideration is black, has a submetallic lustre. One specimen which was examined had a specific gravity of 5.36. It occurs in thin layers and nodule-like forms in the felspar. The nodules show a concentric structure. The structure and occurrence are illustrated in the accompanying photographs. In the same deposit occurs also, black mica, beryl, tourmaline, fluorspar and two other minerals of which no identification has yet been made.

The chief interest in the analysis of the mineral from the economic point of view is the presence of tin in it. Minerals of the same class as this are often associated with tinstone, as are also the other minerals present in the deposit, a considerable area in the district contains rocks in which fluor spar and other fluorine and boron holding minerals occur. It would seem therefore, that these rocks should be carefully examined for other deposits in which tin may occur in greater amounts.

A quantitative analysis, in which however, the separations were afterwards shown to be imperfect, indicates the following composition:

Rare acids	75.75	per cent.
$Sn O_2$	0.92	"
Fe O	11.14	"
Mn O	10.22	"
Cu O	0.03	"
Rare earths	2.00	"
	100.06	

Among the rare acids niobic and titanic were identified. The rare earths present in this mineral include ceria, didymia, and the gttrium group.

Some Comparison in Stamp Milling Practice.*

By Melville B. Weekes, School of Practical Science, Toronto.

Gold has been the most valued and cherished metal from the very earliest times. As far as history goes back and among every nationality we find it the king of metals. In the most primitive state of gold milling the crushing was done in the hollow or cavity in the surface of a large hard stone; a piece of quartzite, or other hard material being used as a pestal. When the ore was ground sufficiently fine the light material was washed off with water, leaving the particles of gold in the bottom. Stone mortars in which this operation was conducted have been found Wales, in Central America and the Pyrenees.

The most primitive methods at present in use are found among the tribes on the Gold Coast of West Africa and in the interior of China. Here the gold-bearing quartz is broken into small fragments between two stones, and is then ground down to a powder between two pieces of granite or quartzite, the upper stone being worked with a rocking motion backwards and forwards over the surface of the other, which is usually a somewhat large smooth slab, sloping slightly away from the operator. The fine material gradually works down and falls from the stone into flat wooden dishes resembling prospecting pans. In these the gold is washed free from quartz in the usual way. The next advance was the employment of what is generall called the "Dolly."

In this the pestle, or hammer, is fastened to the end of an elastic sapling 12 to 15 feet long, one end of which is firmly embedded in the ground. The resilience of that bent sapling enables the operator to use a much heavier weight than he could possibly use alone. The connecting link between this and the old Saxon mill is found in some parts of the Andes. This consists of a small two-stamp mill driven by a water wheel, the whole being constructed of wood bound together with raw hide thongs. The stamp head is shod with a granite boulder and the mortar is also a block of granite. The fine stuff is panned down and the gold recovered by washing in a wooden dish called the "batea."

In the fifteenth century a small mill was in operation in Europe, which was practically the Saxon as we know it, only in a very crude form. It was driven by a water wheel on the same shaft with which was a large wooden barrel, with wooden cams projecting from it. The whole was made of wood, except the stamp head and mortar, which were either iron or stone. The ore was usually crushed dry, but at the beginning of the sixteenth century wet crushing was introduced as an improvement.

The date of the first use of mercury in extracting gold is unknown. Pliny mentions the fact that mercury will take up gold, and it is probable that it was known long before his time. The first use of mercury on the American continent was in Mexico about the year 1557. It soon spread, however, to Peru and neighboring countries.

The first stamp mill in California was erected in Mariposa County

*Students Competition Quebec Mining Association.

in 1850. It consisted of eight stamps driven by water power, each stamp having its own mortar. In this mill the cams acted to one side of the centre line of the stamp stem, and the stamp revolved, thus being the forerunner of the modern California stamp. Soon the large wooden barrel and short cams gave way to the small shaft and long curved cams, as we know them to-day. It is sometimes thought that the revolving stamp greatly increases the grinding action in the mortar, but this is an erroneous idea, as in a properly lubricated mill little or no rotation occurs during the fall of the stamp.

Having now given a very brief account of the development of the modern stamp mill, the writer will endeavor to give as briefly as possible the prevailing practice in several of the most famous mining regions of America and Australasia, and to show how in each case the practice varies with the character of the ore and local circumstances.

Gilpin County Practice.—Gilpin County, Colorado, with its area of only 122 square miles has produced up to 1897 over $76,000,000 worth of gold, the largest yearly out-put being $3,340,300 in 1889, while for 1897 it is estimated at $2,000,000. The first mills in this district were designed for fast drop and shallow discharge and were very successful in treating the oxidized material from the upper portions of the lodes. Copper plates and riffles containing mercury were used to catch the gold, 70 per cent. being about the average extraction. When the oxidized zone was passed the ore became less quartzose and the percentage of pyrites increased considerably. Then a difficulty arose; the percentage extracted began to diminish from 70 to 50 and finally down to 30. Most of the mills were forced to shut down, and the end of Gilpin County's prosperity was thought to be at hand. But in the meantime, men with money and experience were working steadily trying to solve the all important question. As a result of their efforts there arose that practice which belongs peculiarly to Gilpin County. This may be summarized briefly as the slow drop, deep discharge system. The stamps usually run about 550 pounds and make from 1¼ to 1½ revolutions with every drop. The speed is from 30 to 35 drops per minute, and the order of drop is 1-5-2-4-3. The depth of discharge is thirteen inches when the dies are new, but increases to 15½ as they wear down. The shoes are of ordinary cast iron 5½ inches deep and 8 inches in diameter, weighing about 85 pounds. The dies are 3½ inches deep, slightly larger than the shoes, and weigh 45 pounds. The shoes wear away at the rate of 11.3 ounces per ton of ore crushed, and the dies at the rate of 4.5 ounces per too. The capacity of the mills in this district is approximately 1.14 tons per day of 24 hours for each stamp. The screens used are burr slot No. 1½, which is equivalent to 50 mesh wire cloth. The screen surface is 4½ feet by 8 inches, and their average life is 81 days. The amalgamation is done both inside the mortar and on copper tables. Mercury is added regularly to the mortar, about one thimblefull every hour. The mortar contains both a back and front plate, made of plain copper. The former is 12 inches wide and 4½ feet long and is placed at an angle of 40 degrees. The front plate is 4½ feet long and 6 inches wide and set almost vertical. The amalgamating tables are of ordinary copper made in one piece 12 feet long and 4 feet wide, having a grade of 2⅛ inches per foot.

In the Hidden Treasure mine, which is typical of the district, the consumption of mercury was 6½ flasks per year for 75 stamps, or at the rate of 4.3 pennyweights per ton. The outside plates are cleaned and dressed every 24 hours, and the inside ones are cleaned every 48 hours, except when treating especially poor ore, when the period is much prolonged. Of the total amalgam recovered, fully two-thirds is obtained from the mortar, being about equally divided between the two plates; thus it will be seen that the three amalgamating contrivances each collect about the same amount of gold. On retorting the amalgam yields about 40 per cent. of bullion, which usually runs from 782 to 786 parts of gold per thousand and from 207 to 211 parts of silver. The rate at which the mercury is added is determined by the consistency of the amalgam on the plates. There is an opening in the front of the battery above the screen frame where the mill man can insert his arm and tell from the feel of the front plate whether the proper amount of mercury is being added.

The amalgam as obtained from the plates is ground in a mortar with hot water until of an even consistency. The water is then decanted off and mercury is added until the amalgam is quite thin. This is poured from one dish to auother until all sand and dirt has been removed. It is then squeezed through canvas and the resulting hard amalgam is roughly moulded into balls and placed in a retort lined with thin paper. The amalgam is hammered down until two thirds full. The cover is put on and luted down with clay and retorted in the usual way.

The only chemical used in the mill is potassium cyanide. Of this 260 pounds were used in crushing 28,793 tons of ore. The tables were dressed with a weak solution of two ounces of potassium cyanide in three gallons of water every 12 hours. The ore treated in this mill carried 13 per cent. of concentrates, chiefly iron pyrites. The pulp after leaving the tables passes over blanket strakes 3 feet long and 18 inches wide. These collect any escaping mercury and amalgam and also the heaviest pyrites. The present tendency, however, in this district is to discard these strakes, as any material they collect would certainly be saved in the subsequent concentration. This is done on shaking tables, locally called "bumpers." They are a peculiarity of Gilpin County practice, being a variation from the ordinary Rittinger pattern. One of these machines treats the pulp from 15 stamps. The speed varies with the percentage of pyrites present, but averages 130 strokes per minute. The concentrates carry from 1 to 1½ ounces of gold to the ton, but are not treated in the mill, as smelters are near at hand, where they are sold for 95 per cent. of their assay value, minus the smelting charge, which varies from $5 to $8 per ton, depending on the demand. The amount of water used is from 1½ to 2½ gallons per stamp per minute, being exceptionally low owing to the small capacity of the mill, and the steep grade of the tables. From this description it will be seen that the object aimed at is to keep the pulp in the mortar for a comparatively long time. This is rendered necessary by the very refractory nature of the ore, which carries more heavy sulphides than any other ore treated by plate amalgamation in the chief mining centres of the world. A rough analysis of the ore gives the following:— Metallic sulphides, 10-20 per cent.; quartz, 15-20 per cent.; vein matter, other than quartz, (chiefly felspathic material), 60-70 per cent. Of the metallic sulphides, those of iron and copper preponderate. On this ore, therefore, on which the quick drop, shallow discharge methods utterly failed, we find the peculiar practice of Gilpin County eminently successful. The richness of the ore may be obtained from the following, which represents the out-put of one mine for 1890:—150 tons of hand picked sulphurets, averaging $92.79 per ton; 1,376 tons of concentrates, giving $15.06 per ton, and 10,321 tons of mill stuff, averaging $7.42 per ton net. The extraction is very good considering the character of the material, and averages about 85 per cent., of which 25 per cent. is obtained from the concentrates. In this ore the gold is in a very finely divided condition and is intimately associated with the pyrites. From this it will be seen that fine crushing is absolutely necessary. That the slow drop and deep discharge is particularly suited to this class of work may be gathered from the fact that over 70 per cent. of the material issuing from the 50 mesh screen will pass through 100 mesh. In this fine material the percentage of pyrites is much higher than in the ore. This is accounted for

by its greater specific gravity, which keeps it in the mortar for a longer time than the quartz and feldspar. This district is behind the times in some respects; there are no rock breakers nor automatic feeders, but the necessity for these is not so great as in mills of larger capacity and lower grade ores.

Black Hills, South Dakota Practice.—A marked difference is at once seen when comparing this with Gilpin County practice. The ore in the Black Hills is exceedingly low grade, averaging about 4½ pennyweights per ton, hence, if it is to be treated successfully the capacities of the mill must be large.

The gold is found in quartz and pyrites finely distributed through vast masses of mica and amphibole schists, and frequently impregnating the schists themselves. From a geological standpoint the region consists of an outcrop of Archaeon rocks, about 1½ miles long and ½ a mile wide, surrounded by later sedimentary rocks. The oxidized portions above water line are especially free milling, giving tailings that carry only 25 cents a ton, while from the unaltered ore they sometimes run as high as $2.25 cents per ton. A description of the Homestake mill will be typical of the whole district, as there is very little variation, and only in minor points.

