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The Canadian Mining Review

Established 1882

Vol. XV. No 4 MONTREAL OTTAWA HALIFAX. APRIL, 1896.

MINING LAWS OF ONTARIO.

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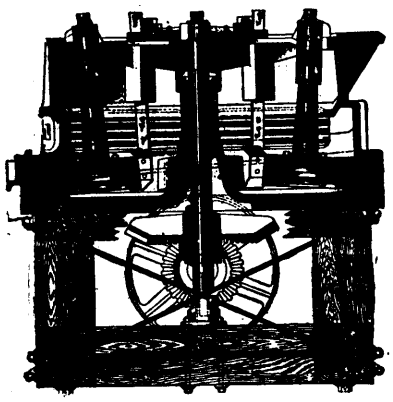
ARCHIBALD BLUE,
Director Bureau of Mines

TORONTO, May 25th, 1894.



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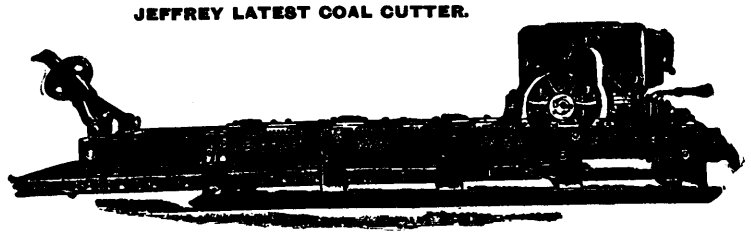

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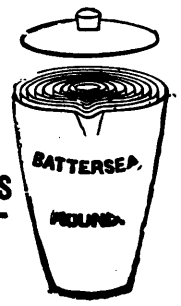

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THE MINING REVIEW

Established 1882

Official Organ of The Mining Society of Nova Scotia; The General Mining Association of the Province of Quebec; The Asbestos Club; and the Representative Exponent of the Mineral Industries of Canada.

B. T. A. BELL, Editor. Published Monthly. OFFICES: Slater Building, Ottawa.

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Mining Investment.

The report of mining successes is inevitably followed by mining investment Where money has been made more may be made. A dividend-paying mine always occasions the purchase of an adjoining property, reputed to have an extension of the vein, and sometimes a whole district is bought up on the strength of one rich spot. The stories that have come of late from South Africa, Western Australia, Cripple Creek, Cariboo, Kootenay, Trail Creek, Western Ontario, Nova Scotia and other localities where the precious metals have been profitably produced, have revived a waning interest in the mining industry as an investment. But above all the fortunes made in mining share speculations in London have stimulated the promotion of companies to satisfy the demand of the public for this fascinating form of gambling. Mining exchanges are being established in many cities for the purpose of dealing in the shares of mining companies, some of which are organized solely for this purpose, the only production of the enterprise being certificates of stock, usually fine specimens of the engraver's art.

It seems probable that the present year will witness the greatest interest in Canadian mining that has ever been known. The troubles in South Africa and the war scare that arose out of the message of the President of the United States upon the Venezuelan question have checked foreign investment in the enterprises of those countries and there seems to be more disposition for English capital to seek Canadian opportunities than has been manifested for a long while. There are evidences also that the wary Canadian capitalist will be tempted by the golden bait and will seriously entertain the laudable impulse to assist the mining development of his own country.

Considering this probable course of events it may be well to endeavor to give some counsel to those who will be solicited to invest in mines. And first we would say to all such, do not spurn the request as a temptation of Satan and treat the proposal with scorn. But rather give it serious consideration for two good reasons, one of which is that there are certainly great prizes to be had in mining, and the other is that such investment is one of the best ways of benefitting a country. Do not say as did a multi millionaire the other day, when solicited to put a small sum into a legitimate and promising mining operation, "I would rather take the money and throw it into the ocean, then I should know it was gone, and have done with it; but if I put it into a mine I should lie awake nights and worry about it." There was perhaps some excuse for this good man's petulance, for his office was adorned with a large frame containing very ornamental share certificates of defunct mining companies.

As to prizes in mining, many examples are now being afforded in British Columbia, Nova Scotia, Quebec, and more recently in Ontario. Prospects that were bought from needy explorers at prices ranging from $100 to $1,000 are being sold for $20,000 to $50,000 and upwards, and again the investors in these mines are receiving dividends from the production of ore. Mines are not all swindles or mere holes in the ground to sink money in. They are frequently good, and when they are good they are often very good. Ore deposits that on the surface only yielded $4 or $5 a ton, upon being followed to a depth, have increased in value to $50 or $60 a ton and have paid handsome profits. New districts are being opened to which railway transportation will soon be given, such as Boundary creek, where immense ore bodies can now be purchased at moderate prices, and by development are sure in some localities to show rich pay centres that will make the fortune of the lucky investor, or else will prove to be of so good an average that, considering the cheapness of mining and treating large masses of ore, the profits will be great and steady.

As to benefits to the country, we can hardly expect either patriotism or utility to have much influence in deciding an investment. Yet it may have its weight with some minds, and such should understand that money put into mines probably moves a more varied and larger number of industries than any other investment. Every amount expended upon mineral production is divided among a multiplicity of interests, for a mine as a rule involves the creation of a little village of its own, and in the opening of the mine and the winning, transport and treatment of the ore a wonderfully diversified demand is made upon the other branches of production and industry. Mining investment has a good mental effect, and ought to be recommended as a tonic and stimulant for invalids. It is intensely interesting and gives a wide range to the thoughts and opens up enquiry about localities and methods of work that are both entertaining and instructive, and when the telegram comes that the pay streak has been struck and high assays secured, and that the vein has widened with depth, the excitement is so pleasurable that it is as good as a dividend in itself for its effect upon the happy investor.

The greatest difficulty, however, in mining investment is to decide what is a good venture, and it is on this point that we aim to give some good advice to our capitalistic friends. There is no doubt that they have been woefully bitten by glib-tongued promoters, who, coming with all the romance of the wild and wooly west about them, effectually pull the wool over the confiding investor's eyes. Even when they have gone to visit the mine personally they have been equally deceived. After a wearisome journey and the discomforts of log cabin bunks and miners' grub, they toil up the tortuous trail or scramble through the thick underbrush until, when the spot is reached where the treasure is said to be, they are too exhausted to investigate properly, and too disgusted to feel any interest. They willingly accept the representations of others rather than make further effort to examine for themselves. Or if they go into the tunnel or descend the shaft, with eyes scarcely able to peer through the grim darkness, they see nothing but moist, black rock, until the well instructed and wily pit foreman strikes with his pick and hands up a glittering piece of ore, and then another, saying with each stroke, "It is here—and here—and here," until the visitor thinks the whole face of the tunnel is solid ore, whereas it may only have a few streaks that the miner knows just where to strike. Or if the visitor selects samples himself they may be salted. A man was recently met in the wilds of British Columbia looking for a gold mine to put a stamp mill on. He had a mill brought in 150 miles from a railway, but had no mine to

employ it. Enquiring as to how so singular a thing happened, he said that he went to examine a mine and was particular to select all the samples of quartz with his own hands, but he incautiously laid the specimens down on the ground, and when his back was turned a man adroitly sprinkled some flour gold over them. The assays went so high that the mine was bought and the machinery ordered, but at last one of the men got faint-hearted and "blowed" on his partner, and new assays of rock proved the mine to be worthless. These stories are common enough, and are only alluded to in order to show how difficult it is for one, who has not the special experience needed for judging, to determine the value of the proposed investment. A novice would not venture to buy flour or grain without the inspector's certificate, yet men will buy mines or mining shares on the merest impulse or the recommendation of strangers, or else will venture upon their own judgment, which has not been trained to the work in view and is therefore valueless. The lesson to be taught is the value of expert testimony—the importance of consulting the men who know about such matters as much as can be known—for it must be admitted that a good deal is necessarily unknown about a mine and the practical miner often sneers at his skilled professional brother by saying, "One man can see into the ground as far as another." But this remark is not correct, for some men can see a long way into the ground, or at any rate can discern that there is hardly a chance of there being any value out of visual sight. The maxim we would impress upon the investor is, Look at the men, not at the mines. Consider that you are probably incompetent to judge of a mine by personal examination and that you must necessarily be at the mercy of some one. Mining investment is largely a matter of confidence; that is the bother of it. But being so, it behooves one to be wary whom he confides in. If a man high in his profession, of good repute and known to have been successful in his undertakings, offers an investment, let it be carefully considered, and give such an one a decided preference over the unskilled promoter who retails his hearsay stories into your ear. It is easy to find reliable men, of skill and experience in mining, and we advise intending investors to seek them out and profit by their counsels.

Coal Trade Prospects.

There are not wanting evidences that the coal mines of Nova Scotia are likely to participate to the full in what appears like a general expansion of trade. At any rate the outlook is better than for some year past and the contracts already concluded ensure a large increase on 1895. Although, owing to local conditions, the Acadia Coal Co. have been having a quiet time lately, their sales for the current year are in excess of last and as a good portion of their output is consumed by large hardware industries in the Maritime Provinces, and the latter are fully booked for six or eight months ahead, there is no doubt that this enterprise, as well as the Springhill and Drummond mines, will benefit very considerably. We hear on good authority that so bright is the outlook in the iron and steel trades that the Nova Scotia Steel Co. expect for the first time to be able to consume the whole of their make of pig iron for 1896 at the steel works. This will mean a large increase in the consumption of fuel at both works, in which all the local mines participate. The Drummond colliery has had the busiest winter on record, having shipped over 40,000 tons during the first quarter of the year. This mine has been put in good order for the season's work and the capacity increased The company were making preparations to start the back slope, but this may not now be necessary, as a contract for 30,000 tons which they took last year has this time passed to a competitor. Thanks, however, to the excellent quality of coal now being sent away and the greatly improved picking and screening appliances, the Intercolonial Coal Co. is more than holding its own in the general market and is likely to finish up the year with an increased haulage. The coal washing and coking plants continue to work satisfactorily, getting rid of all the surplus slack and turning out 500 tons of large, strong coke per month. Messrs. Matheson, of New Glasgow, are making a new picking belt for this mine capable of handling 700 to 800 tons a day. They are also busy with two splendid Lancashire boilers for Old Sydney mines, and have just completed an extensive range of haulage gear for the Dominion Coal Co.

Travelling Cape Breton-wards, we find that at New Campbellton the Messrs. Burchell are busy with their preparations for a good season's work. They have developed the 4 ft. seam to a capacity of 400 or 500 tons a day, and now that the ice has cleared away and traffic through the St. Peter's canal is resumed, they anticipate steady work all through the year. They have already loaded several schooners and are chartering others for their regular trade.

The General Mining Association have had a large number of men at work all through the winter, putting the Old Sydney mine in order for a record output in addition to banking upwards of 50,000 tons. Improvements have been made in the pumping appliances by the use of compressed air, and a new battery of boilers is to be put in early in the season. The contracts already concluded in the St. Lawrence, Newfoundland and Nova Scotia markets justify the expectation that a substantial increase on last year's total will be shown, and this doyen of Canadian collieries may ship 250,000 tons and thus maintain its position at the head of all its competitors.

From the Dominion Coal Company great things are expected this year, as with the installation of endless haulage in Caledonia mine and the erection of another tower at International Pier, their equipment is now complete; the former is already in operation and the latter will soon be at work. So far as the capacity of the mines is concerned an output of 1,500,000 tons could readily be given, but there are one or two factors in the case which render it difficult to forecast with accuracy how high the season's work may total. The unknown quantities are the requirements of the new People's Light and Heat Co., Halifax, and the possibilities of the American market, The former will not be in operation until the autumn, but from then until the end of the year they may probably take 30,000 to 40,000 tons. The 50,000 tons which this company sent last year to the States will be increased to at least 100,000, possibly more. Half of this will be used by the railway companies and half for domestic and other purposes. Should the gigantic scheme which Mr. H. M. Whitney is now seeking to carry through the Massachussets' legislature become a *fait accompli*, a permanent market for a very large quantity of Cape Breton coal would be assured, but in any case this cannot affect the tonnage for 1896. Sales up the St. Lawrence will be at least 150,000 tons in excess of last year, and as Montreal stocks are by this time almost depleted shipment will commence earlier than for many years past. We understand that the first cargo for Quebec was shipped from Louisburg on the "Loughriggholme" as early as 17th April. Altogether it seems probable that this large and enterprising corporation will, during 1896, ship not far short of 1,200,000 tons, and we trust this is is only the earnest of still larger shipments and the beginning of more profitable seasons.

EN PASSANT.

The law respecting the free admission of mining and smelting machinery not manufactured in Canada has again been renewed. Under this concession machinery of a value of $169,749 was brought into Canada duty free last year, and the imports during the present season will likely be in excess of this figure. The statement prepared by the Nova Scotia and Quebec Mining Associations has superseded that formerly in use and fyled in the Customs department by an enterprising Canadian manufacturing establishment. We are also glad to announce that the present controller, the Hon. John F. Wood, is making the most liberal interpretation of the law.

The Mining Society of Nova Scotia will hold its next meeting at Halifax in the last week of July, during the summer carnival. An invitation to participate in the proceedings has been extended to the sister organisations in Quebec and Ontario, and it is likely there will be a good attendance from all three societies.