The ore as it comes from the mine is thrown upon grizzlies from which the fine material passes directly to the ore bins. Until a few years ago the coarse ore was put through Blake crushers, the largest in the market having a receiving capacity of 9 inches by 15 inches. They were set to crush from 1½ inch to 1¾ inch stuff, and 8 of them working 20 hours a day easily kept 160 stamps supplied with ore. These have now been entirely superceded by the Gates gyratory crusher, which has a much larger capacity. In the Highland mill of 160 stamps, two No. 6 Gates crushers keep the batteries well supplied with ore. The feeding of the ore into the battery is done automatically. Both the Challenge and Tullock feeders are in use and give very satisfactory results. The mortars are small compared with those used in in Gilpin County. The inside bottom dimensions are, width, 10½ inches, length 50 inches, total inside height 47 inches. The depth of discharge varies considerably as the dies wear down, but in the Homestake mill an effort is made to keep this uniform. When new dies are put in a seven inch chuck block is used making the depth of discharge 9 inches. After two weeks it is replaced by a 5 inch chuck block the difference representing the wearing down on the dies for that period. Just before new dies are put in the depth of discharge has reached its maximum of 11 inches.

The stamps run from 850 to 900 pounds. The rate of drop varies between 85 and 90 per minute, and the height averages 9½ inches, but there is a tendency to slightly increase this. It is here that the marked distinction between Gilpin County and Black Hill practice is to be seen. The capacity of the latter region is 4 tons per stamp per 24 hours, nearly 4 times as much as in Gilpin County. The screens used in the Homestake mill are No. 8 diagonal slot punched Russian iron, which is equivalent to 30 mesh. These screens wear out very rapidly, seldom lasting longer than one week.

In some of the mills two amalgamated plates are used inside the mortar, but in the greater number only the front plate is used. It is made of plain copper, 5 inches wide, 3-16 inches thick, and extends the whole length of the mortar. This plate is fastened to the chuck block by means of screws. Mercury is fed into the battery at a rate depending upon the richness of the ore, and is regulated by the condition of the amalgam on the outside plates. At the Deadwood Terra mill (160 stamps) 10 pounds 14 ounces of mercury are consumed every day. The figures for the Golden Star mill (160 stamps) are 24 pounds 3 ounces. This great difference is accounted for by the fact that the ore treated in the latter is considerably richer than that treated in the former. About 78 per cent. of the mercury used is saved. The water consumed at the Homestake mill is about 1½ miner's inches per battery of 5 stamps per day. This is at the rate of 3 gallons per stamp per minute, and this may be taken as a fair average of the whole district.

As the pulp issues from the mortar it drops six inches to the apron plate. This fall is broken by a splash board which prevents the pulp from scouring the plate. The apron plates are usually 10 feet long and 4½ feet wide. They are of the best Lake Superior copper, and are made in one piece. The grade is 1½ inches per foot. Every two apron plates deliver their pulp to one tail plate which is of the same size as aprons, and has the same slope. The inside plates are cleaned twice a month and the apron and tail plates are cleaned and dressed every morning. There are the usual traps and other devices for collecting mercury and amalgam which has escaped the plates. These are very essential in this region, where the enormous capacity of the mills and the quick treatment render mercury and amalgam very liable to be carried away in the tailings. The traps are cleaned out every two weeks when the accumulated pyrites is treated in a pan to recover the mercury and amalgam. How important these traps are, may be gathered from the fact that in a 60 stamp mill there is recovered every month by this means 90 ounces of amalgam and 184 ounces of mercury which previous to their introduction were entirely lost. In these mills an effort is made to keep the battery water at a temperature of 70 degrees Fah., as this gives the best results in amalgamation. To accomplish this in cold weather the exhaust steam from the engine is passed through the supply tank. This gives an opportunity for the introduction of oil and grease into the battery water, and this must be carefully guarded against. The ore in this district carries from 3 to 5 per cent. of concentrates of which only two per cent. are saved. This is accomplished on shaking tables similar to those in use in Gilpin County. The number of them is, however, very inadequate to the large amount of pulp to be treated, there being only 8 machines for 120 stamps. In this respect, therefore, the Black Hills region is not what it should be, but in the automatic handling of the ore and cheapness of milling it is an object lesson to the world.

Grass Valley, California Practice.—Grass Valley in Nevada County, California, is the leading gold producing region in the State. Since 1851 this district has been a large producer of gold, and at present the average yearly output is about $2,000,000. A description of the North Star mill, containing 40 stamps, will give a good idea of the whole district. The ore consists of quartz veins in exceedingly hard dioritic rocks and it is very difficult to crush. As it comes from the mine the ore is dumped on grizzlies which permit all material less than two inches to fall through into the ore bins beneath. The remainder is passed through rock breakers of the Blake pattern, having a receiving capacity of 9 inches by 15 inches. Three of these are sufficient to keep 40 stamps supplied. From the crusher the ore falls into bins which deliver on to Challenge automatic feeders of which there is one for every battery of 5 stamps. The stamps weigh 850 pounds, made up as follows:—

Steam	358 lbs.
Head	228 "
Tappet	112 "
Shoe	152 "

The height of drop is from 6 to 8 inches, and the speed 82 to 85 drops per minute. The crushing capacity is 1.6 tons per stamp per 24 hours. No attempt is made here to keep the depth of discharge constant, conse-

quently it varies from 2 to 6 inches. The screens in use are perforated tin plate equivalent to 30 mesh wire cloth. There is only one plate used in the mortar the front one, 52 inches long by 4½ inches wide It is made of silver plated copper containing one ounce of silver per square foot of surface. Outside amalgamation is carried on by means of three plates; the battery or lip plate, the apron plate and the sluice plate. These are all made of ⅛ inch silver plated copper similar to the inside plate. The battery plate is 4 feet 2 inches wide and 18 inches long. From this the pulp flows through a distributing box and falls 3½ inches on to the apron plate. This is 4 feet 5 inches wide for a length of 2 feet 6 inches, it then tapers down to a width of 22 inches in 2 feet, and discharges on to the sluice plate which is 22 inches wide and 12 feet long. The grade of the apron is 1½ inches per foot and for the sluice plate it is 1 inch per foot. The outside plates in this mill are a splendid example of bad practice. They should be of the same width for the entire length. It is common to see the amalgam actually scoured off the surface of the plate by the very rapid flow of pulp caused by narrowing the plate from 53 inches to 22 inches. This has become apparent to the management of the mill lately, and now two batteries of five stamps each have the sluice plate widened to 46 inches' while the rest of the mill use the 22 inch sluice plate The pulp from ten stamps those having the 46 inch sluice plate) flows direct to the vanners, while that from the remaining thirty passes over shaking tables of the Rittinger type before reaching them. The concentrating plant consists of four Frue vanners and 12 Triumphs, there being two machines for each five stamps. They are run at a speed ranging from 200 to 230 strokes per minute. The Frues give better results than the Triumphs and need less attention. Mercury is added to the mortar at the rate of 2 ounces per hour, and is regulated, of course by the condition of the amalgam on the plates. Of the total amalgam 66 per cent. is recovered from inside the mortar. The general clean up takes place twice a month, and this is the only time that the inside plates are cleaned. The outside plates are cleaned and dressed every morning. The loss of mercury varies from 10 to 14 pennyweight per ton of ore. The W. Y. O. D. Mill is the newest in the district, being erected in 1890, and has several improvements. The drop varies from 5 to 7 inches, and the rate from 90 to 100 drops per minute. Chrome steel shoes are used which give perfect satisfaction. The outside plates have a width of 50 inches and a total length of 14 feet. The inside plate is 4 feet long and 4 inches wide, and 66 per cent. of the amalgam is obtained from it. The ore is crushed in a Gates rock breaker. There is also an increase in the amount of silver plating on the amalgamating plates. They contain 5 ounces of silver per square foot of surface. The concentrating is done of Frue Vanners which save 2½ per cent. of sulphurets assaying $100 per ton. This is shipped to the chlorinating works where it is treated for $16 a ton. The mercury lost is 11 pennyweight per ton of ore. The percentage of gold extracted runs from 87 to 90. All the mills of this region use silver plated copper, the tendency being to increase the amount of silver. Hitherto the amalgamating was all done outside the mortar, the quick short drop and large capacity being the rule, but now it is becoming the custom to use one plate in the mortar and rather lessen the capacity and increase the percentage saved.

Australian Practice at Ballarat, Victoria.—This is the most productive region in Australia, and has been so since the discovery of the placers in 1851. In 1894 the output was $3,896,000, of which $1,525,000, came from the alluvial deposits. A description of the Star of the East Mill which was erected in 1895 will, perhaps, give a good idea of the most modern Australian practice. It consists of 60 stamps arranged in two sections of 30 heads each. The stamps weigh 1,000 pounds, the drop is from 8 to 8¼ inches, and the speed is 73 drops per minute. The centre stamp in every five, drops half an inch less than the others. This is said to give a better splash of pulp and thus increase the capacity. The order of drop is 5-3-4-2-1. The depth of discharge is two inches with new dies, but increases to 4 inches as they wear down and even more if the ore is unusually refractory. The ore assays from 13 to 17 pennyweight per ton, and the concentrates, of which 3½ per cent. are saved, run $75 per ton.

This region is very much behind America in the absence of rock breakers and automatic feeders. The feeding is done by boys and is of a very uncertain and irregular nature. There is no doubt that the cost of putting in rock breakers and feeders would soon be saved by the lessened expenses and the greater capacity arising from the regular feeding of smaller material: In order to keep the copper plates free from tarnish, a bucketful of lime is added to every 10 stamps every few hours. Two ounces of mercury are added to each mortar every hour. There are no inside plates used. The amalgamating tables are made of plain copper, having a grade of ⅞ inches per foot. At their lower extremity there are three mercury wells, two deep ones and one shallow one. These serve to catch escaping mercury, but the amount of gold they recover is very low. Below the wells are the blankets. The materials retained on these are collected and placed in a heap with the addition of lime and left to stand for two days; they are then added to the battery again. From the blankets the pulp passes on to shaking tables of which there are 8 for 60 stamps. These tables are of an inferior type, and do very poor work. The older mills in this district use mercury wells in preference to plates, and they actually do better work, for the ore is peculiarly suited for them, being very free milling, and carrying only a small per cent. of sulphurets

This district as a whole is away behind the times in regard to the handling of the ore — the crushing and feeding and concentrating. Nevertheless, the cost of milling is remarkably low, being about 58 cents per ton. The loss of mercury is also exceptionally low, running about 3½ pennyweights per ton of ore. The capacity of the 1,000 pound stamps of this region is about 2.4 tons per stamp per 24 hours. The tendency is, however, to go back to the 850 pound stamps.

Bendigo, Victoria, Practice.— This district has also been famous since the first discoveries of gold in 1851. In 1892 the production of gold from quartz reefs was $3,500,000 approximately. The general working of the mills in this region is very much the same as in Ballarat, therefore little need be said of them. The stamps are about 900 pounds each, made up as follows:—

Stem.	325 lbs.
Tappet	66 "
Head.	159 "
Shoe.	198 "

The speed varies between 68 and 75 drops per minute. The height of drop is between 8 and 9 inches The depth of the discharge is two inches when the dies are new, but increases to 6 inches as they wear down The crushing capacity is about 2 tons per stamp per 24 hours. The screens used are perforated sheet metal (iron or steel) containing from 120 to 180 holes per square inch, the most widely used one having 143 holes to the inch, and their diameter is .023 inches These screens last only 8 working days The absence of rock breakers and automatic feeders must be noted here also, and, in fact, throughout the whole of Australia The gold saving is commenced in the mortar by the addition of mercury, and is followed by amalgamating tables, wells and blankets The tables are plain copper, 5 feet wide, 13 feet long, and the grade is 1⅛ inches per foot The wells are 5 in number, only the first two of which contain mercury The blanket strakes are 5 feet wide and 13 feet long The blanket

are washed every two hours. In most mills no further concentration is done, although lately one mill has introduced the Gilpin County shaking tables, which give good results The loss of mercury is 7 pennyweights per ton of ore The amount of water consumed varies from 4 to 7 gallons per stamp per minute About one-half the gold is recovered from the mortar box, which owing to its high specific gravity it settles down in the bottom The percentage of extraction is very good considering the work the mortar has to do. From 9 to 9½ pennyweight are obtained, while the tailings carry from 1½ to 2½ pennyweight per ton It is a fact worthy of notice that these mills sell the right to treat their tailings to Chinamen for $40 per month, and they make a good thing out of it. All the battery frames in this district are of iron of local manufacture.

Otago, New Zeland.—Erom 1861 to 1892 this district has produced gold valued at $96,553,535 The out-put for 1892 was $2,117,635 A description of the Phoenix Mill will be typical of the whole district. The stamps weigh 800 pounds each. The height of drop is between 7 and 8 inches, and the speed 75 to 80 drops per minute The depth of discharge varies from 2½ to 4½ inches. The crushing capacity is 1½ tons per stamp per 24 hours Both wire cloth and perforated sheet metal screens are used, but the former are much preferred. No mercury is added to the mortar box The gold in the ore is exceedingly coarse and free, and is collected in the mortar where it settles down by reason of its weight, and also on blanket strakes 6 feet wide and 15 feet long, having a grade of ⅞ inches per foot. The coarse gold is found in the mortar and on the upper blankets, and as you go towards the lower end the gold gets finer and finer. Four gallons of water are used per stamp per minute. The blankets at the upper end are washed every hour, while the lower ones are washed at longer intervals. The blanketings are collected and treated in a revolving barrel 5 feet long and 4 feet in diameter which takes a charge of one ton. To this a flask of mercury (75½ pounds) is added and some water, and the barrel is set revolving at a speed of 20 revolutions per minute. This is kept up for 24 hours, when the amalgamation is supposed to be complete. The charge is then emptied into a vat from which it is slowly fed on to Rittinger shaking tables with the addition of water. This treats the charge in three hours. The material, amalgam, pyrites and heavy sand which are separated out by these tables is then treated in prospecting pans which have their inside surface amalgamated. This readily collects all the gold and amalgam. The pulp as it leaves the blanket strakes is not further treated, as the concentrates are of too low grade to warrant working. The loss of mercury is 8.5 pennyweight per ton of ore, and this rather large amount is due, no doubt, to the high speed at which the amalgamating barrel is run, which should only have about 14 revolutions per minute instead of 20. Over 60 per cent. of the gold comes from the battery residues, and the remaining 40 from the blankets. Some few mills in this district use copper plates, but it is evident that if blankets will catch the gold (and they do so) they are to be preferred to plates as being less expensive, and requiring less care. One boy can attend to the blankets belonging to 15 stamps. It is a remarkable fact that one mill in this district, the Invincible, collected the gold by adding the mercury to the mortar, then by copper plates, wells, and finally blankets. As an experiment the supply of mercury was stopped and only blankets were used, and the amount of gold recovered actually increased. There is no doubt that the gold is remarkably suited for collection on blankets owing to its coarseness. The cost of milling is about 70 cents a ton, and the yield from 10 to 11 pennyweight.

The following table gives the cost of milling and the yield in pennyweight, and other information regarding the district herein described:

Name of District.	Yield of Ore in dwts. per ton.	Cost of Milling in cents.	Weight of Stamps.	Crushing Capacity in tons.	Percentage of Concentrates.	Contents of Concentrates, ozs. per ton.	Loss of Mercury, in dwts	Consumption of water in gallons per stamp per minute.
Gilpin County, Colorado....	6 — 8	75	550	1.0	12 —15	1 — 1½	3½— 8	1½— 2
Black Hills, Dakota.....	4½	70	850	4.0	....	....	5	3 — 3½
Grass Valley, California....	5 — 7	81	850	1.6	2½— 3	3 — 5	9 —14	3½— 4
Ballarat	8½— 9	56	1000	2 4	1 — 3½	1½— 3½	3 — 5	5 — 7
Bendigo	9 — 9½	58	900	2 3	1 — 2	1½— 2½	7 — 9	6½— 7½
Otago.....	10 —12	70	800	1.5	....	....	5 — 8	5½— 5

In the preparation of this paper the writer is indebted to the following works on the subject:—Stamp Milling, Louis; Stamp Milling, Rickard; Metallurgy of Gold, Rose; Gold Milling in the Black Hills, Hofman.

Manganese Deposits of Nova Scotia.

By Mr. W. F. Jennison, Walton, Hants Co., N. S.

One of the most important members of the iron group is Manganese. Its discovery and use is of great antiquity, having been used by the ancient Egyptians and the Romans in the manufacture of glass, one of its many uses of to-day.

It may be found in all ages of rocks from the Archæn upwards, and its formation is continually going on as will be observed in many places. The writer has particularly noticed it in the region of the Manganese belt running through Hants county, N. S., where the waters from the springs and brooks, settling on the low lands, deposit a sediment of black oxide of manganese on the rocks and pebbles, and a slimy, bluish, oily looking scum on the small ponds and pools, which is often mistaken for oil.

It also forms an important part of the animal and vegetable kingdoms as well as of the mineral. The human system is said to contain a proportion of one part of manganese to twenty parts of iron, and it is hardly possible for us to dine without partaking of manganese through the vegetables served us.

Up to thirty years ago manganese was used principally in the manufacture of bleaching powders and glass, but about this time Weldon's recovery process was invented and put into practical use, which reduced the amount used in the manufacture of bleaching powders to about one-tenth the original consumption.

To speak briefly, Weldon's invention is a regenerative process, whereby it enables the manufacturer of chlorine to use the ore over and over again indefinitely.

About the same date of the Weldon invention came the introduction of manganese into the manufacture of steel, and this, with the increasing demand in other industries, over-balances the great reduction in its use due to the Weldon process, and the consumption now is greater than at any previous time.

Dr. Penrose, in his excellent volume on manganese, gives a tabulated statement of its principal uses, and I cannot do better than reproduce it here.

Alloys....	Spiegeleisen..... / Ferro-manganese....	*Alloy of manganese and iron.
	Manganese-bronze ..	Allow of manganese and copper with or without iron.
	Silver-bronze	An alloy of manganese, aluminum, zinc and copper with a certain quantity of silicon.
	Alloys of manganese with aluminum, zinc, tin, lead, magnesium, etc.	

*An alloy containing 25 per cent. and under of manganese with iron is known as spiegeleisen; on alloy containing over 25 per cent. manganese with iron is known as ferro-manganese.

OXIDIZERS.	Manufacture of chlorine, Manufacture of bromine, As a decolorizer of glass, As a dyer in varnishes and paints, Leclanche's battery, Preparation of oxygen on a small scale, Manufacture of disinfectants (manganates and permanganates.
COLOURING MATERIAL.	Calico printing and drying, Colouring glass pottery and brick, Paints. ..... Green, Violet.

Manganese never occurs in its metallic state, but always as an oxide, carbonate or silicate.

In Nova Scotia the following oxides occur and are named here in order of their importance to the producer: pyrolusite ($Mn\ O_2$), psilomelane, braunite ($Mn_2\ O_3$), manganite and hausmanite ($Mn_3\ O_4$). Psilomelane and manganite being the hydrous forms of pyrolusite and braunite. It has been said that some pyrochrosite has been discovered at Tennycape, but it has never come under the observation of the writer.

Legend says that Nova Scotia has the honour of being the first producer of manganese in America. The date of its discovery is very obscure, but the "story goes" that the French used *savon des veniers* (the fanciful name for pyrolusite) in their making of glass and pottery at Piziquid, now Falmouth, Hants Co., before the expulsion of the Acadians in 1755. The best evidence given of this is that on a farm, about a mile above the Avon bridge in Falmouth, on an area of about thirty feet square, having the appearance of a razed building, a specimen of pyrolusite had been found having attached to it pieces of glass and pottery. Evidently the French had used manganese, but for what particular use and at what date we have no reliable authority, and know but little of its history or discovery in Nova Scotia until 1801, when it was found at Tennycape, Hants County.

Nova Scotia has produced the purest and best ores of the world, and although the production has been small compared with that of other countries, yet, on account of its great purity and high crystalization, its product has great value and is used almost exclusively as an oxidizer and as a coloring material.

Dr. Penrose says "the most beautifully crystallized pyrolusite found in America is that from Tennycape Mine, Nova Scotia."

Prof. How reports Messrs. Tenant, of Glasgow, as saying in reference to the Tennycape ore, "they had never seen so fine." And the London *Mechanic's Magazine* said in 1880, *"these Nova Scotia ores, so much freer from iron than those found in Europe, will be a great boon."

Dr. How gives several analyses of Nova Scotia ores above 90 per cent. peroxide of manganese—(one as high as 98 per cent.)—and less than one-half per cent. of iron, and although I have a number of analyses of these ores, I can find only one showing a trace of phosphorus and none showing sulphur.

The following analysis made in Dr. How's laboratory by Mr. H. S. Poole is a fair average:

Hygrometric water	1,660
Water of composition	3,630
Peroxide of iron	.603
Soluble baryta	.724
Gangue (barytes)	1.728
Oxygen (by loss)	7.035
Peroxide of manganese	84.620
	100 000

Manganese occurs here in Nova Scotia in the manganiferous limestone of the lower carboniferous series, which extends in an eastward or westward course through Hants and Colchester counties, and is also found in Kings, Pictou and Antigonish counties, as well as in the Island of Cape Breton. It overlies the Devonian quartzite which, in Hants county, skirts the southern shores of the Minas basin from the Avon river on the west to the Shubenacadia river on the east, and continues on, crossing the river about five miles from its mouth. It is faulty and tortuous. It is several hundred feet in thickness, and is overlain by large beds of gypsum.

The principal deposits in this belt are the Tennycape Manganese Mining Co's (including the Tennycape mines at Tennycape, the Feuchtwanger and Sturgis mines at Pembroke), the Churchill mine at Walton, and the East Mountain mine in Colchester. There are other minor deposits which have had but little development, as the Parker property at Tennycape, the Wm. Stephens property at Walton, the Scott property at Minasville, and the Cheverie property at Cheverie.