We regret to announce the death of our old friend, Mr. William King, for many years managing owner of the King Bros. asbestos mines at Thetford, Que. Mr. King was widely known and respected, and his kindness and hospitality endeared him to every one who had occasion to pay a visit to his mine.

The annual meeting of the Asbestos Club will be held in the Club House, Black Lake, on Thursday, the 30th inst.

It is stated that Mr. John McDougald, M.P. for Pictou County, N.S., is to be appointed Commissioner of Customs. Mr. McDougald's interests in mining and his knowledge of the requirements of the industry would render his appointment peculiarly acceptable to the mining community.

The Hon David McKeen having resigned his position as resident manager of the Dominion Coal Co., Ltd., Mr. Hiram Donkin, C.E., formerly in charge of the company's railway, has, we understand, succeeded to the position.

Mr. F. Cirkel, M.E., who has been in Germany during the past two months, is expected home early in May. Mr. Cirkel has been visiting various continental works manufacturing graphite, in the interests of the Ontario Graphite Co., and we are informed as a result of his investigations a milling plant of the best German practice will be erected in Ottawa. About 450 tons of graphite have been shipped from the companies' mines to Ottawa pending the construction of the new works.

Mr. H. M. Whitney, President, and Hon. David McKeen, Vice-President, of the Dominion Coal Co., were in Ottawa last week and had an interview with Sir Charles Tupper. One of the objects of their visit was to discuss the advisability of applying for a similar charter for the manufacture of fuel gas in Canada to the one now under consideration by the State of Massachussets.

The Nova Scotia Steel Co. is rapidly developing its valuable hematite mine on Bell Island, Nfld., and expect to make large shipments during the coming season. They are obtaining splendid results from the use of the ore at Ferrona and the Nova Scotia steel works, and have received an offer from a prominent New York firm for all their surplus yield in 1896. We also understand that they have been approached by an English firm, who, owing to the present inflation of trade in the Old Country and the enormous expansion of the steel industry, find it difficult to obtain adequate supplies.

Mr. Graham Fraser, the president of the company, has just gone to Newfoundland to install the new manager, Mr. J. Sutherland, of Pictou, and to make an inspection of the works.

It is not unlikely that in the course of another year this enterprising company may try their luck in developing what is believed to be a valuable coal area near Port Hood. Two good seams of coal have already been exposed and favorably reported upon by an expert from the office of Mr. Emerson Bainbridge, M.P., one of the leading English mining engineers. If this mine should be opened the company could obtain their supplies of fuel by barge within five or six hours' tow of their works. This should enable them to compete successfully with any works in the trade.

Much stress is laid upon the claim of cost, extravagance and losses in mining, by a certain class, when the subject is under discussion. Statements are often made concerning the amount of money put into mines in order to bring a little out, and other comparisons which are odious, not because they are comparisons, but because they are not. In the first place it may safely be stated that the money expended in the actual development is paid to a class of hard-working men and contributes not only to their support, but also goes to some extent to the maintenance of other branches of business. Outside of the money expended in the legitimate development of the mines, there are and have been large sums of money spent which cannot be justly charged to the account of mining The items under the head of expense account which a young superintendent, fresh, perhaps, from school, and knowing nothing of mines, may spend in the luxurious furnishing of an office with plate mirrors, velvet carpets and fine furniture, and the purchasing of horses, carriage, wines, etc., cannot under any strict business law be fairly added to the cost of mining. In one sense, also, the expense of inexperience, which purchases machinery before there is a mine to be worked, or erects a costly plant for milling ores where a smelter is required, should not be added to the sum total of the legitimate cost of mining. Mining, when most intelligently and economically conducted, is an expensive industry. Large capital is required to insure success even where experience and ability of the highest order directs every operation. The business of extracting ores, in and of itself, is costly and difficult under the most favorable circumstances, so that it should not be forced to bear an additional burden in this direction for which it is in no sense responsible. Already there is noticeable a marked improvement in this direction. A better understanding more generally prevails. Business men are giving personal attention to their investments and are investigating more thoroughly than ever before the basis of the enterprises into which they are invited to put their capital. Under the dispensation which is rapidly removing the development of a mine from the speculative influence of the stock-board to the domain of practical productive industry, a cloud of evils have taken flight and others are preparing for a hasty exodus. Every successful method of treatment, every new line of railway, every new facility in the way of more available mills or smelters, improved machinery and every economy tends to decrease the cost of mining and, as, a natural consequence, to increase the value of the product and extend the producing capacity of our mines. These things give promise of most wonderful results in the future and establish beyond a doubt the security and permanency of the most promising industry in our Dominion.

Perhaps no other line of industry has suffered so much from inexperience and a total disregard of the fundamental principles of business as the mining industry of this country. At the moment when eastern Canada is threatened with a flood of western mining stocks, it may be not unnecessary to remind our readers that *production* is the chief object to be attained, and the security assured in this direction must be considered the only real basis of value in investigating the merits of any proposition in this great field, which promises such remunerative results under proper management.

The history of the struggling existence and final starvation of many local papers in prosperous mining localities is not a creditable record for an industry so broad and liberal in many other respects. Especially is this true in view of the fact that the mines have been most faithfully upheld and owe the large proportion of their value and success to the very means which has been neglected and unrewarded. The report of mining properties, strikes of ore bodies in mines, shipment from smelters, value of ore and mill runs, has been most faithfully made, to be copied by the metropolitan review in the centres of capital until a tide of enquiry and investment has been attracted to the locality and a general condition of prosperous activity established by which hundreds have been benefitted. In many cases this gratuitous work, which has cost.

time and money, has been done faithfully and impartially for those who have never contributed the amount of an annual subscription to the paper which has been the chief cause of their prosperity. The mining industry of Canada today owes its promising condition, its general activity, the favorable state of public opinion towards mining, the investment of capital and the remarkable development now taking place more to the influence of the press than to any one or all other influences combined, but its return for all this benefit has, as a rule, been most niggardly and certainly unjust.

The coal output of British Columbia during the year 1895 amounted to 939,654 tons as compared with 1,012,953 tons in 1894. The producers were as follows:—

Nanaimo colliery	338,198
Wellington do	336,906
Union do	264,550

The quantity exported was 756,333 tons, principally to San Francisco, San Pedro, and San Diego, in California. Shipments were also made to Oregon and Washington States Alaska, Petropauloski, Hawaiian Islands, and to Acapulco in Mexico.

Successful Gold Mines.

No. 1.

The Golden Lode.

The property is situated in the Uniacke gold district, Hants Co., Nova Scotia.

Operations were started in January, 1894, and a shaft was sunk with a view to cutting a pay chute at that time worked on the adjoining property by Messrs. Thompson & Quirk. A survey of the latter property showed that the pay chute should be cut by the shaft on the Golden Lode property at a depth of about 350 feet. In March of 1894 a company was formed with a capital of $30,000, and the sinking of the shaft was carried on with all possible speed. At a depth of 300 feet a minor pay chute was cut, which gave a mill test of 6 oz. of gold per ton, and at 350 feet the main roll was cut and milling operations at once started.

The main pay chute has an average width of 8 inches, and an average depth of 55 feet, and dips about 32°. The average mill returns for the last year gave 9½ oz. of gold per ton of quartz.

At the end of March, 1895, exactly a year from the formation of the company, the first dividend, one of 5 per cent., was paid to the shareholders, and since that date monthly dividends of five per cent. have been paid regularly, thus up to date making 13 dividends of 5 per cent. each, or at the rate of 60 per cent. per annum. The shaft has now been sunk to a depth of a little over 400 feet, from which a slope on the dip of the pay chute has been driven for 250 feet, and the ore gradually taken out by overhead stoping. At a distance of 150 feet from the shaft a rise has been put up, connecting the upper pay chute, 50 feet above, which is now being worked back in the direction of the shaft. The mill returns for this upper pay chute still give 6 oz. per ton.

Besides paying a dividend of 60 per cent. the company have spent upwards of $5,500 in development and additional plant, including a large compound duplex plunger pump, with a capacity of 160 gallons per minute, which it is estimated will be capable of coping with any water likely to be met, up to a depth of 2,000 feet on the incline. It will thus be noticed that besides paying a dividend of 60 per cent. on the capital of the company, an additional 18 per cent. has been expended in improving the property and adding new machinery.

The milling plant consists of a 5-stamp mill, which is, however, ample, as only from 20 to 30 tons of ore are crushed per month.

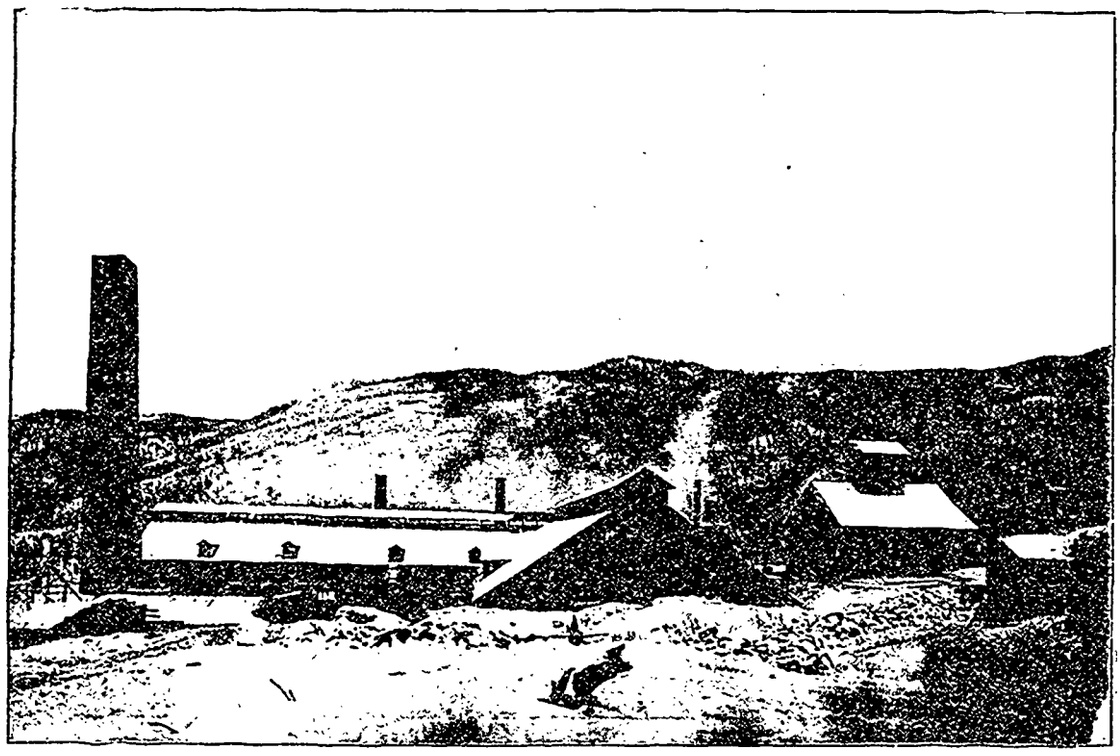
The officials of the company are:— Directors, Mr. H. H. Bell, President; Mr. A. A. Hayward, Managing Director; Mr. A. M. Jack, Sec.-Treas.

GOLD MINING IN NOVA SCOTIA.

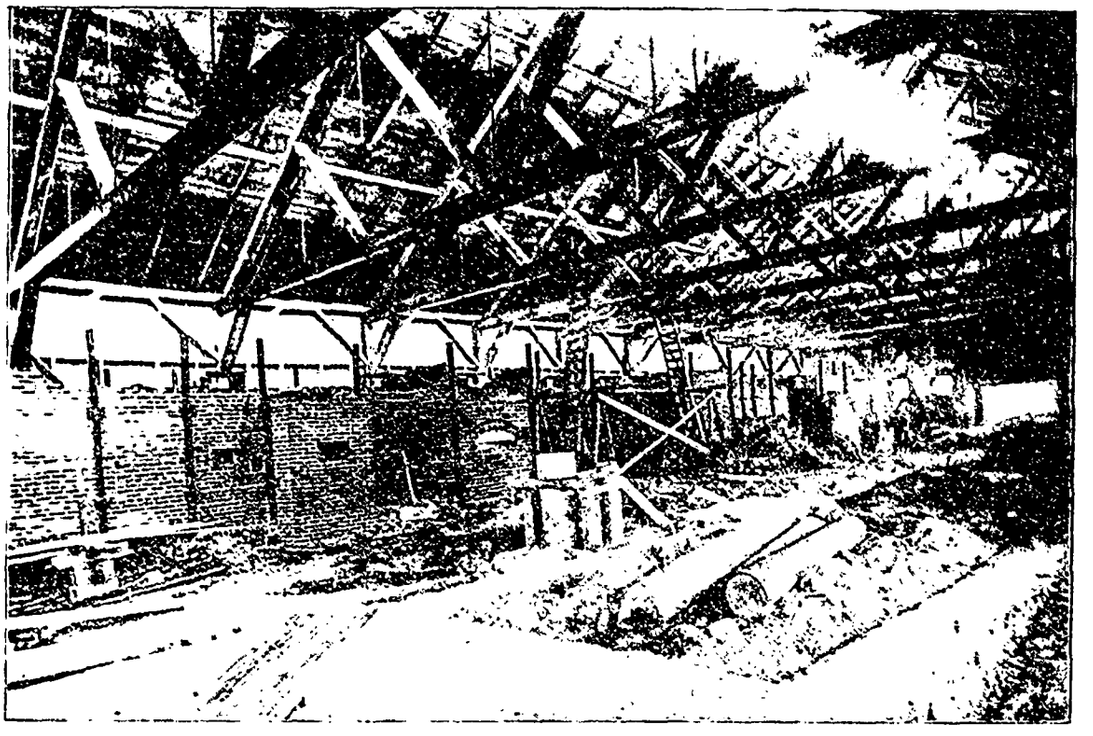
The following Returns from the Mines have been reported for royalty since our last issue.