The Parker property and the Churchill mine are not on the regular belt, but are outliers showing a displacement of from a quarter to half a mile.

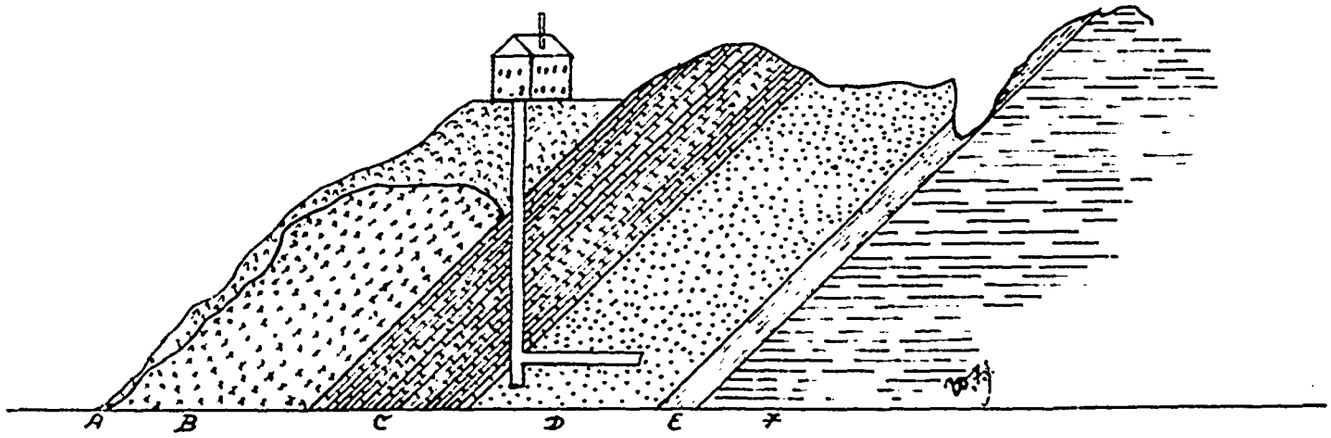
Through Hants county, a distance of 40 miles, the outcrops are numerous and easily traced. The deposits of manganese have their particular zones and are not disseminated through the whole length of the belt, as miles of the manganiferous limestone may be found not carrying any appreciable amount of manganese.

Having made a special study of the manganese deposits of this province, and having been associated with Tennycape for several years, allow me to describe its particular formation; and what is true at Tennycape is also true of other parts of the same belt.

The manganiferous limestone belt here varies in thickness from 150 feet to 300 feet, and is subdivided into three distinct divisions. In each division the occurence of manganese is quite different from the others.

The accompanying figure shows the relative position of each subdivision.

*Mineralogy of Nova Scotia by Prof. How, D.C.L.



CROSS SECTION OF TENNY CAPE MINE—SCALE 100'=1 INCH.

A, Blackish Shale. *B*, Gypsum. *C*, Brecciated Limestone. *D*, Massive Limestone. *E*, Shaly Limestone. *F*, Devonian Quartzite.

Immediately underlying the gypsum is a thickness of about 60 feet of brecciated limestone, known to the miners as "the soft ground." In this the manganese occurs in round boulders or pockets, varying in size from a few pounds to the famous "Dykeman pocket" of a thousand tons. When these pockets are taken out not a perceptible trace of manganese can be seen. Under this is a massive limestone, what the miners term "white rock," about 75 feet thick, colour light grey, and its solidity is such that in drifting or sinking in it very little, if any, timber is required. In this the ore occurs in lenticular veins, with well defined sides having a regular dip and strike varying in thickness, sometimes pinching out to a mere nothing, but always leaving a "leader" to follow.

Under this, and separated from the Devonian quartzite by a few inches of clay, is a shaly limestone with an average thickness of 15 feet, carrying numerous regular veins from the very smallest up to five or six inches in thickness.

This, possibly, is the most valuable division of the three. It has been estimated that if the entire belt was taken out and concentrated it would yield from 15 to 20 per cent. of the very best pyrolusite; and yet it has never been worked to any extent, simply because Tennycape has never had a concentrating plant that could profitably handle such rock.

Nothing but the very crudest machinery has ever been introduced in the mining of manganese in Nova Scotia. A pick and shovel, a hand drill and cobbing hammer, with a wheel-barrow and hand jig (which no doubt the ancient Egyptians also introduced) comprises the plant necessary to the manganese miner of Nova Scotia What practically has not been saved at the cobbing table goes to the waste dumps, which are an accumulation since 1861. These dumps have been estimated to contain 50,000 tons of rock which will yield 10 per cent. ore. They have paid well, after a season of rain, to hand-pick them. Verily, verily, there has been sufficient wasted in our mines to thoroughly develop them.

We might write with satisfaction on the geological position of our manganese; its modes of occurrence; its distribution; its ancient, medieval and modern uses, but why a modern concentrating plant has not been installed in a mine with possibilities like Tennycape, is the hardest of all to explain.

A mine that has been known to the world for over 25 years, and whose ores have sold in the United States market as high as $140.00 per ton, and whose average price for the past 20 years would be not less than $80.00 per ton, and whose product is practically inexhaustible, all high grade, crystallized ores, and should be produced at a cost not exceeding $15.00 per ton—why it still remains the same as twenty years ago, and has never had a plant with which its ores can be mined and treated with any degree of certainty or workable profit, to me is a mystery that I must leave for others to explain.

The Cableway in Open Pit Mining.

By SPENCER MILLER, C. E., New York.*

The problem of Open Pit mining, whatever the mineral may be, consists of: First, the removal of the overburden; second, the removal of the ore and waste.

The overburden is usually a waste product and must be taken off at the lowest cost per ton, and the value of the appliance applicable for work of this sort depends largely upon the character of the ground to be stripped.

The advantages to be derived from a machine to hoist and convey loads, using a suspended cable as a trackway, have been appreciated by engineers for a hundred years or more, but it has remained for the last few years to see any practical development of such a machine, and the modern "cableway" stands to-day as the result of such development.

The wire rope tramway, a device which conveys loads, but has no capacity for hoisting, is not considered in this paper.

The first practical form of cableway, called a "Blondin," was put into use about 1860, in the slate quarries of Pennsylvania. (See Fig. 1.) It consisted of a cable suspended on an incline of about 25 degrees. A cable carriage operated on this cable, and a fall block, adapted to rise and fall from the cable carriage, and a hoist rope, which performed the double function of hoisting the load to the carriage, and conveying the carriage up the inclined cable These cableways fitted the particular conditions that existed in the slate quarries so perfectly that they were frequently duplicated, and are still to be found in slate quarries, with very little improvement.

FIG. 1.—"The Blondin."

Some experiments were made to improve the cable carriage, so that it would work on a flatter angle, and the "Harris carriage" is undoubtedly the best example of its kind remaining in the market. It works between stops, fixed at top and bottom of inclined cable, and hence is limited in its usefulness. In some conditions, however, it serves admirably. Manufactured in conjunction with fall rope carriers, it bears the commercial name of the Harris-Miller cable and carriage. (See Fig. 2.)

The next form of cableway was one in which the main cable was suspended practically horizontal. The carriage in this event was moved back and forth by the use of an endless rope operated by a drum, being a part of the hoisting engine. Another drum performed the function of hoisting. Such a machine was first introduced for open pit mining at the Tilly Foster mines, New York. The reason for its adoption was that a derrick could not be constructed with sufficient reach to hoist and deliver material from the pit.

The problem at Tilly Foster was to convert the old mine into an open pit by the removal of something like 300,000 cubic yards of rock. It was calculated that this would uncover at least 600,000 tons of ore. This excavation was something like 450 feet long by 300 feet wide. It was quite imperative that a skip load of material should be lifted up directly at the place where it might be filled, and it was therefore necessary to use a hoisting and conveying device, which would reach out further than it would be practicable to use a derrick. At that time, about 1888, the cableway was in a crude state of perfection, but in

*Paper read before the Canadian Mining Institute, March, 1898.

spite of the crudeness of the machine it was found to be by far the most practical device that could be used for that purpose. The plant, as originally installed, consisted of four cableways, and a large derrick with a 100 foot boom. The cableways were much preferred to the der-

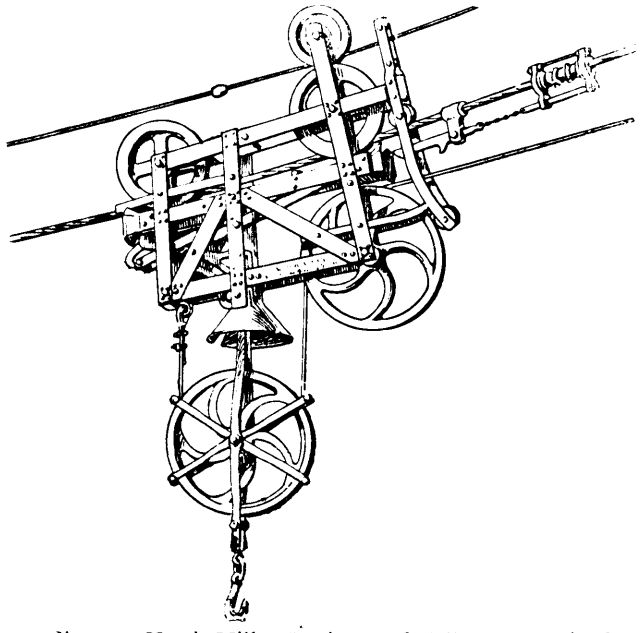


FIG. 2.—Harris-Miller Carriage and Fall Rope Carrier for Incline Cableways.

rick, and by them practically all the work was done. It was found by actual records that the cableway would take out ten per cent. more loads per day than the derrick, in spite of the fact that it was reaching out some 300 feet, while the derrick on the other hand could only reach out 100 feet. Similar engines were used for hoisting the load in each case, and a separate steam engine was used for swinging the derrick. The comparison made was between a crude cableway and a derrick of the most modern type, the latter operated by a high speed engine and swung by steam. The recent improvements in cableways would probably make a still more favourable showing for the cableway, possibly 25 per cent.

On this plant, chain connected fall rope carriers (Fig. 3) were used to support the hoist rope between the towers, and the carriage, which consisted of a series of blocks, with 8 in. or 10 in. wheels to run on the main cable, spaced about every fifty feet, connected with ½ in chains. These heavy and cumbersome fall rope carriers were the source of much annoyance. The hoisting rope does not need supporting oftener than every 100 feet, but with the chain connected carriers, the chains themselves must be supported so as to be out of the way of obstructions below, in fact the chains must not hang lower than the skips, say 15 feet. This brings the carriers 20 to 30 feet apart. The weight of the chains and carriers used on this plant was about a ton. The chains would swing about and get entangled in the fall block, and with each other; they limited the speed, and wore the cable, added to its strain and increased the power required in conveying the load fully 40 per cent.

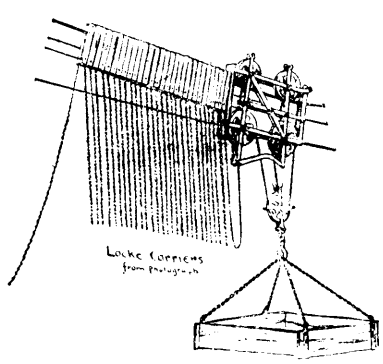


FIG. 3.—Chain Connected Fall Rope Carriers.

Long and high speed cableways were not practicable with the chain connected fall rope carriers Figure 4 shows the first departure therefrom, and represents the beginning of a development in the line of improved fall rope carriers. As will be observed an auxiliary rope, about ⅝ in. in diameter, is suspended above the main cable, held in a parallel position to the main cable by passing under wheels in the cable carriage. On this rope a series of buttons are secured, whose diameter increases with the distance from the head tower. Slots in the head of the carriers, corresponding to the diameter of the buttons, allow each of the carriers, in passing down the incline, to be stopped at its proper button. These carriers have small wheels to roll on the auxiliary or button rope. Thus, the heavy, cumbersome chains are dispensed with, and these fall rope carriers, spaced by buttons, and weighing in all

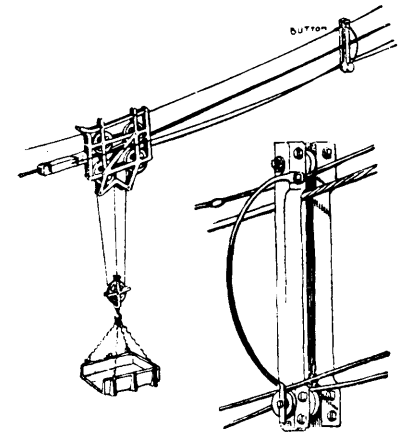


FIG. 4.—First Form of Miller Carrier.

about 100 lbs., answer all the requirements of chain connected carriers, weighing, with the chain, 2,000 lbs., the latter causing an increased strain on the anchorage of about five tons.

The button stop fall rope carrier was next applied to a horizontal cableway of 855 ft. span. Means had to be provided for drawing the fall rope carrier out with the carriage, as gravity was not to be depended upon as in the last case. To this end a horn was placed upon the carriage, which served the twofold purpose of lifting the carriers bodily from the cable, thus dispensing with wheels on which the carrier might run on the main cable, and also, on these horns the carriers were taken when distributing them along the cable.

The original carrier was of wood and iron. The development of a few years has brought the carriage and carriers up to a standard form, as shown in Figure 5. The cable carriage is built with two, or three,

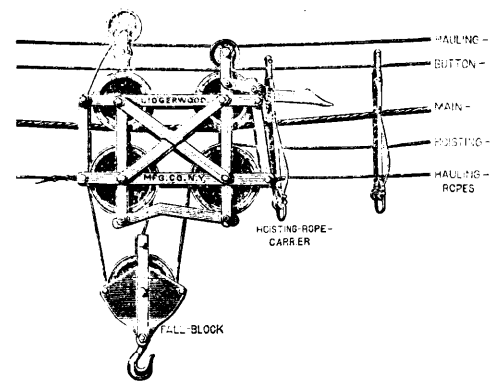


FIG. 5.—Standard Two Wheel Carriage and Fall Rope Carriers.

main cable wheels. The various ropes are indicated in the illustration. The horn in front of the carriage picks up the carriers as it passes toward the engine, and also carries them out as the carriage recedes; the buttons on the button ropes take the carriers from the horn and leave them spaced along the main cable at proper intervals for supporting the hoisting rope. These buttons increase in size, receding from the head tower, as also do the corresponding slots in the head of the top of the carrier.

Figure 6 illustrates one form of engine with double cylinders fitted with reversible link motion. The drums are of large diameter, friction type, one to carry the hoisting rope, and the other is turned with a curved surface as shown, and carries the endless rope. The endless rope is wrapped around the drum five or more times, enough to secure sufficient friction to keep it from slipping in the opposite direction to that in which the drum is turning, and the ends are passed over the sheave wheel on the towers, and made fast to the front and rear wheels of the cable carriage.

The hoisting drum is independent of the other, and, being of the same diameter, winds at the same rate of speed, and keeps the load at the same height, if so desired. This drum has a band brake by means of which the load can be sustained. The reversing lever, friction and brake levers, are all brought to a central position, so that the operator can work all of them in one position. The load may be hoisted or lowered at any point under the line of the cable, and the horizontal motion is given to the load at any height to which it may be raised. The author prefers however, whenever the conditions permit, to employ an engine with tandem drums, constructed however with special reference to cableway work.

Recent developments heve been in the direction of increasing the capacity of the cableway by increasing the number of trips per day. This has been largely accomplished by the use of the device known as the aerial dump, figure 7, whereby the act of delivering the load from the skip is done automatically by the moving of a lever by the engine man so that the load may be automatically delivered at any point desired. This not only saves a man for releasing the load, but it also largely reduces the time required for dumping the load.

A further improvement, namely, that of making the entire plant movable, has brought the cableway up to a position where it is a long distance travelling crane. (Fig. 8.)

In one of the iron ore mines in the Lake Superior region, the experiment was tried of remodelling one of the modern cableways, so as to operate a self-filling grab bucket. The experiment was partially a success. It required, however, some very material modifications to the machine in order that the operation should be entirely successful. At the present time that feature has been made an entire success, (Fig. 9)

FIG. 7.—Aerial Dump.

and two have been built to excavate sand from the bed of a river and deliver it to bins on dry land, where it is screened and shipped to St. Louis. This machine represents one of the most modern labor saving improvements as applied to the modern cableway. One of these plants has, by actual count, made 33 trips in 44 minutes. It averages, however, from 30 to 40 trips per hour, or from 300 to 400 trips per day. The bucket has a capacity of one and a half yards. The amount of material actually delivered is 18 car loads per day, averaging 18 yards per car, bringing the total up to 324 cubic yards. To deliver this amount of material to the bins requires a labour force of,

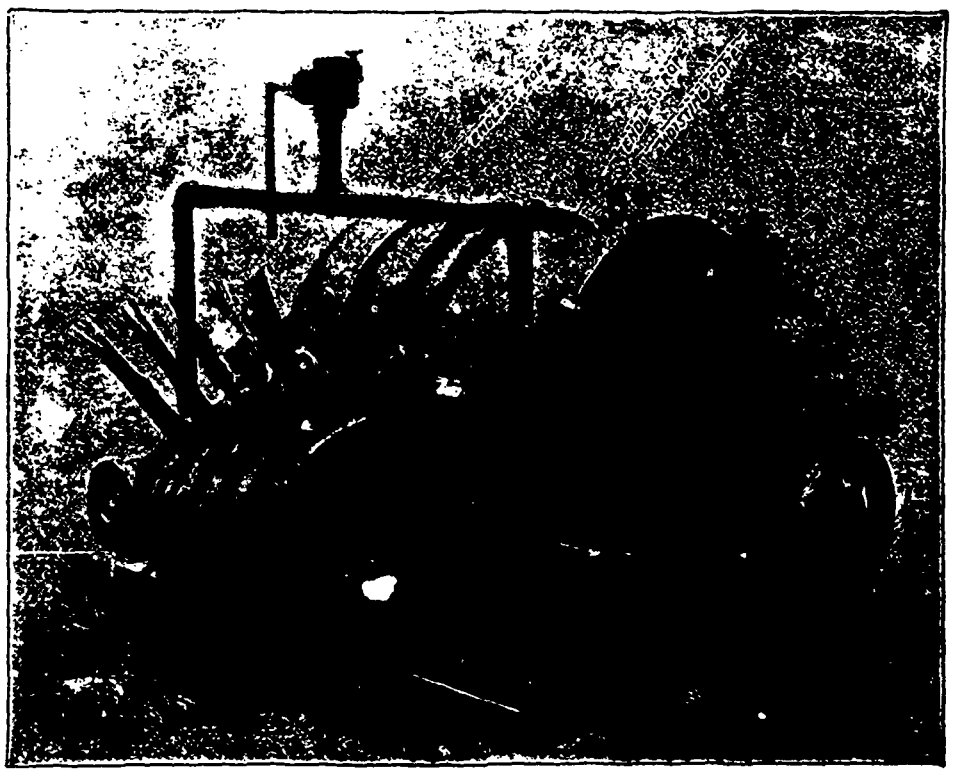


FIG. 6.—Cableway Engine.

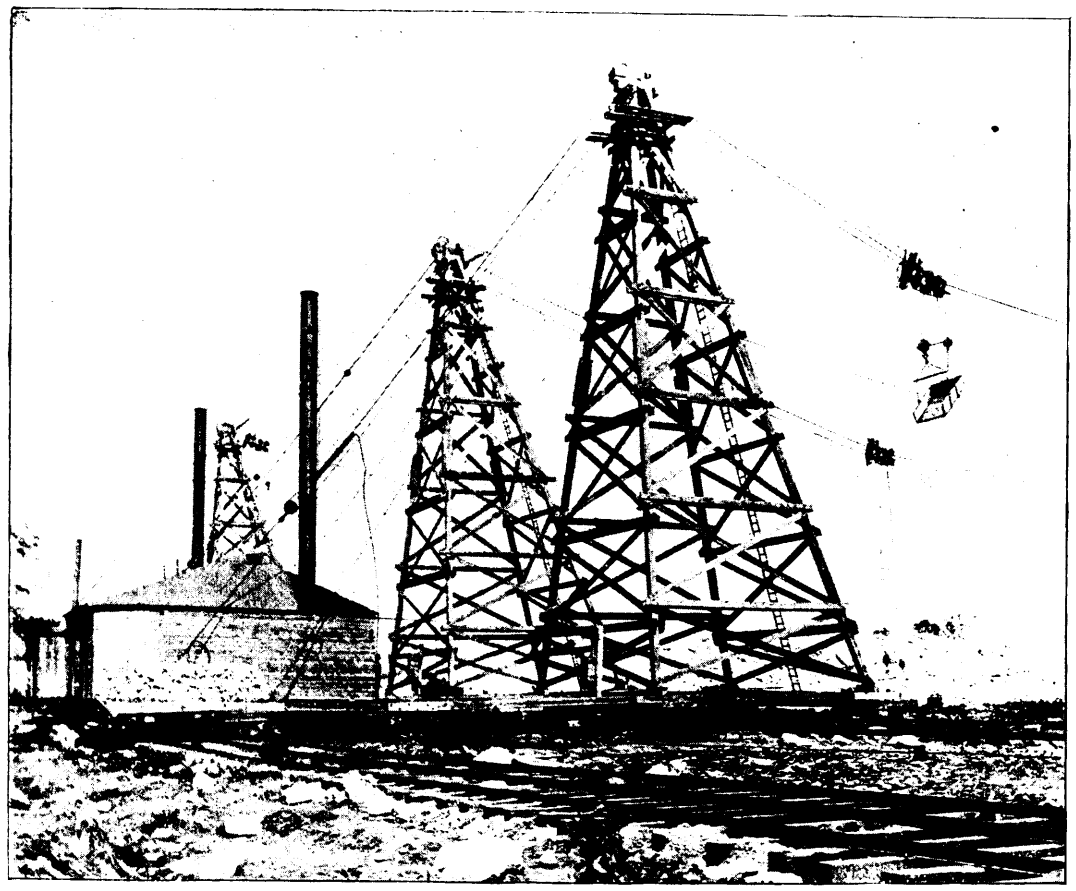


FIG. 8.—Head Towers, Traveling Cableways.