Name of District.	Name of Mill or Co.	Months in which Crushing was done and Returns made.	Quartz Crushed.	Yield of Gold.			Total Yield.		
			No. of Tons.	Ozs.	Dwts.	Grs.	Ozs.	Dwts.	Grs.
Sherbrooke	New Glasgow Co	March	280	72	0	0			
"	McNaughton Co	March	137	103	14	0			
"	Stellarton Gold Mining Co	March	56	12	10	0			
			473	188	4	0	188	4	0
Moose River and Caribou	Moose River Gold Mining Co	March	130	29	3	0			
" "	Damas Touquoy	January, February, March	1579	140	10	0			
			1709	169	13	0	169	13	0
Gold River	T. N. Baker	January, February, March	56	107	0	7	107	0	7
Stormont	Richardson Gold Mining Co	February	1150	197	15	0			
"	James A. McDonald	February	155	69	0	0			
"	J. C. McDonald	February	169	133	5	0			
"	Griffin Gold Mining Co	March	159	100	0	0			
"	J. D. Copeland	January, February, March	743	361	7	0			
			2375	861	7	0	861	7	0
Waverley	Tudor Gold Mining Co	Oct., Nov., Dec., Jan., Feb., March	1598	248	10	0	248	10	0
Brookfield, Queens Co	W. L. Libbey	March (Quartz 150, Slate 275)	425	330	0	0	330	0	0
Wine Harbor	W. A. Adams	Sept., Oct., Nov., Dec., Jan.	458	271	17	6	271	17	6
Lake Catcha	John H. Anderson	March	6	3	12	0	3	12	0
15-Mile Stream	New Egerton Gold Co	January, February, March	1570	1034	15	0	1034	15	0
South Uniacke	J. J. Withrow	January, March	72	61	6	18	61	6	18
							3276	5	7

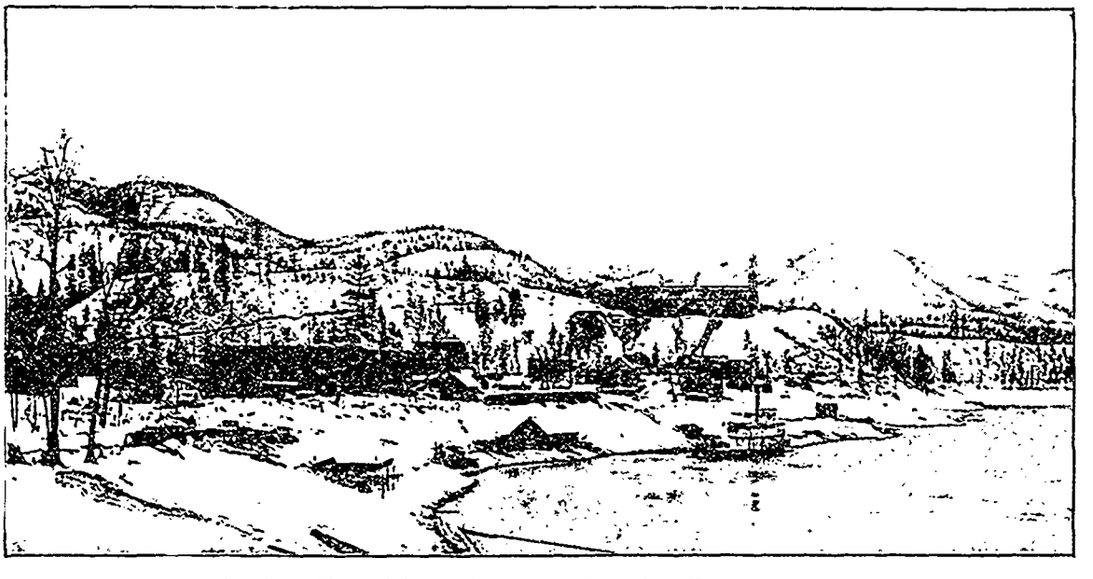
Rossland, B.C., in 1895.



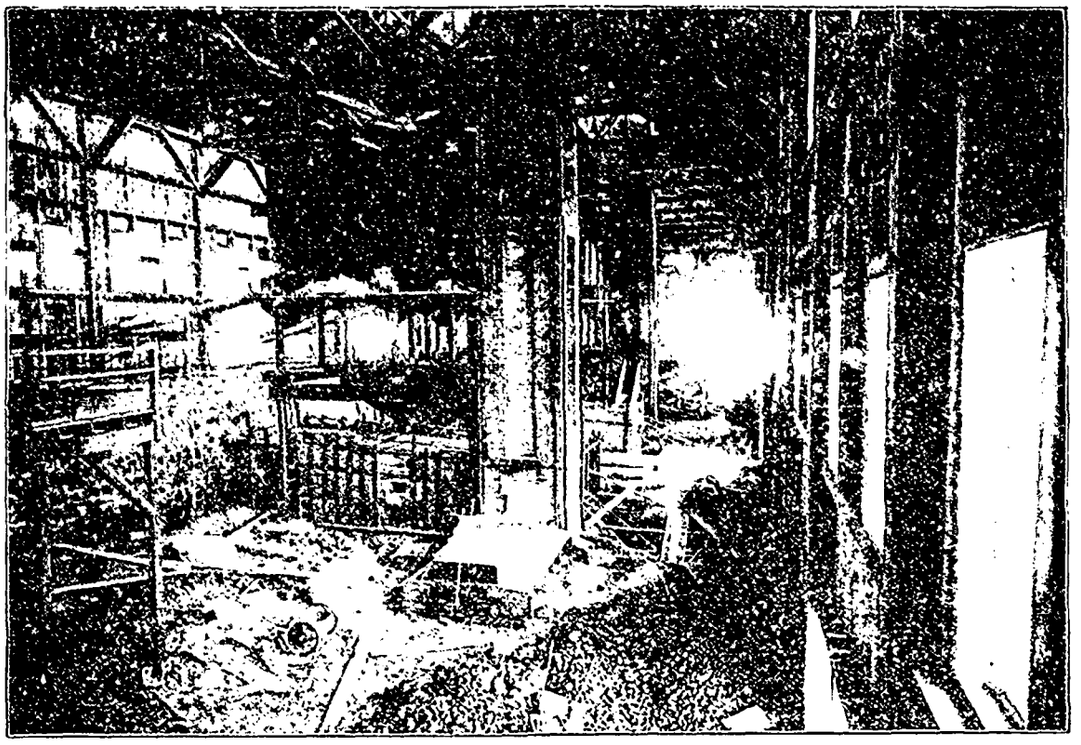
The New Trail Smelter. Daily Capacity 200 Tons.



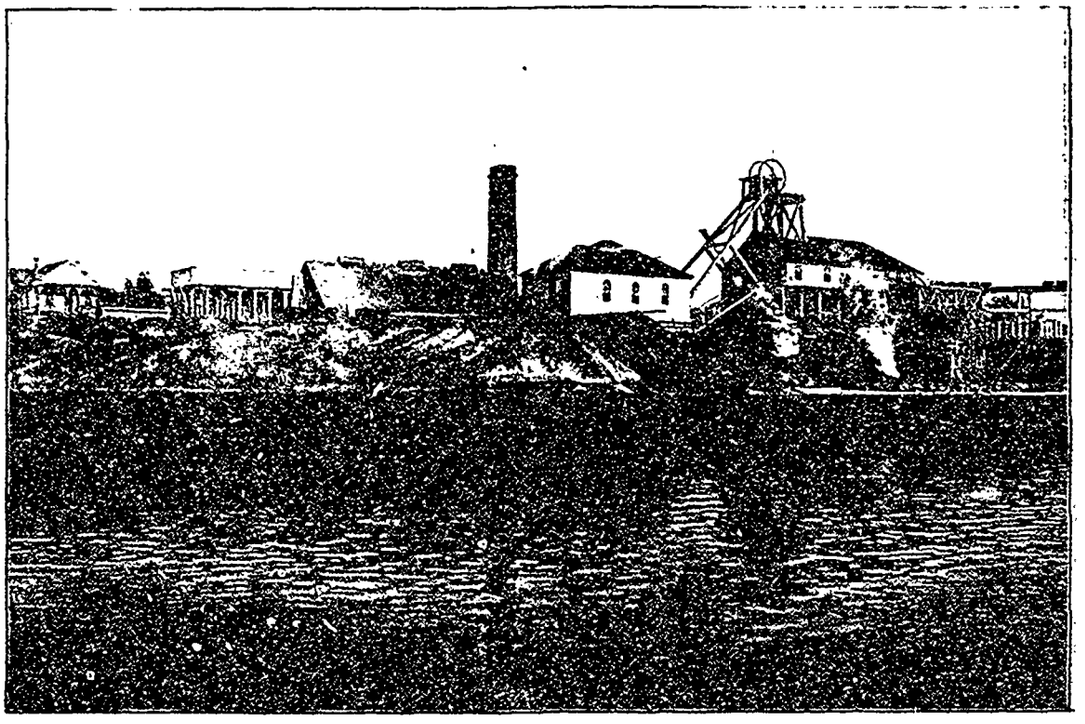
British Columbia Smelting and Refining Co.—O'Hara Furnace Building.



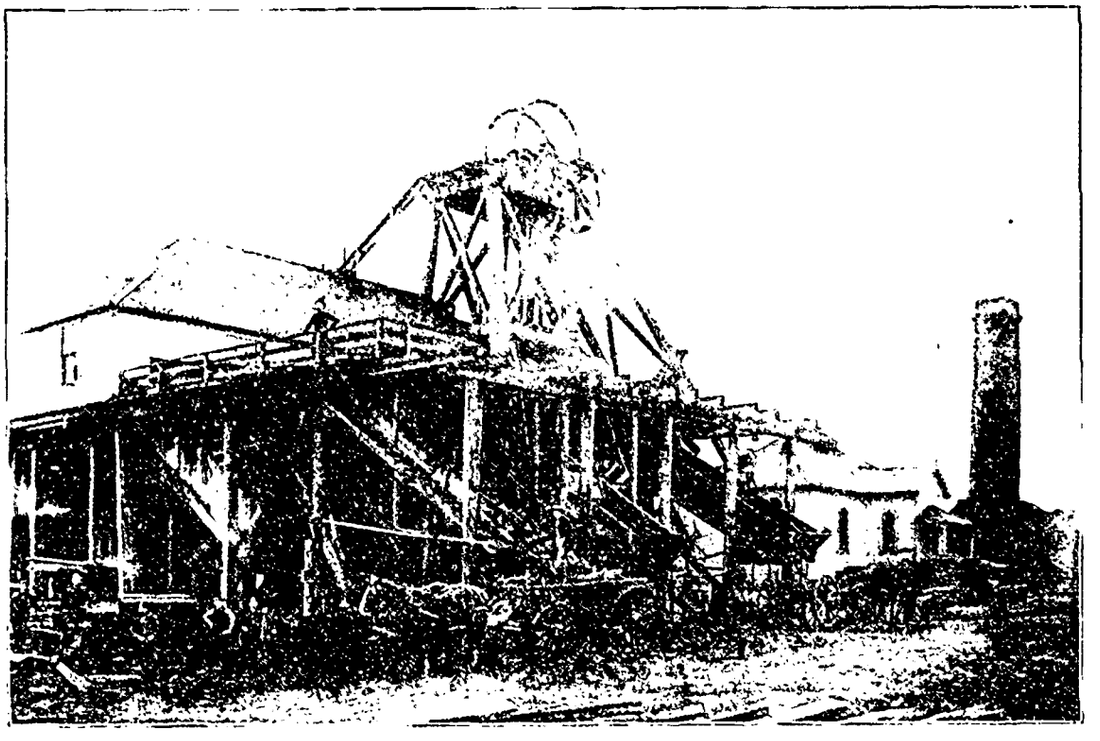
British Columbia Refining and Smelting Co.—New Works at Trail, B.C.