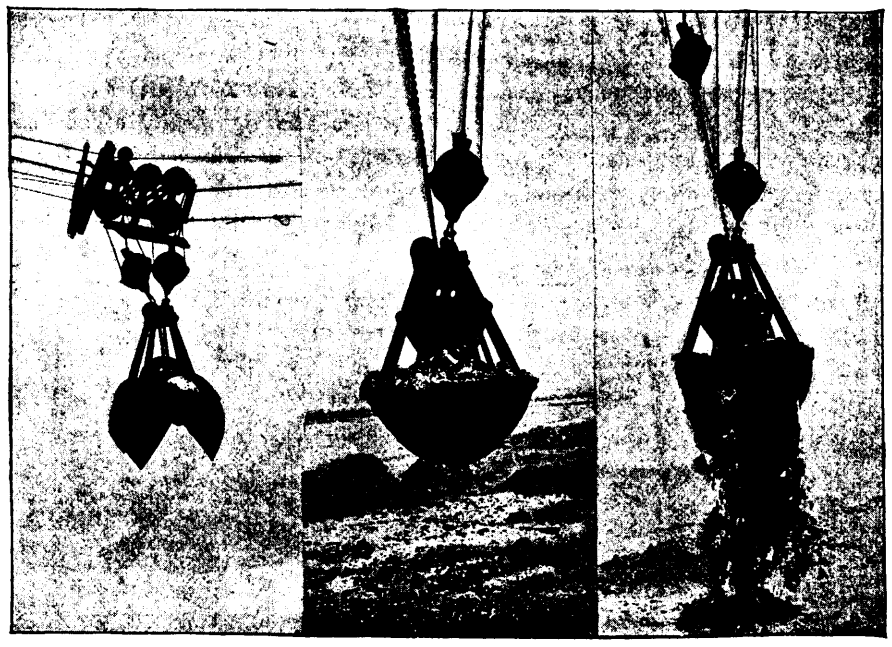


FIG. 9.—Self-filling Grab Buckets at different stages.

One engine man at	$2 50	per day.
One fireman at	1 50	"
One signal man at	1 25	"
Fuel (say)	2 00	"
Oil	25	"
	$7 50	

Making a cost of $7.50 per day. Estimating 300 cubic yards as the daily capacity, it will be seen that the actual operating cost is about 2½ cents per yard. Of course this does not include any labor force about the screens, nor does it include the wages of a foreman, nor any repairs, which, while slight, must be considered as an item of cost.

About five years ago some experiments were tried near Topeka, Kansas, in which a clam-shell bucket was applied to a short cableway. The only machine of which there is any record, does not show one in a perfected state; but it is undoubtedly entitled to the credit of being the pioneer in the use of the self-filling bucket upon a cableway. This machine was used in handling deposits from river beds and streams, and delivering them to the sluice way on the bank. A description of this machine states as follows: "The one great drawback, to placer mining, has been the question of effective machinery for handling the earth deposits of our river beds and streams, consequently our placer mines have never been worked deep enough to even ascertain their possibilities,

or determine their richness Tests have shown that the richest deposits lie near the bed rock, but to successfully work this deposit and extract therefrom the vast quantities of fine free gold has been the problem, difficult up to the present time.

An interesting form of cableway for placer mining was erected about a year ago in Alder Gulch, Mont., for handling placer. Alder Gulch was famous twenty years ago on account of its rich placer findings, and according to the shipments of Wells, Fargo & Co., from Virginia City, they have variously estimated the gold shipped from that Gulch at between sixty and seventy million dollars.

The old methods were so restricted, the difficulties so great, that all they got out from the placer was the coarse gold.

A group of English capitalists installed a novel form of cable way in order to solve the problem ; first, for the excavation of large quantities of material at a low cost per yard ; second, the delivery of the material at sufficient height, so that the gold saving flume could be used of sufficient length and grade, to thoroughly save the finer gold which escaped the original miners ; third, the delivery of the tailings at such an elevation that they would dispose of themselves.

The cableway shown in Figure 10, contains many novel features not found in any other cableway. The centre tower shown contains a hopper, the bottom of which is 40 feet above the bed rock. This hopper 27 × 16 × 8 feet slopes from each side to a center channel 30 inches wide, and this channel slopes back to the head of the flume, or the gold saving sluice. The "A" frame tail support was made light and portable, so that it could be easily shifted about the hopper as a center. This cableway is now being remodelled, so that this tail towers will travel on wheels.

A peculiar form of bucket, known as the drag bucket was used for digging the placer, see Figure 11. In the operation of this machine the bucket is carried over the point where the material is to be dug. The pocket is then lowered to the ground, where it automatically settles into a position favorable for digging. The carriage is then run forward leaving the bucket on the ground. When the direction of the ropes leading from the carriage to the bucket is favorable, the hoisting line is hauled in and the bucket dragged along the ground, and the teeth of the bucket will plough into and cut their way through the gravel and the bucket completely fill, after which it is hoisted, conveyed and dumped automatically into the hopper.

Material from the hopper passes through a 5 foot 6 inch grizzly which separate the rocks and boulders, which pass down the chute to one side. This sluice is 30 inches wide and about 200 feet long, with iron riffles made of "T" iron in the first two boxes and with end wood riffles the remainder of the length. The tailings are delievered 25 feet above the ground level, and dispose of themselves without rehandling.

The hopper tower was built of 8 x 8 timbers on account of the fact that that size of timber was easily obtainable at the point ; 10 x 10 timbers, or even 12 x 12 would make a better construction. At the top of the tower there is an auxiliary tower, or bonnet (supporting the main cable) which revolves, accommodating itself to the position the main cable occupies. This is done without the disturbance of the ropes leading from the head of the tower down through guiding sheaves to the engine. The engine is of special form, built by the Lidgerwood Mfg. Co. of New York, and has 10 x 12 cylinders, drums, 33 inch diameter ; operating levers are carried to the rear convenient for the lever-man. The main cable is of 1¾ inch diameter crucible steel. This cableway has actually handled over 400 buckets in 10 hours. The bucket handled 1½ yards of material.

In spite of the heavy cost of fuel and labor, the actual cost of the material handled does not exceed three cents per cubic yard. With this particular cableway in operation, with its fixed tail tower, it was found most profitable in operation, first, to allow the bucket to dig a trench to bed-rock, then the material at either side of the trench was washed into the trench by an hydraulic giant. Had the tail tower, however, been as portable as it will be when it is mounted on wheels, there would be no necessity for the hydraulic work, although it is a question as to whether the fine gold resting on the bed-rock, cannot be washed cleaner in this way, than it can by any other method. With this method of mining, gold in pockets is easily recovered.

The labor force around this outfit consists of a lever-man, fire-man, signal-man, hopper-man and rigger. The pipe force, when the pipe was used, consisted of a pipe-man, and two assistants to loosen heavy boulders and move them out of the way. Boulders up to 600 pounds weight could be easily picked up by the bucket when loosened, but it

FIG. 11.—A Drag Bucket.

is found more desirable to keep them out of the hopper and confine the bucket work to the more gravelly material, which carries the gold. One man is also employed in maintaining the dump and bed-rock flumes.

Several interesting installations of cableway are found in Canada. Mr. F. T. Snyder describes a Lock-Millar cableway (Fig. 12) 450 foot span in use at Keewatin, Ont., by the Ottawa Gold Milling and Mining Co. This cableway has a capacity easily of 200 tons per day, and is run by belted drums from a line shaft in the mill. The operator is in full view of the bucket at all times.

The Asbestos and Asbestic Co., (Limited), of Danville, Quebec, employ seven cableways which spans from 150 to 450 feet, having a capacity of two to four ton loads, averaging 200 tons per day. The cables are inclined all the way from 1 degree to 30 degrees. The horizontal ones employ an endless rope and double drum engines. Fall rope carriers will shortly be installed on the long span cableways. A side pulling line is employed, secured to the hook of the fall block out of line with the cable. Mr. H. J Williams, Superintendent, says he is very partial to cableways for large capacity and long distances.

Bell's Asbestos Co., Thetford Mines, P.Q., employ six cableways 200 to 400 foot span, inclined at about 45 degrees. As the output of all these cableways is only 500 tons per day, it suggests the thought that possibly one traveling cableway, with all the modern appliances, might do all the work of the six now in use. The traveling cableways

on the Chicago drainage canal handled 1,000 tons per ten hours, or twice the output of the six cableways above.

An interesting example of open pit mining with cableways was given to this Institute two years ago by Mr. R. E. Chambers, M.E, of New Glasgow. His paper on "A Newfoundland Iron Deposit" describes a double traveling cableway, 300 foot span, in use in Belle Island, situated in Conception Bay. A bed of iron ore, averaging eight feet thick, dipping at an angle of about 20 degrees, is being mined by the cableway method

The advantages of open pit mining have been dwelt upon to such an extent, that no argument will be made in defence of the plan. The annoyance incident to underground mining, where the excessive cost has to be met of timbering, shaft sinking, pumping, or the largely increased cost of breaking the ore (this one point sometimes makes a saving of 80 per cent.) the extra cost of blasting, makes the idea of open pit mining extremely popular.

The cost of removing the overburden varies much with the nature of the ground, especially with reference to the point of dumping the waste. It frequently happens that a cableway may be applied in such a way as to span the opening, and carry back the waste to a depression so that the overburden may be delivered directly to its dumping ground.

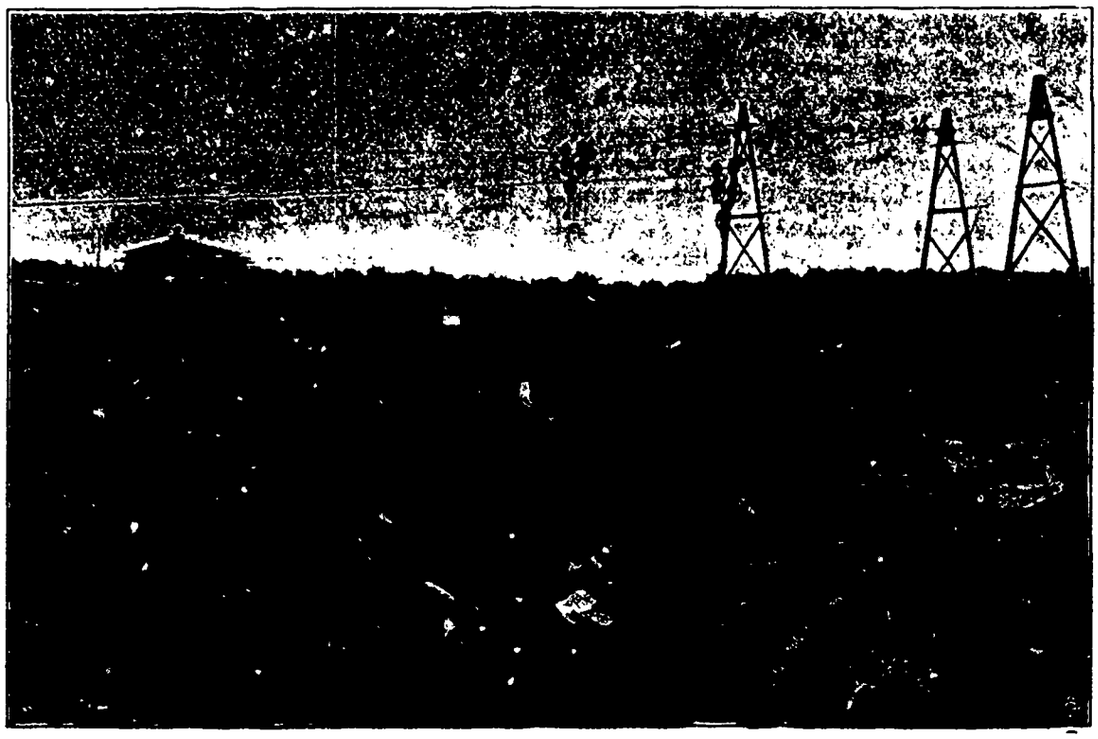


FIG. 13.