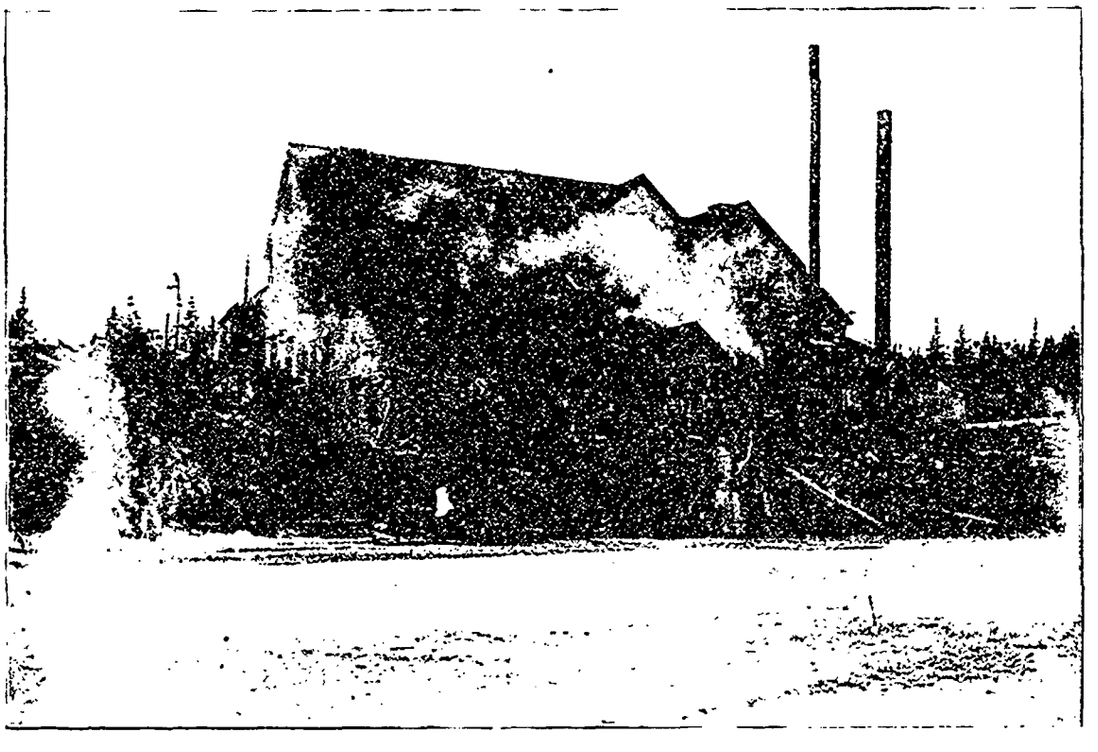
The New Smelter at Trail, B.C.—Combined Automatic Roasting and Matteing Furnaces.



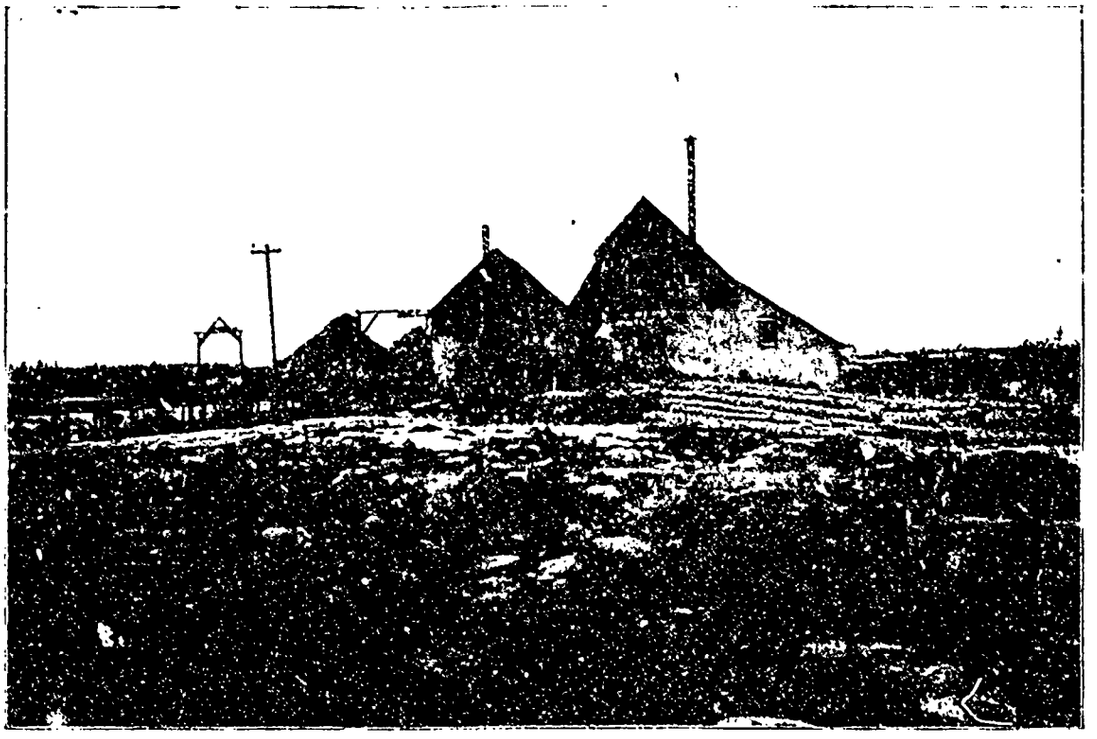
New Vancouver Coal Mining and Land Co.—No. 1 Shaft from Harbor.



No. 1 Shaft, New Vancouver Coal Mining Co., Nanaimo, B.C.

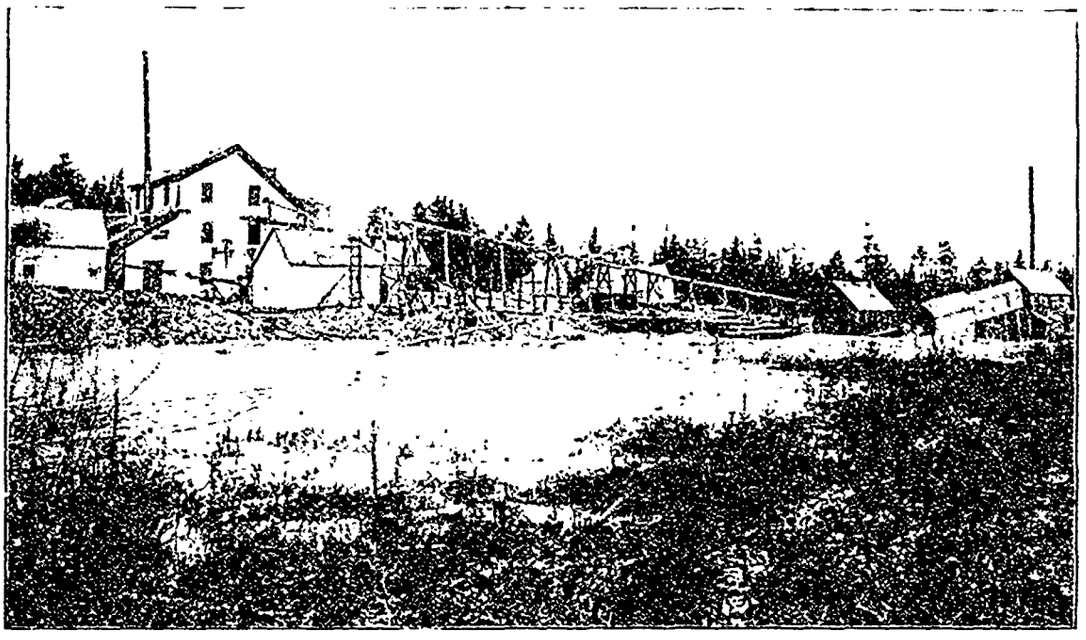


Richardson Gold Mine 40-Stamp Mill at Country Harbor, N.S.



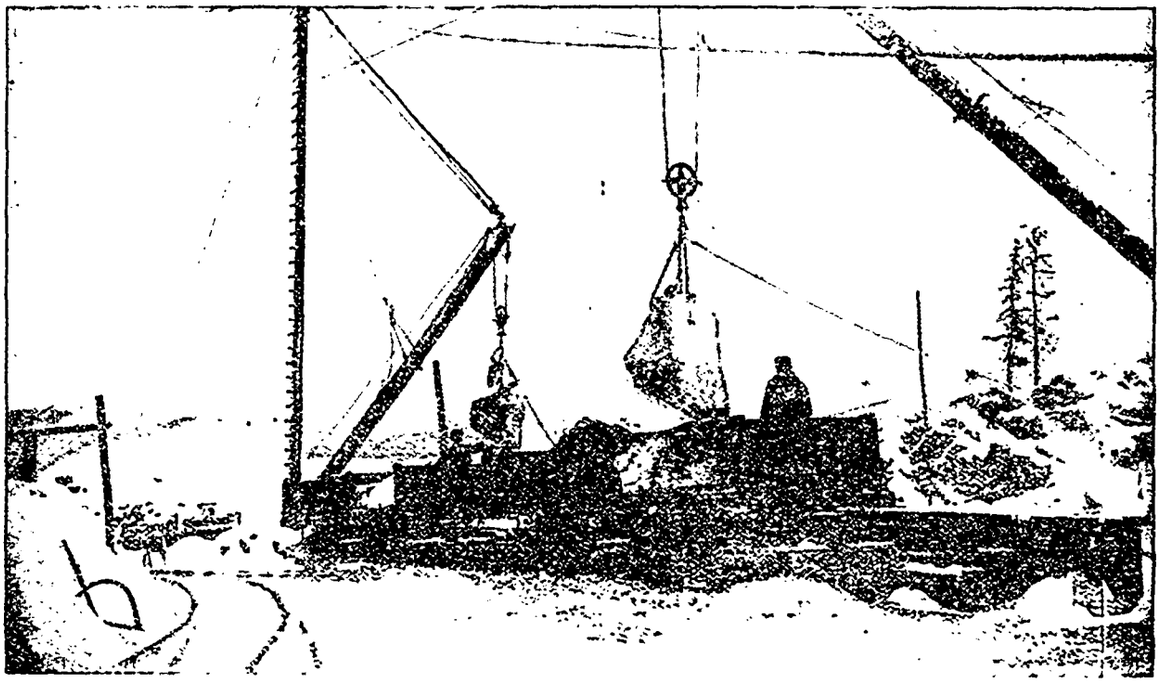
Richardson Gold Mining Co.—Shaft House and Forge.

Richardson Gold Mine, N.S.—Face East Tunnel, width 20 Feet.



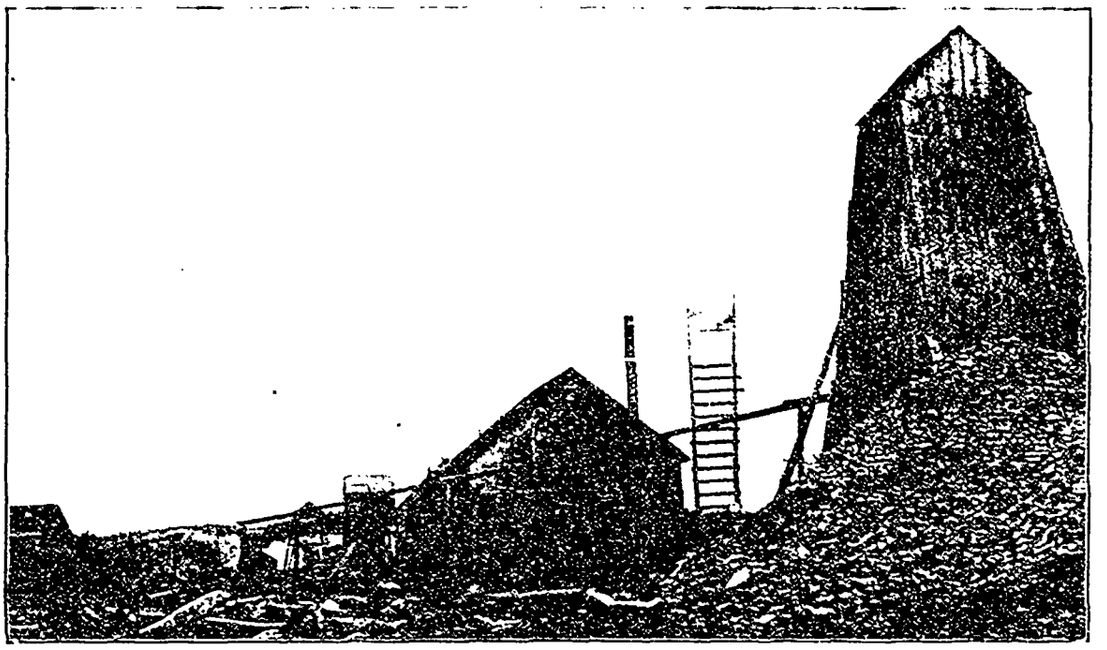
North Brookfield Gold Mine and Mill, Nova Scotia.

Wallingford Mica Mine, Templeton, Que.