FIG. 14.

The cableway must also be considered as superior to any method of working with incline railways, as is frequently done where the pit is shallow. In whatever way the incline railways are put in, or railways in the bottom of the mine, they are sure to cover a certain amount of ore. A blast is certain to throw considerable material on the tracks, the cost of removing which must be considerable.

The cost of loading the material into the shallow skips used on the cableway makes a very appreciable saving over the cost of loading into cars. The records of the Chicago Drainage Canal show that while laborers sledging and filling into cars averaged only 7 to 8½ cubic yards per man, per day, in filling into skips for the cableways the laborers averaged from 12 to 17 cubic yards per day. The extraordinary difference, however, made on the Chicago Drainage Canal would not be so great, were it not for the fact that considerable of the stone on the canal had to be sledged before it was small enough to be lifted into the cars. In mining operations where the material breaks up easily under the hammer, this difference would not be so marked.

The cableway has been applied for stripping coal mines in Pennsylvania. Two cableways, one for handling lime rock from the quarry to the crusher, and the other for handling iron ore have recently been installed in Alabama, U. S. The latter hoists and conveys the iron ore, which lies in a thin layer near the surface, from the mine to the crusher. Both cableways were also employed for stripping off the top layer of earth and other refuse. The span of each cableway is 900 feet and the load handled six tons. This is an entirely new departure for mining and quarrying in that section of the country. As the installation is recent, I have very little data as to the cost of operation.

The development of the last seven years has added to the cableway :

The Button Stop Fall Rope Carrier.
The Aerial Dump.
The Travelling Towers.
The Self Filling Buckets and Drags.
Spans have been increased from 800 to 1,650 feet.
Loads have been increased to 25 tons.

And incident to the above :—

Daily Capacity has increased from 400 to 1,200 tons in 10 hours

The cost, per ton handled, has been reduced fully 50 per cent. in the last seven years.

With this development a serious difficulty has appeared, viz., the rapid wear of the main cable of the cableways on the Chicago Drainage Canal. With previous cableways running at moderate speeds and small daily capacity, the life of the cable would be eight or ten years, while on the canal, the cables would last but a few months. It is of course not proper to measure the life of a cable in years, or months, but in tonnage. The Austin Dam cableway, 1,350 feet span, handled at least 250,000 tons of material during its construction, and when taken down on the completion of the work was in good condition. The cableway at Pt. Pleasant W. Va., has been in steady use for several years, and is 1,506 feet span, and the main cable is in good condition.

It is worthy of note that no cableway, having a span of over 1,000 feet has ever worn out its main cable. The strain on these cables, due to the weight of the load, and the weight of the cable itself, is estimated to give the same factor of safety with the short as with the long cables, and yet the long span cables handle more tons of material. The reason, therefore, for this, is found in the observed fact that the weight of the cable between the load carriage and the tower, is so much greater in the long spans that it counteracts the tendency of the carriage to sink so deeply into the sag of the main cable. In other words, the angle of bend is less, and hence the longer life of the main cable.

If, therefore, the main cables of the twenty cableways on the Chicago drainage canal, had been 2 1/2 in. or 2 5/8 in. diameter, instead of 2 1/4 in., and of milder steel, I do not hesitate to predict that their life would have been more than doubled.

The engineer, however much he may urge to the adoption of elements of large factors of safety, is constantly held in check by commercial considerations.

The rapid wear of the Chicago drainage canal cableways, however, did not prevent them from holding the record, cost of plant considered, as the most economical machines for excavating the rock work of the canal. The cantilever conveyors by all odds the most perfect hoisting and conveying machines on this great work, cost over twice as much as the cableways, and the daily operative expenses were only 1/4 of a cent per cubic yard cheaper than the cableways. This is according to the reports of the engineers in daily attendance on the work. One quarter of a cent saved per yard, meant about $1.25 per day, while the interest on the *extra* cost of the plant was $3.00 per day.

The author hopes this paper will be taken as simply recording the development up to date. So many important improvements are now under consideration, that in a very few years he hopes to show the cableway still further in the front rank with labor-saving devices.

CANADA,

PROVINCE OF BRITISH COLUMBIA,

No. 3.

IN THE SUPREME COURT.

IN THE MATTER OF

O. K. GOLD MINING CO.

Limited Liability (Foreign) in Liquidation.

The undersigned Official Liquidator will sell by Tender, subject to ratification by the Court,

The O.K. Mine and Buildings belonging to said Company; also the entire Mining and Milling Plant of said Company, situated on the south slope of O.K. Mountain in Trail Creek Mining Division, about 2 1/2 miles west of Rossland and close to main wagon road and Red Mountain Railway, leading from the City of Rossland, West Kootenay District, British Columbia, to Northport, Washington, distant about 15 miles. The claim is surveyed and Crown granted.

The ore was at first largely free milling. It was originally treated by a five stamp mill, which was superseded by the present 10 stamp mill.

The O.K. Mine has been worked since 1893, and has always been a producer. About 2,472 tons of ore from this mine were milled from January 19, 1897, to June 19, exclusive of several hundred tons of custom work for adjoining mines.

It is most favorably situated in all respects.

The new ten-stamp mill is thoroughly equipped for the economical handling of ore. It is connected with the mine by a 600-foot gravity surface tramway, with 20 wire rope carrying rollers, etc., complete, the elevation of the workings being 200 feet above the mill; one 3-wheel brake with 650 feet 5/8-inch steel wire rope; two self-dumping ore cars, 18-inch gauge.

The mill contains two 50 horse-power Standard tubular boilers, each containing 54 12-foot tubes; one 85 horse-power Corliss engine; one 10 stamp mill; one No. 6 Blake crusher; one grisly 4 x 10, 3 x 3/4 iron; two Challenge automatic feeders; one overhead crane, with iron track; one 1-ton Weston differential pulley block; one gold retort, with cover, wedges and condenser pipe; one Rand straight line Class C 12 x 18 air compressor, capable of running four drills; one 28" x 8 foot air receiver; one No. 7 Miller duplex pump; three 6-foot Fraser & Chalmers frue vanners; plain belts; one 4-core hydrometric sizer; one Woodbury concentrator; one bumping table; extra amalgamating plates following concentrating table, and one Fraser & Chalmers ore sample grinder, etc.

BUILDINGS

The principal buildings are: The new mill building, containing 10-stamp mill, but designed and built to accommodate 25 stamps; engine and boiler house, office buildings, mess room, cook house and store room, manager's residence.

DEVELOPMENT WORK

Comprises three main tunnels, one winze and a number of drifts, a shaft 15 ft. deep, together aggregating over 1,500 ft., which is entirely confined to one corner of the property. Two-thirds of the property are as yet unprospected.

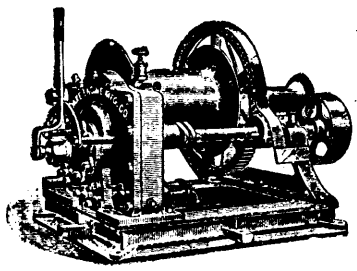
Tenders are now invited for the sale of the property as a whole, including new 10-stamp mill, the mine, four machine drills and all buildings connected therewith.

The undersigned reserves the right to accept or decline any tender, and to withdraw the property from sale at any time, and the further right to fix a reserve price upon the property, and to make such other conditions as may meet with the sanction of the Court.

The property is open for inspection, and intending purchasers will find it advantageous to make an application for this purpose to the undersigned, at No. 3 Imperial Block, Rossland, B.C., where an inventory can be seen and all further necessary information will be furnished.

Richard Plewman,
Official Liquidator.

Telegraphic and Cable Address,
"PLEWMAN." Use Bedford McNeil's Code.



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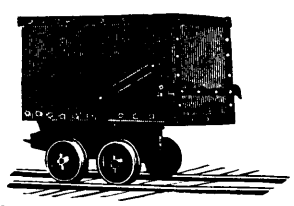

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Accountant and Official Assignee. Liquidator of the O.K. Mining Company.

Stocks of merit and B. C. mining properties for sale. Special catalogue furnished on application. Correspondence solicited. Use Clough's & Bedford McNeill's Codes. Telegraphic and cable address, **Plewman, Rossland.**

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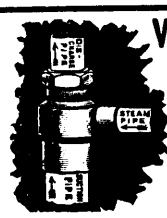
A first-class Lithographic Quarry in the Towship of Marmora. Title perfect. Correspondence solicited.

Address: **GEO. S. DAVISON,**
Care Canadian Mining Review. **Ottawa, Canada.**



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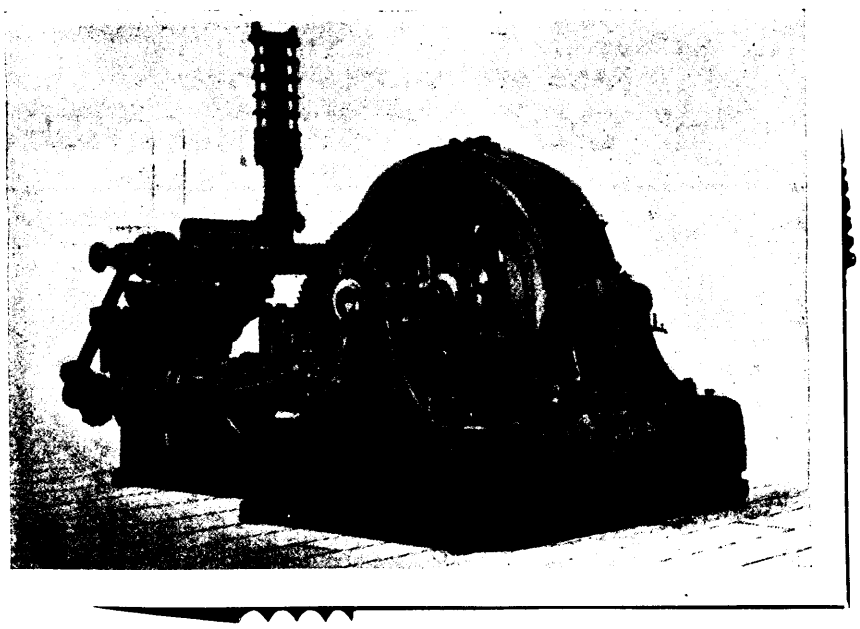

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DENVER, COLORADO, U. S. A.