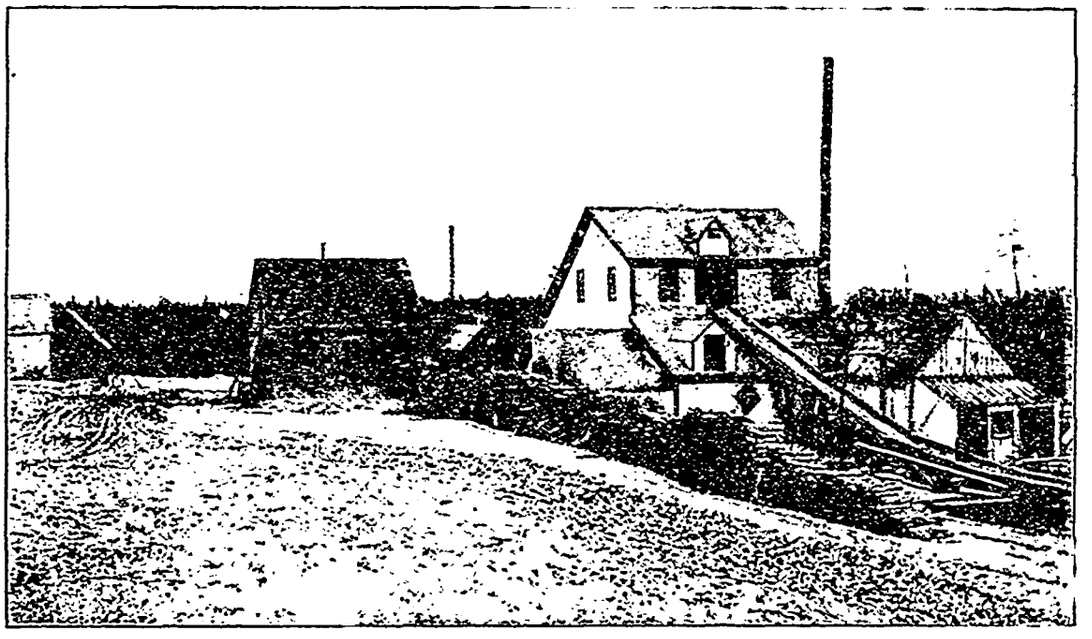


Bell's Asbestos Co. Ltd.—Thetford Mines, Que.

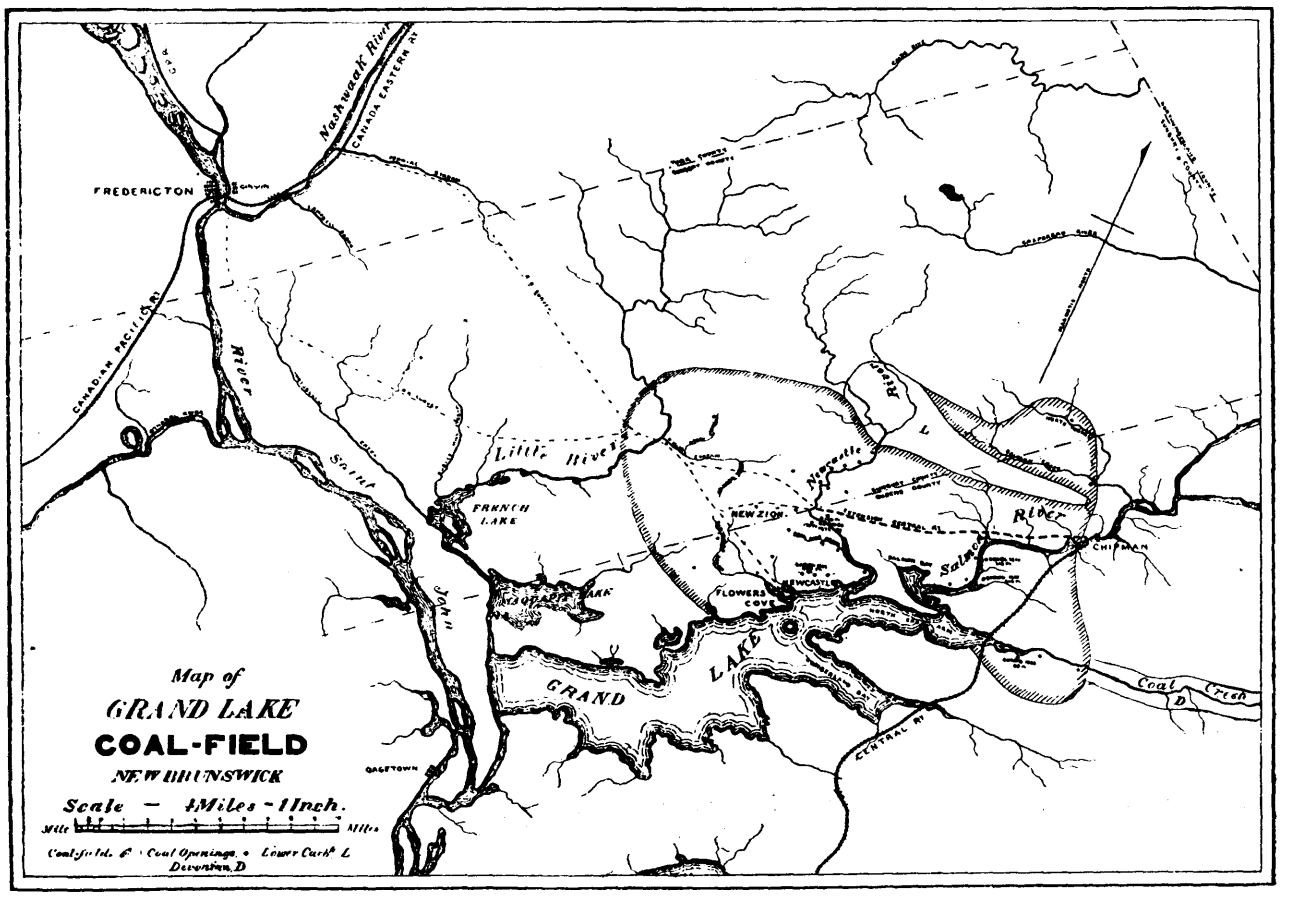
Broad Cove Coal Co. Ltd.—Outcrop of 14 Foot Seam, Cape Breton.



Surface Works. Torbrook Iron Mine, Nova Scotia.



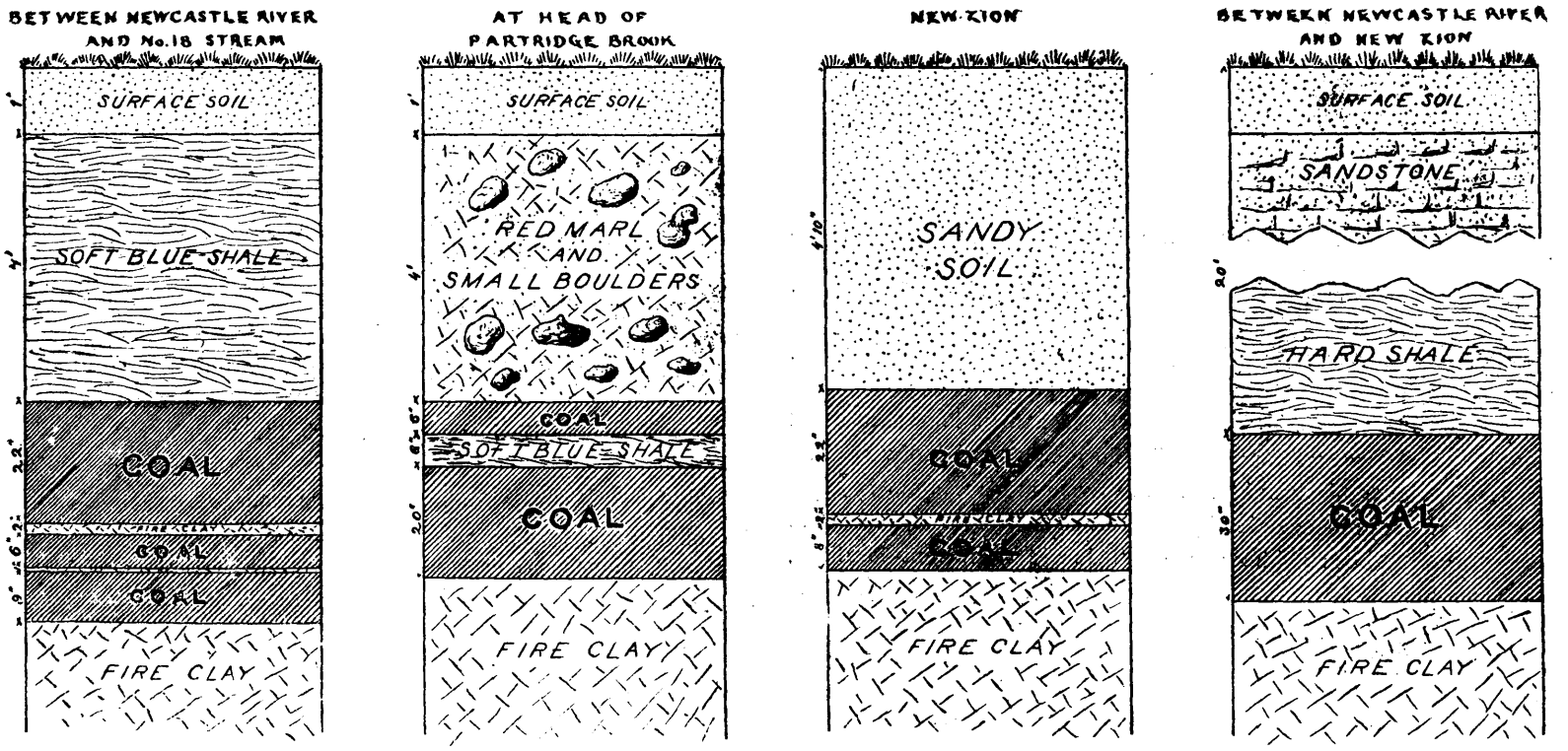
10-Stamp Mill at North Brookfield, Nova Scotia.



SECTIONS OF SURFACE SEAM

Scale — 2 Feet - Inch

Inches 0 1 2 3 Feet 1 2 3 4 5 6 7 8 9 10



Notes on the Grand Lake Coal Field of New Brunswick.

By R. G. E. Leckie, B. Sc., Torbrook, N.S.

The Grand Lake coal-field is situated about seventy miles north of St. John city, and in a direct line between Fredericton and Moncton, twenty miles east of the former town, and fifty miles west of the latter. It is thus the nearest coal field to the Province of Quebec, being four hundred and eighty-four miles from Montreal by rail, (25 miles of which, between Grand Lake and Fredericton, have not yet been constructed) or more than 200 miles nearer than the nearest Nova Scotian coal field. The distance by rail to St. John, *via* Fredericton by C.P.R., is 90 miles, and the distance by water So. To Fredericton, the distance by river is the same as to St. John: the river and lake being navigable for boats drawing under nine feet of water.

The coal field lies to the north of Grand lake, extending inland from the shore about 10 miles.

Grand lake, 25 miles long, and from 4 to 7 miles wide, is a navigable arm of the river St. John, and into which flow several large streams.

The coal-field extends from Coal creek on the east, to Little river on the west, while through it run the Newcastle and Salmon rivers. The southern boundary is the lake shore, while the northern limit has not yet been absolutely determined, owing to the existence of extensive bogs, out of which the rivers mentioned take their rise

The area thus bounded contains about 100 square miles, and comprises the operative, or workable field, the most productive section of which, is that portion west of the Newcastle river, and known as the Newcastle field. Workable coal has recently been discovered west of Little river, which I think may prove of importance, owing to its proximity to Fredericton in comparison to the rest of the field, but its extent has not yet yet been determined. The strata in this district lie almost flat, rising gently from the lake shore inland in a north-westerly direction. The dip seldom exceeds four or five degrees. The undulations are gentle and in no case abrupt, the surface generally conforming to the folds of the strata.

Prof. L. W. Bailey and Mr. G. F. Mathew, in their report for the Geological Survey of Canada, (Report of Progress 1872-73) divide the carboniferous formation of Central New Brunswick somewhat as follows:—

Lower Carboniferous, composed of red conglomerates and sandstones, red shales and purplish doleritic rocks containing zeolites.

Middle Carboniferous, sub-divided as follows:—

Barren Measures: Resembling the millstone grit of Nova Scotia—consisting of grey conglomerates, coarse grey grits and sandstones, and grey sandy shales. Thickness, 200 feet.

Productive Measures: Corresponding to the lower productive measures of Nova Scotia—consisting of finer grey sandstones, fossiliferous shales, fire-clays and coal seams. Thickness, 200 ft.

Upper Carboniferous, consisting of purple sandstones and shales. Thickness, 200 ft.

The only coal seam in the Grand lake coal-field known to be of economic value is the "surface seam." This seam consists of very clean coal, of an average thickness of 2 ft., but varying in places from 1½ to 3 ft It is generally accompanied by a smaller seam, from 6 to 8 inches in thickness, which occurs either above or below it, in different localities, and is separated from the larger seam by a few inches of fire-clay. The "surface seam" has been found to underlie continuously the whole coal field, save where it has been eroded in the localities where the streams cut through the bed.

The term "Newcastle coal" has been applied to the coal mined in the vicinity of the Newcastle river, and in the district between the Newcastle and Little rivers. In this district the seam is thicker, and of much better quality than in the eastern portion of the coal field, where coal mining operations were first pursued.

The Grand lake coal was first discovered by the French about 200 years ago, near the mouth of the Salmon river, where the seam is about 20 in thick, and of rather poor quality. With the belief that thicker beds of coal existed below the surface seam, boring operations were commenced in 1837 by a private company organized for the purpose. The first bore-hole was put down near the mouth of Salmon river, and a depth of 403 feet was reached. At 21 ft. the "surface seam" was encountered, 1 ft. 10 in. thick, and at a depth of 262 ft. a bed of bituminous shale and coal was struck, 8 ft. in thickness. The method of boring, however, was unsatisfactory, and on this account a second boring was made in 1866 on Coal creek, five miles west from the first, but was only carried to a depth of 96 ft., when the drill became jammed in the hole, and operations suspended. The surface seam was the only coal passed through.

Again in 1870, another boring on the Salmon river proved equally barren of satisfactory results. A seam of impure coal, 6 in. thick, was found at a depth of 96 ft. Disagreement between members of the company caused cessation of work, when a depth of 218 ft. had been attained

In 1872 73 boring operations were conducted by the Local and Dominion Governments, near the Newcastle river, at a point 3 miles inland from the lake and 12 miles west of the old bore-holes. Mr. R. W. Ells superintended the work. Two holes were put down, 170 and 190 ft. respectively: but apart from the "surface seam" no coal was struck.

The same year (1873), at a point 3 miles south from the last holes, and half a mile from the lake shore, a bore-hole was sunk to a depth of 400 ft., the last 100 ft. of which appeared to be in a formation underlying the coal measures. No coal was reported from this boring.

Taking the result of these bore-holes, and considering the careful explorations conducted in this district by Prof. Bailey and Mr. Mathew, we may safely state, although possible, it is by no means probable, that there exist other seams of value underlying the "surface seam."

I have stated that the area of the Grand lake coal-field is about 100 square miles: but this does not include that portion of the district where the upper carboniferous overlies the productive measures.

A remarkable fact in connection with this coal seam is that in no place has the coal been found at a greater depth than 45 ft., and it is not probable that at any spot, in the Grand lake coal-field proper, it lies at a greater depth than 60 ft. below the surface. This fact, therefore, enables the coal to be mined at any point by sinking of shafts comparatively inexpensive and requiring no heavy machinery, but rather that of a portable nature, which could be moved from place to place as the coal became worked out

Hundreds of acres have been proved by means of test pits, where the coal is merely covered with a few feet of alluvial, and would be won by the process of stripping. Steam shovels could be advantageously employed in this connection. The areas capable of being thus stripped occur mostly at or near the heads of the various brooks.

An important and valuable feature of this coal-field is that, from the position of the coal seam, it has a natural drainage by means of the streams which traverse it, cutting through the strata at a lower depth than the coal.

The coal obtained from the "surface seam" is bituminous and of the coking variety. The following are some of the analyses of Newcastle coal, made by Wm. Small, B. A. Sc.:—

—	I. Newcastle River.	II. New Zion.	III. No. 18 Brook.
Volatile	37.30	35.25	37.10
Fixed carbon	59.35	55.80	61.10
Ash	3.35	4.20	1.80
Sulphur	2.66	1.68	1.98
Coke	62.72	60.00	62.90
Moisture	....	4.75	....

To show the similarity which exists between Grand lake and Cape Breton coals, I append the following average of the analyses of Cape Breton coals as given by the Geological Survey of Canada, and confirmed by a complete set of analyses made by Dr. Gilpin:—

Volatile	33.44
Fixed carbon	61.87
Ash	4.22
Sulphur	2.37

Grand Lake coal ignites quickly and burns with a bright flame. Screened Newcastle coal is an excellent house and steam coal, whereas the fine is well known as a blacksmith coal of superior quality.

The great difficulty heretofore in the way of obtaining the deserved place in the market for Newcastle coal, arises from the fact that farmers holding land in fee simple are allowed the privilege to mine the "surface seam" on their property, without the payment of royalty to the Government. Each farmer having conditions favorable, therefore, mines coal on his own land. He usually lets the mining out by contract, paying the contractor so much per chaldron. The miner, if not very scrupulous, allows a certain percentage of shale, pyrites and poor coal to make up his chaldron, and the coal not being picked or screened generally goes to the market in a very bad state.

Dr. Gilpin, in writing of this coal, states, "when properly cleaned and handled it should furnish a good quality of coal, comparing well with other maritime coals."

In regard to quantity of coal available in the Newcastle field (that is the district between the Newcastle and Little rivers), we have 40 square miles of coal area. Assuming specific gravity of coal to be 1·26, or weight 78·75 lbs. per cubic foot, and taking 20 inches as average thickness of seam, we find that in an acre we have 2,552 tons; and for 40 square miles we have 65,331,200 tons. Allowing 20% for areas where the seam is eroded by streams, this gives us a balance of over 52 million tons available in this district. The Geological Survey report estimates the coal of the Grand lake coal field at not less than 154,948,000 tons.

Mining operations have been continued on a small scale for over thirty years, with an annual output of about 4,000 chaldrons. Not more than 125,000 tons have been mined in the district.

With the present limited output the coal costs the miner about 80 cents per ton, including timber, stores, etc.

The cost of teaming the coal to the lake shore (three to six miles) is from 45 to 70 cents per ton. Cost of shipment to St. John or Fredericton by wood-boats, 70 cents per ton. Total cost in St. John or Fredericton, $2.20 per ton.

Screened Newcastle coal, with proper facilities for mining, handling and transport, ought to be landed in the above named places for little more than half the present cost.

Nova Scotia Coals as Steam Producers.

By F. H. Mason, F.C.S., and W. G. Matheson.

The object of this paper is to place on record some results obtained from an analysis of samples of coal from the various mines in Nova Scotia This was undertaken principally because of the fact that it is impossible in any books of reference known to the writers to get at any information as to the thermal value of the fuel we are compelled to use, and hence the difficulty of instituting a comparison between the duty of any steam plant using our own coal and those using coal mined elsewhere. It is not unusual to find full information concerning coals of other countries, and hence well known, while our own coal is all disposed of in one item, and that comparing by no means favorably. Of course this is entirely as regards coal as a fuel as being capable of evolving so much heat, of being able to evaporate so much water, of containing so many T. U. With its properties as a gas producer, or its value for coking we have nothing to do. Most of it is used for generating steam, and its value for this is what concerns us most. How many lbs. of water will one lb. of it evaporate? That is the question we wish to settle, for on this depends the comparison of one steam plant with another. We find that at such a place, for instance, one steam user is evaporating 6 or 7, or 8 lbs. of water per lb. of coal, while others are doing 9 or 10, or 11. Why the difference? Is it due to difference in design of generators, or difference in quality of fuel? Or if one manufacturer decides on testing his plant what about the result? for he knows nothing of what the fuel he is using is capable of doing, and hence the result is more or less valueless. If it is high he is probably satisfied, but if it is low or only fairly good, where does the fault lie? Is he using a generator that is wasteful or could he get better fuel for his money?

The only method of his satisfying himself on this point is by knowing the calorific value of the fuel, and to get at this value of the different coals in the province was the reason for instituting the tests herewith recorded.

Nova Scotia Coal.

The method used for taking the calorific power of the various coals was a calorimetric one, and the instrument used was a modification of the Thompson calorimeter. In order to make the results the more comparable, the initial temperature of the water in each case was the same. The combustion of the coal was brought about by a mixture of 2 parts of chlorate of potash and 1 part of nitre. The formula by which the results were calculated was the usual one, namely:

$$x = \frac{(t'-t'')(w+cs)}{n}$$

n = weight of coal.
w = weight of water.
c = weight of copper in calorimeter.
s = specific heat of copper.
t'' = initial temperature of water.
t' = final temperature of water.

There also has to be a correction for the heat taken up by the glass. We consider that for a laboratory test which will give the truest calorific power of a coal the calorimetric test is in advance of any other method.

Attempts have recently been made to revive Berthier's method for estimating the calorific power of coal. This method consisted of placing a weighed quantity of finely divided coal thoroughly mixed with more than sufficient mon-oxide of lead to completely oxidize it, and calculating the calorific power from the resulting button of lead. A little thought will show that this method is not reliable, although at times it may closely approximate the true calorific power. It is an open question whether some of the more volatile matter of the coal will not become volatilized at a temperature below that required to reduce oxide of lead, but setting aside this by no means unimportant factor, there are other reasons which will render Berthier's method valueless.

There are three constituents of coal whose action on oxide of lead it is mainly necessary for us to study, namely, carbon, hydrogen and sulphur.

The final chemical action of these three substances on litharge may be expressed by the following equations:—

$$2\,PbO + C = 2\,Pb + CO_2$$
$$PbO + 2H = Pb + H_2O$$
$$2\,PbO + S = 2\,Pb + SO_2$$

Taking the atomic weight of lead as 207, oxygen as 16, hydrogen as 1, carbon as 12, and sulphur as 32, we get following equivalents of lead for each of the elementary component parts of coal under consideration:—

1 part of carbon	=	34.5	parts of lead.
1 " hydrogen	=	103.5	" "
1 " sulphur	=	12.9	" "

We next have to consider the calorific power of each of these elements, for which purpose we propose to take the figures obtained by Sibbermann:

Carbon	=	8080 calories.
Hydrogen	=	34462 "
Sulphur	=	2216 "

It will thus be seen that while the calorific power of hydrogen is more than four times that of carbon, part for part hydrogen will reduce three times as much lead as carbon. As a set-off against this enormous source of error the whole of the oxygen contained in the coal in a free state will have to be satisfied with sufficient hydrogen to form water, before any lead becomes reduced.

Comparing sulphur to carbon it will be seen that the discrepancy is not so great, but a high percentage of sulphur will give by this method a calorific power higher than the truth.

The other method of taking the calorific power consists of first making an analysis of the coal, and then giving each component part its calorific power and adding the whole together: the whole of the oxygen is satisfied with sufficient hydrogen to form water, and the calorific power of the surplus hydrogen only estimated.

The calorific power of a fuel taken by this method is open to the following sources of error: (1) In the combustion of the coal, iron pyrites is converted into ferric oxide and the sulphur into sulphurous anhydride; in the presence of lime or other base this latter would remain behind with the ashes, and its calorific power would escape calculation. (2) The hydrogen in the water of combination which always exists in fire-clay (a very usual constituent of coal ash) would be calculated as hydrogen (3) In the event of a coal containing a carbonate—and many coals contain carbonate of lime, while some of our Nova Scotia coals contain carbonate of iron—the carbonic acid would be evolved in the combustion and be calculated as carbon. In general practice it is found that the calculated calorific power is greater than that obtained by the calorimetric method, while that obtained by the Berthier method is less.

The following (taken from the report on coals suited to the steam navy by De la Bache and Playfair) are the evaporative powers obtained by calculations and the actual practical results obtained in boilers of a few British coals:—

Locality.	Calculated Evaporative power of 1 lb. coal.	Practical Result of 1 lb. Coal.
Ebbn Vale.....	15.635 lbs. water.	10.21 lbs. water.
Mynydd Newydd....	14 904 " "	9 52 " "
Porthmawr.....	12.811 " "	7.53 " "
Elgin Wallsend.....	13.422 " "	8.46 " "

Of course in actual practice a certain amount of the coal escapes complete combustion, which accounts to a great extent for the wide difference between theory and practice, and then a by no means inconsiderable amount of heat is lost up the chimney stack and by radiation.

Turning to the sulphur contained in coal, its mode of combination is a matter of no small importance. It may appropriately be described as volatile sulphur, fixed sulphur and sulphur in ash

The first form is principally a matter of consideration for the gas manufacturer, as in the destructive distillation of coal, it will be evolved as either hydrogen sulphide or one of the sulphides of carbon. The fixed sulphur, or the sulphur contained in the coke, usually exists as a sulphide of iron, and is a matter of consideration to the iron manufacturer. The sulphur contained in the ash probably originally existed in the coal as a sulphate of sulphide of one of the alkalis or alkaline earths, or it may in the process of burning be taken from the sulphide of iron by an alkali or alkaline earth present in the coal. This last form of sulphur is not detrimental to the coal, whatever may be the use to which it is put. For steam and household purposes both the volatile and fixed sulphur are equally noxious.

Ashes of Coal The consumer too often contents himself with a knowledge of the proportion of ash in a coal, while he utterly disregards its composition.

Much iron pyrites is very injurious to steam coal, for in the reducing atmosphere of the grate in which the coal is burned, the iron pyrites does not become oxidized, but remains in the ash, and falling to the bottom of the grate in a semi-liquid form, it comes in contact with the fire bars. Here it cuts off a considerable amount of the draught and stops its cooling effect on the fire bars, and they becoming heated are rapidly eaten away by the corrosive action of the sulphide. Similarly, when the composition of the ash is such that it sinters together, a clinker is formed on the fire bars, cutting off to a large extent the cooling effect of the draught, and consequently fire bars become heated and readily oxidized. It is exceedingly unusual to get an ash which is sufficiently fusible to run between the bars of the grate, unless it be mainly a sulphide of iron, which as we have already stated, is injurious to the fire bars. It is therefore advisable to try and select a coal with a difficultly fusible ash. Such an ash should be high in silica and may contain from 15 to 25 per cent. of alumina. It should be low in oxide of iron and very low in lime, magnesia and the fixed alkalics.

Many other forms of ash are of course equally infusible, for instance an ash mainly composed of an alkaline earth.

Provided the ash does not clinker, a comparatively high ash is rather beneficial in a steam coal than otherwise, for it holds the fire together and prevents it from too rapidly collapsing.