PROVINCE OF BRITISH COLUMBIA.

Gold, Silver, Lead, Copper, Coal, Coke, Oil, Iron, Mercury, Platinum, Etc., Etc.

THE MINES OF BRITISH COLUMBIA HAVE PRODUCED OVER $112,000,000.

AMOUNT AND VALUE OF MATERIALS PRODUCED 1896 AND 1897.

	Customary Measures.	1896.		1897.	
		Quantity.	Value.	Quantity.	Value.
Gold, Placer	Oz.	27,201	$ 544,026	25,676	$ 513,520
" 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 LILLOOET, 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, ILLECILLEWAET 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 constructde. 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.

For information, Reports, Bulletins, etc., address

PROVINCIAL MINERALOGIST,
Department of Mines,
VICTORIA, B.C.

The HON. JAMES BAKER,
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CANADIAN MINING INSTITUTE

NOTICE OF INCORPORATION

NOTICE is hereby given that application will be made to the Parliament of Canada at its present Session for an Act to incorporate **"The Canadian Mining Institute"** to promote the Arts and Sciences connected with the economical production of valuable Minerals and Metals, to encourage and promote the Mining and Metallurgical industries of the Dominion of Canada and for other purposes.

Dated at Ottawa this 11th day of March, 1898.

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SCHOOL OF MINING,

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The Following Courses are offered

1—Three Years' Course for a Diploma in

(A) Mining Engineering.
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2—Four Years' Course for a Degree in

(A) Mining Engineering.
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3—Post-Graduate Course for the Degree of

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

4—Prospectors' Course.

The School offers to Mine Foremen, Assayers, Prospectors and Mining Men generally, Special Courses of Instruction beginning January 4th, 1898, and continuing eight weeks.

5—Extramural Classes for Prospectors and Mining Men.

Lecturers are sent to Mining Centres to conduct Classes in Elementary Chemistry, Mineralogy and Geology as applied to the discovery and winning of valuable minerals.

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

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,

SCHOOL OF MINING, KINGSTON, ONTARIO.

BOUNDARY CREEK MINING AND MILLING CO.

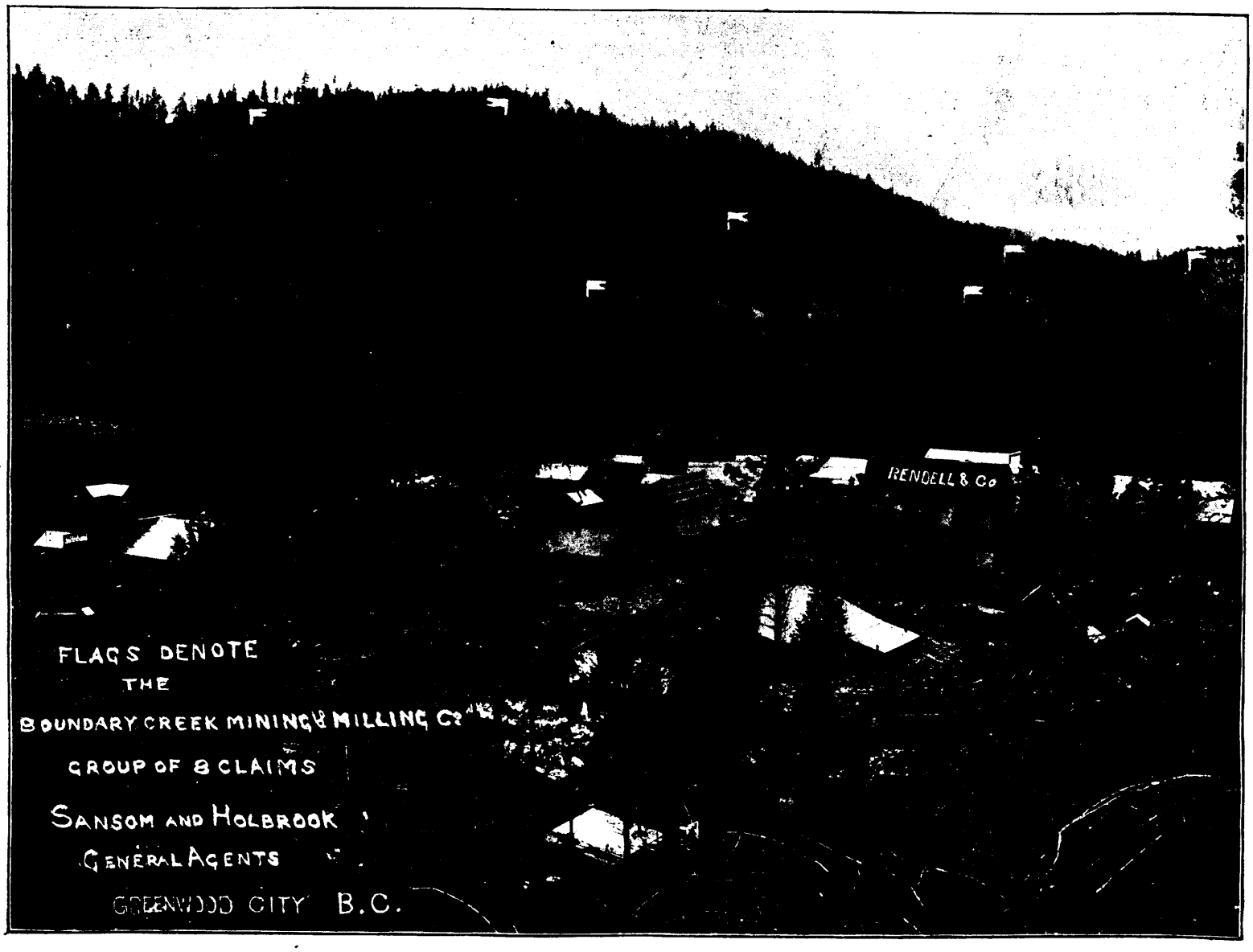
INCORPORATED OCTOBER 21st, 1896.

CAPITAL, $1,500,000. **1,500,000 SHARES AT $1.00 PER SHARE.**

700,000 Shares in the Treasury for Development.

This Company owns and operates a group of the highest grade in Gold, Silver and Copper properties in Boundry Creek.

CLAIMS—The G. A. R., D.A., O. B., S. H. B., J. A. C., FRED D., S. F., C.S. & H., D.H. and BIG LEDGE, constitute the group, which is the most compact and advantageously situated of any under one ownership in Boundary Creek. The proposed Columbia and Western R.R. being surveyed to pass right through Greenwood City and along the base of the hill.



From the above photograph it will be readily seen that, lying as they do on a steep sloping hill, the properties offer unusually good facilities for drainage and rapid and economical development, by main working tunnels driven in from the base of the hill.

The veins lie in the Granite Area—which occupies the upper part of Boundary Creek basin—along the line of contact with the more basic eruptures, and are among the oldest locations in the camp.

A small shipment of 8,653 lbs. was made to the Everett smelter in 1894, yielding per ton, Gold, $103.15; Silver, 74-7-10 ozs.; Lead, two per cent., and a considerable amount of shipping ore is at present on the dumps of the different claims.

Careful investigation is earnestly invited by the Company, as their properties are being developed with a view to making mines and not to booming stock.

Attention is drawn to the large amount of stock (700,000 shares) put into the Treasury, and to the fact that the properties are all fully paid for.

150,000 Treasury shares fully paid up and non-assessable, have been put on the market at 10 cents, and most of the stock so far sold has been taken up locally. A large proportion of the miners now working are also taking stock in payment. For further particulars address

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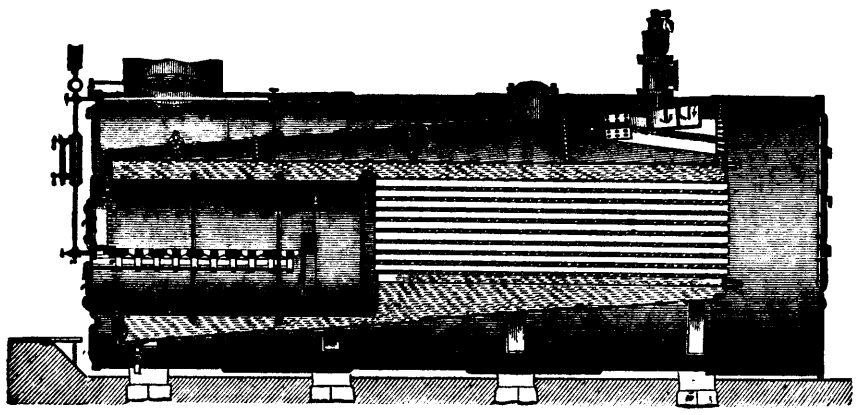

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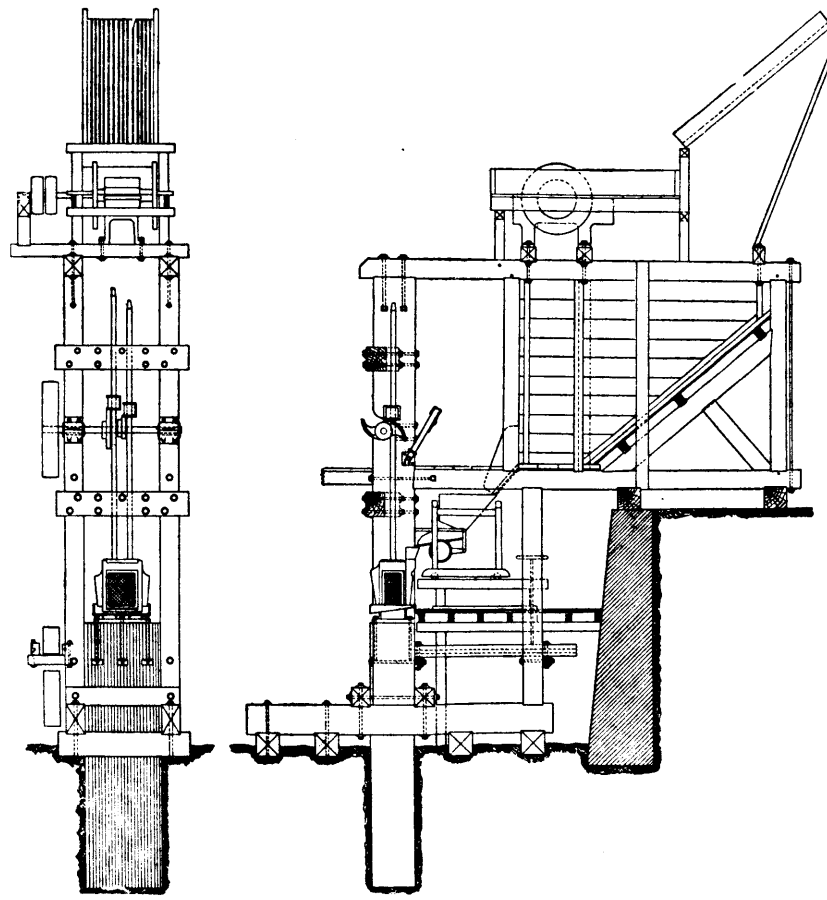

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