The physical as well as the chemical properties of a coal are a matter of considerable importance. Two coals may be obtained of approximately the same quantities of volatile matter, fixed carbon and ash, yet the one will coke and the other will not. The length and character of the flame is a matter of no small importance, as is also the character of the coke.

Samples—The samples received from the various mines were for the most part in fairly small pieces and showed no signs of unfair picking.

In taking the samples for analyses the whole box was turned out, the larger pieces broken, the whole carefully mixed together. From this a sample of about 10 lbs. was taken and crushed through a 4 mesh sieve. This was again carefully mixed and a sample of one pound taken and ground through a 60 mesh sieve, and from this the analyses were made.

METHODS OF ANALYSES.

Moisture—The powdered coal was heated in an oil oven at a temperature of 110° until the weight was constant and the loss taken as moisture.

Volatile Matter—The coal was heated in a closed crucible in a muffle in a reducing atmosphere, at a temperature below the melting point of gold and above the melting point of silver. The loss in weight, less the moisture, was taken as the volatile matter.

Fixed Carbon—The coke obtained from the previous experiment was heated in a muffle in an oxidizing atmosphere until oxidation was complete. The loss in weight gave the fixed carbon, while the residue gave the ash.

Sulphur—This was estimated by two and sometimes three different methods, all of which gave equally good results. For quickness the method in which the coal is mixed with about four times its weight of pure sodic carbonate, heated at first gently, and finally strongly, for fully an hour, the mass is turned into a crucible and digested with bromine water, then filtered, and the filtrate acidulated with hydrochloric acid, and the sulphur precipitated with baric chloride.

The second method was similar, only a mixture of two parts of pure magnesia and one part of sodic carbonate was used, instead of the sodic carbonate alone.

The third method, and one which gives very accurate results, consisted of heating the coal in a current of oxygen and passing the products of combustion through bromine water and hydrochloric acid and precipitating the sulphur as barium sulphate.

—	Caledonia.	Dominion No. 1.	Hub.	Old Bridgeport.	Sterling.	Reserve.
Moisture lost at 110° C.	0.93	0.92	0.90	1.25	1.60	1.12
Volatile matter	28.02	25.13	29.10	31.81	37.96	32.00
Fixed carbon	68.05	71.22	65.50	63.86	54.84	63.93
Ash	2.19	2.73	4.50	3.09	5.60	2.95
Total sulphur	1.72	1.10	3.29	1.33	4.03	1.33
Sulphur in ash	0.05	0.10	0.12	0.12	....	....
Calorific power	7623	7403	7458	7238	7403	7513
Color of ash	Buff	Whitish buff.	Purple brown.	Light buff.	Purple brown.	Whitish buff.
Character of flame	Medium; very smoky.	Long; very smoky	Long; smoky.	Long; slightly smoky.	Long; smoky.	Very long; very smoky.
Character of coke	Light.	Puffed up; light, tender.	Hard, metallic.	Puffed; light	Puffed; light	Light; metallic

—	Victoria.	Old Sidney.	Joggins.	Springhill.	Drummond.	New Campbellton.
Moisture lost at 110° C.	2.00	1 05	1.64	3.17	1.10	4.58
Volatile matter	34.65	34.65	30.08	28.28	24.55	32.07
Fixed carbon	58.42	57.67	60.42	65.30	66.65	56.86
Ash	4.93	6.63	7.86	3.30	7.70	7.46
Total sulphur	3.48	4.10	4.96	1.29	1.45	5.90
Sulphur in ash	....	0.14	....	0.08	Nil.	....
Calorific power	7513	7623	6798	7898	6963	7073
Color of ash	Purple brown.	Purple brown.	Purple brown.	Buff	Buff	Purple brown.
Character of flame	Long; very smoky	Long; very smoky	Medium; smoky.	Medium; clear.	Long; smoky.	Medium; smoky.
Character of coke	Puffed up; light.	Very puffed up; light; tender.	Hard, compact.	Hard, metallic.	Hard, metallic.	Light, fingery.

Notes on Gold Milling.

By E. B. Preston, M.E., California State Mining Bureau.

When assured of a constant and sufficient supply of ore, it is of the greatest importance that the site for the mill should be chosen with due regard for economic treatment. This necessitates the observance of the following points.— The means of transportation of the ore from the mine to the mill, which should be done automatically, or at least with as little handling as possible, conveying the ore at once to the highest point in the mill, so that it will descend by gravity from one to the other in all the different consecutive operations. Another important feature is to provide sufficient space for capacious ore-bins, which are necessary to prevent a stoppage of the mill through a lack of ore, caused through unavoidable delays in the mine or along the roads. The accessibility of the mill site as regards fuel, water, or electrical transmission, according to the motive power to be used, and their continuity and cost at all seasons of the year, must likewise be considered. The possibility of placing the levels for the different floors on solid rock foundations should be investigated, as stability of the machinery is most essential for successful milling.

The ideal site would be to have the mill in close proximity to, but below the level of, the collar of the shaft or the mouth of the tunnel, on sloping ground, where the ore can be delivered directly from the mine to a "grizzly" on the upper floor of the mill, to be passed later, without rehandling, through the crushers, ore-bins, self-feeders, mortars, etc., while leaving sufficient space for a waste dump. For a mill arranged in this manner, including concentrators and canvas platforms, 40 ft. of fall should be available. If chlorination works are also to be used, a greater fall is desirable.

MILL CONSTRUCTION.

After deciding on a suitable site, the surface should be removed down to the bedrock and leveled off for the different floors. Solidity and accessibility are the chief points to be observed in placing the different parts of the mill. Where required, heavy stone walls should be erected as buttresses. The foundation for the mortars and the proper erection of the battery frames are points requiring particular attention. For the mortar-block, a trench is prepared of suitable depth, preferably in solid bedrock, proportioned to the height of the block, and wide enough to leave about 2 ft. of free space around it, which is later filled in with concrete or tailings from the battery. These mortar-blocks vary from 8 to 15 ft. in length and are dressed at the upper end to the size of the bed plate of the mortar. In California they can be obtained frequently from a solid cut of a pine tree, or else consist of two or three sawed blocks fitted or bolted together; but where clear timber of the required size is difficult to obtain, the block can be constructed of 2 in. plank, as is done in the Black Hill in Dakota.* There the bottom of the trench for the block is leveled and some sand tamped down, on which two layers of 2 in. plank are placed crosswise and spiked to each other, and made perfectly horizontal. On this foundation a mortar-block is constructed of 2 in. planks, from 11 to 14 ft. long, according to the depth of the trench. The planks, which should be of clear lumber, and varying breadths (in order to break joints), stand on end, with their width parallel to the long side of the mortar. They are spiked together and fastened above and below with binders bolted to each other by transverse rods; the upper binders (8x12 in.) being even with the top of the mortar blocks; the lower binders (12x12 in.) are 3 ft. lower.

The top of the mortar-block should be planed perfectly true and leveled, and where several blocks are placed in line all the blocks should be sawed off to one height. Before setting the mortar upon the block a sheet of rubber cloth, ¼ in. thick, should be placed between, or when this is not obtainable, two or three folds of mill blankets, well tarred, will answer the purpose.

The mudsills should be of square timber, free from sap, bedded in concrete on the bedrock and secured by anchor bolts to the foundation; they also should be bolted to the linesills.

The uprights of the battery frames are supported in various styles; with diagonal braces and hog chains at front or back, or with so-called knee-frames. In the former style the brace is placed on the same side as the counter-shaft, which rests low down on the battery-sills. This style is well suited for small mills using stamps not to exceed 750 lbs., but for large mills using heavy stamps the knee-frames are the more suitable, with the counter-shaft on a level with the cam-shaft. What is known as the reversed knee-frame forms a strong, compact construction, but requires the counter-shaft to rest on the battery-sills behind the frame.

The battery posts are made 24 in. deep, and from 12 to 20 in. wide; the center one of a ten-stamp mill being made the heaviest, as having to bear the greatest strain. They are let into sills and secured to the line timbers by bolts. Besides the braces, the posts are given stability above the mortar by the guide timbers which extend from end to end in one piece, and are let into the posts, to which they are bolted. The lower one is placed about 6 in. above the upper edge of the mortar, and the center of the upper one is 3 ft. from the top of the post. The seat for the cam-shaft bearings is cut in the upper part of the posts.

After lowering the mortar on the block, with the planed bottom resting evenly on the sheet of rubber cloth or folds of tarred blanket, it is fastened perfectly rigid by eight bolts, four on each long side, passing through the flange, which is cast on the bottom of the mortar. This flange is 4 in. wide and about 2½ in. thick. The feed floor should be high enough so that these bolts can be conveniently reached, to permit their tightening when required. The journals for the cam-shaft, which are placed in the recesses cut out of the battery posts for their reception, are lined up and "babbitted" prior to receiving the cam-shaft with its cams. The stems are placed from ½ to 1 in. from the cam-shaft, and just far enough from the cams to clear them when dropping. The cam-shaft is made of wrought iron or soft steel, from 4½ to 5 in. in diameter, turned true, and should have key-seats for securing the cams. There should be two key-seats, and

*Gold Milling in the Black Hills, by H. O. Hoffman. Transactions of the American Institute of Mining Engineers, Vol. 17, 1888-89.

placed one-third of the shaft circumference apart. At one end of the cam-shaft the cast-iron "hub" of the belt pulley (with flanges) is keyed on. This pulley is built of wood, and turned true on the shaft. Where there is more than one battery to the mill, it is best to have a cam-shaft for each ten stamps, as this permits of repairs, such as changing cams, etc., without stopping more than ten stamps.

The guides, which direct the drop of the stems, are in two sets, upper and lower —the former above the tappets, and the latter below the cams—and are bolted to the guide-girts by eight bolts. They are best made of hard wood, but pine answers sufficiently well—though the former lasts five times as long as pine. The old style guide consists of two pieces of 4 in. plank 14 in. wide, planed on all sides, and of sufficient length to fit easily between the battery posts, with equi-distant semi-circular grooves, fitting together, for the passage of the stems. A quick and exact way to make these grooves is to clamp the two planed planks tightly together as they are to be placed on the frame, set them on edge, and, after marking off the centers for the five stems, bore out the circle (using the joint line for the point of center) with a long-handled auger having an adjustable bit. These are kept in many mills for this special purpose.

Before bolting the guides in place, half-inch pieces are placed between the two halves, and adjoining each stem, which are planed down later as the guides wear, leaving but little play for the stem. After boring out the grooves for the stems, and before putting the guides in place, they should be lubricated. A convenient and economical plan is to cut some semi-circular pieces of thin sheet iron of a somewhat larger diameter than the grooves, and drive them into the wood at both ends of the channel; then lay the halves level, groove side up, and fill the latter with linseed oil, letting them remain until the wood has taken up all it will absorb, when the remainder is returned to the can, and the sheet-iron pieces removed.

If, in a pine guide, those portions occupied by the grooves are cut out square, and hard-wood bushings fitted in before boring out, the stem will work parallel to the wood fiber, which reduces the friction, and lengthens the life of the guides; while only the hard-wood bushings would need replacing, making the cost of the guides less.

The great drawback to these guides is that when a stem has to be removed, the entire battery has to stop; hence the adoption of separate guides for each stem, being either all iron or wooden bushing in iron frames, which are held in place by wedges and the lips of the iron frames.

For the support of the stamp-stems when suspended, wooden latch-fingers, or jacks, are supplied. A jack-shaft, 3 in. in diameter, rests in bearings attached to the inner sides of the battery posts; on this, cup-shaped sockets ride, in which the wooden fingers are attached, shod at the upper end with an iron plate ⅛ in. thick, and provided with an iron or leather "hand-hold" near the top.

For the greater convenience of quickly removing and replacing stems, or cam-shafts, large mills are supplied with overhead travelers, or "crabs," in line with the batteries, in connection with a chain block and tackle running on plates secured to the roof, shod with iron tracking. To easily reach the cams, tappets, etc., a platform is placed just below the cam-shaft.

The feed-floor consists of a double-board floor of 1 in. lumber, with broken joints supported on joists 18 in. apart, and about 2 ft. below the feed opening in the mortar.

MILL DETAILS.

The Grizzly is a coarse screen consisting of a number of parallel bars attached to a frame, set on an angle from 45° to 55°, over the ore-bin. These bars may be of round, rectangular, or V-shaped (apex down) iron, or of wood, faced with iron, and resting on several iron cross-rods, held apart with iron washers; the distance between the bars should be equal to the opening the rock-crusher jaws are set to—from 2 to 3 in. There are no fixed dimensions of length or breadth, as these depend in a measure on local conditions; but they are usually from 3 to 6 ft. wide, and long enough (12 to 15 ft.) to give the fine material time to drop through the spaces before reaching the crusher floor.

Where substantial steel T rails are used for tracking in the mine, they can be made to serve for grizzly-bars when no longer of use in the mine, by turning them with the base up.

The grizzly should be placed at the highest point of the mill over the ore-bin, where the car or wagon can enter the dump. Its chief object is to separate at once the finely divided ore from the coarser; a secondary purpose is served in affording an opportunity to recover drills, gads, or hammers that may have come from the mine, in the ore, before they reach the rock-breaker or mortar. Its lower end rests on a platform in front of the rock-crusher, or better, in a chute with an adjustable end-gate placed above the mouth of the rock-crusher so as to permit of its being fed automatically.

Where the ore as delivered from the mine carries less than 5 per cent. of fine stuff, the grizzly should be dispensed with, especially where, in constructing the mill, fall must be economized. Some object to the use of the grizzly, as tending to feed all the hard rock by itself, and say the output of those batteries is below the others.

Rock-breakers or Crushers are placed on a platform below the grizzly and above the ore-bin in such a manner that the crushed rock mingles with the fine stuff passing between the bars of the grizzly. The rock-breaker must be of sufficient weight to remain firm in its place, and strong enough to resist heavy strains; the dies should be easy to exchange and adjust, and all parts requiring to be oiled should be arranged to prevent oil coming in contact with the quartz. In large mills it is best to have one crusher to supply every twenty stamps, and on account of their intermittent work, they should have driving power separate from that of the stamps.

Rock-breakers are adjusted to crush the rock smaller than the throat of the mortar (therefore, less than 3 in.), but as the work of the rock-breaker is cheaper than that of the stamp, it would pay, with very hard rock, to do more of the crushing with this machine, even to the extent of placing two crushers, one beneath the other, and bringing the quartz greatly reduced to the stamps.

There are two general types of rock-crushers. The older pattern carries a flat, fixed jaw, working with one having a reciprocating motion and using flat or corrugated dies that are reversible. The Blake is representative of this pattern. The other pattern has an outer, circular, fixed jaw, within which a corrugated jaw circles, of which the Gates is representative. This latter machine permits of larger blocks being fed. It is an excellent machine for heavy work, and where the rock is not wet or clayey; but it requires greater horse-power, for where a Blake, 10 x 8 in., crushing 3 tons per hour, requires 9 h. p., the Gates, with a diameter of 37½ in., crushing 3½ tons per hour, requires 16 h. p. The Gates consists of a nearly vertical shaft of forged steel, rotated from below by a beveled wheel set ½ in. out of center, on the top of which a chilled-iron conical head is attached, with the base downward rotating within chilled-iron concaves, with an outward slope, set in the cylindrical body of the machine. Between these two faces the ore is crushed, their distance apart below being gauged by set-screws. The shaft, by being made to revolve around an eccentric at the bottom, has a constant crushing power without doing any grinding. A set of concaves lasts two years, and can be replaced; the center shaft with the chilled-iron head has been known to crush 120,000 tons of an average hard quartz before wearing out.

Ore-bins should always be as spacious as the surroundings will permit, but never of less capacity than will carry a twenty-four hours supply for the mill, say about 65 cubic ft. to the stamp. They are usually constructed with a sloping bottom, to facilitate discharging, but where very large bins can be erected this feature is not so essential. These bottoms must be solidly braced and ought to be covered with iron plates over those portions where the ore has to be dropped. The front of the bin is parallel with the mortars and supplied with gates for each battery above the level of the hopper of the self-feeders. These gates should be regulated by a pinion and rack, and set for a regular discharge and delivery, through chutes, into the self-feeders. The chutes should be lined with heavy sheet iron.

Self-Feeders—The entire value of the stamp battery hinges on a regular and even feeding, and as it can be done much better (from 15 to 20 per cent.) by a machine than by hand, this latter method has become well nigh extinct in California. Among the mechanical feeders mostly used are the Challenge (in two patterns), Tulloch, Stanford, and Roller feeders. Although the three latter are very serviceable for certain classes of ore, and are cheaper in first cost, the Challenge is undoubtedly the best all-round machine, which is proved by its almost universal adoption. They are either placed on a frame which runs on an iron track in the feed floor, back of and at right angles to the battery, or are suspended from tracks supported by the battery posts and standards placed against the ore-bin. This latter pattern permits of greereater accessibility to the feed side of the mortar. In general, the Challenge feeders consist of a hopper with a movable circular plate beneath, set slightly inclined toward the mortar, receiving a rotary motion by means of gear wheels acting on the lower face of the plate, which are moved by a friction grip that receives its impetus from a blow of the descending stem on a bumper-rod connected with it. Movable wings extending from the point of the hopper over the plate toward the throat of the mortar permit a given quantity of the ore to be scraped off at each blow through a partial rotation of the plate. The older machines were made with right or left-handed bumpers, but the present and better plan is to place the rod in the center, so that the third stamp in a five-stamp battery imparts the blow. The newest machines have no bumper-rod, but are worked by a collar fastened on the stem above the top of the mortar. Each battery is supplied with its own self-feeder.

The Tulloch feeder consists of a square frame, into which a hopper fits, having below a tray suspended from the frame at any desired angle, and in such a manner a to have a forward and backward swinging motion inside the frame, which can be arrested on the forward motion at a certain point by lugs, underneath the tray, striking a bar. The back of the hopper is supplied with an adjustable scraper, and at each motion of the tray a certain amount of the ore is scraped forward and falls into the battery. The machine is operated by the descent of the stamp.

Mortars.—The mortars in California are mostly single-discharge, and cast in one piece, extremely solid. When required in places inaccessible by waggon roads, they are cast in pieces, which are later bolted together. Their interior form depends on the nature of the ore, and the procedure to be applied; thus we find them made with narrow or flaring, deep or shallow troughs, and with or without inside plates. Mortars with narrow troughs are made for greater output, while a wide trough assists battery amalgamation, and gives opportunity for placing inside copper plates. In some of the newest styles of mortars a series of grooves are furnished in the lining plates, to contain quicksilver. The mortars weigh from 4,000 to 6,500 lbs., the bottoms being made extra heavy; in some of the latest patterns the bottoms are 8 in. thick. The length varies between 4½ and 5 ft., and the height from 4¼ to 4½ ft. The inside width of the trough corresponds with that of the foot-plate of the dies. A heavy flange, 4 x 3 in., is cast on the base of the long sides, in which are four holes on each side for bolts, to secure the mortar to the block.

The difference in design hinges chiefly on the different opinions of leading mining men as to the method and value of amalgamating inside the battery.

The Wilman's mortar was the first attempt at inside amalgamation, using an inside removable copper plate, but this failed to work well; the copper plate, being so close to the shoe and die, scoured and could not retain the amalgam. In remedying this defect, the Pacific mortar was produced, in which the copper plate was placed higher up, under the feed throat; experience in the working of which, suggested changes that finally evolved the Union mortar, which is provided with a copper amalgamating plate, 12 x 48 in., bolted in a recess at the back of the mortar, reaching below the level of the screen opening. This plate is removed on clean-up days to be scraped, and then replaced. Similar good results have been obtained by the writer in using a double-discharge mortar, and filling the back discharge opening with a plank instead of a screen, to which a plate, 8 in. wide and the length of the opening, had been attached.

A modification of this back-plate arrangement is shown in a mortar designed in Milwaukee, Wis. Here the back plate is accessible from the back of the mortar, through a covered opening; it is secured in place by a dovetailed key at each end, allowing it to be adjusted to the varying height of the dies.

Dies.—They consist of a cylindrical body of the same diameter as the shoe, with a square foot plate with broken corners, and should fit loosely against the front and back plates of the mortar. The broken corners permit their easy removal. They are cast both in iron and steel.

Shoes.—They are made of iron or steel, and consist of a cylindrical body of the same diameter as the stamp-head, with a cone-shaped neck, half as wide as the cylindrical body, and about 5 in. long. The weight of the shoe bears a certain relation to the other parts of the stamp, generally about one-sixth of the total weight when made of chrome steel, but somewhat less when made of iron. The cylindrical portion of the shoe is somewhat longer than the corresponding part of the die, on account of its greater wear—the latter being protected by a cushion of quartz. Both shoe and die are used until worn as thin as possible; with the shoe, this may be ½ in., though rarely, while the die is worn to the foot-plate if not fractured previously. This practice is not to be commended, and should only occur in case of necessity. On stamps weighing about 900 lbs. the shoes, if of chrome steel, weigh about 150 lbs., and if of iron, weigh about 20 lbs. less, and are about 9 in. in diameter. The life of the shoes depends on the nature of the quartz and the height and speed of the drop, but as a general rule shoes and dies of steel last as long as two and a half sets of iron ones, and cost twice as much. In the matter of choice between steel and iron, the vicinity of the mill to foundries is of consequence. Steel shoes and good iron dies usually work very smooth, but where the waste iron can be disposed of at a foundry, this metal is preferred for both.

Stamp-heads, Bosses or Sockets.—They are made of cast iron or steel, of the same diameter as the cylindrical part of the shoes and dies, with two conical sockets; the upper one accurately bored out to contain the tapering end of the stem, and the lower one to receive the neck or shank of the shoe with its enclosing circle of thin wooden wedges. Tranverse, rectangular key-ways, at right angles to each other, pass through the stamp-head at the end of the conical openings, connecting therewith in such a manner that when both stem and shoe are attached to the boss they protrude into the key-ways. This enables them to be forced out by the driving in of a wedge-shaped steel drift, about 1 in. wide, 18 in. long, and tapering down from 2 in. towards the point. The ends of the stamp-head are usually reinforced by having iron bands shrunk onto them.

Stems.—They are made of wrought iron or soft steel, turned perfectly true, and tapered at both ends for a distance of 6 or 8 in. They are from 11 to 14 ft. in length,

the diameter varying with the weight of the stamp from 2⅞ to 3½ in. They are reversible, so that is one end breaks the other end can be used before sending to the shop for repairs. When this repair is made, the whole stem should be annealed. The stem carries the greater weight of any part of the stamp, amounting to nearly one-half. The stems hang in the guides at even distances from centre to centre, and are supported while at rest by props or fingers catching on the under face of the tappets.

Tappets.—They are made of tough iron or steel, cylindrical, with a flange on both ends, and accurately bored through the centre, a shade wider than the stem, and counter-bored at both ends; they are provided with a rectangular recess adjoining the central bored hole, 7 to 8 in. long, and from 2 to 2½ in. wide, in which a gib is fitted. This is a piece of wrought iron or steel, grooved on one side, with curvature ⅛ in. smaller than that of the stem, and planed flat on the opposite side. Two, or in some cases three, slots are cut through the tappet between the flanges, at right angles to the stem, which connect with the rectangular recess for the gib, so that keys, when driven through the slot, press the gib against the stem, which should slide smoothly through the center of the tappet. The tappets are faced on both ends and are reversible. The keys are of steel, fitted and marked. Tappets weigh from 100 to 120 lbs. When fastening the tappet, the keys are driven in solid; but care must be observed, as when too tightly keyed, the tappet is liable to split.

Cams.—They are of tough cast iron or steel, double armed, and strengthened by a hub; which latter is frequently reinforced by having a wrought-iron ring shrunk on. The cam itself is the involute of a circle having for its radius the distance between the centre of the stem and the cam-shaft, somewhat flattened, however, at the point of the cam. It comprises a face from 2 to 3 in. wide, ground off, decreasing in thickness from the hub to the point and strengthened by a rib on the under side, which runs from a point to several inches deep at the hub. The cam is fastened to the cam-shaft by steel hand-fitted keys.

Cam-Shafts.—They are made of wrought iron or soft steel, turned true, with double key-seats, 120° apart for cams, besides key-seats for the driving pulley. The cams are slipped on the cam-shaft with the hub side away from the stem, and keyed solidly in their respective places; they must be placed in such a manner that when the cams are raising the stamps, the weight is as nearly evenly distributed over the shaft as possible. For this reason proper attention must be given to the sequence in which the stamps are to drop in the battery. Where the shaft is for ten cams, the following order or succession of drops is recommended, viz.: 1, 5, 9, 3, 7—10, 6, 2, 8, 4, and would give a drop in each battery as follows: 2, 4, 1, 3, 5.

The cam, in picking up a stem on the under side of the tappet, imparts a revolving motion to tappet and stem, requiring from four to six strokes of the cam to complete one entire revolution. A too rapid revolution indicates the need of lubricating. The revolving of the stem assists in giving an even wear to the faces of the shoes and dies, but it does not impart a grinding action to the stamp, as frequently stated, which can be proved by holding a piece of chalk against the stem during its ascent and descent.

Screens and Frames.—Screens of different materials and with different orifices are used; the materials comprise wire cloth of brass or steel, tough Russian sheet iron, English tinned plate, and, quite recently, aluminum bronze. The Russian sheet-iron plates are perforated with round holes or slots; the latter are vertical, horizontal, diagonal, or curved, and are either entirely smooth or burred on the inner side. The latter form is intended for longer wear by closing the burrs with a mallet when too large, thereby prolonging the life of the screen. These screens last from fifteen to thirty-five days. The plates have glossy, planished surfaces, and come in sheets of 28 to 56 in., costing in San Francisco from 65 to 80 cents per square foot. The English tinned-plate screens come in sheets of 1 to 1½ ft. square; they are more flexible than the Russian iron, hence do not permit of the pulp caking along the lower edge when fed high; and, as compared with a Russian iron one of the same perforations, they give a greater discharge, but they are short lived—averaging about ten days. The tin is burned off before using. Brass screens, costing in San Francisco 30 cents a square foot are sold in rolls; they give the greatest discharge for an equal area, and last from ten days to two weeks, but should not be used if cyanide of potassium be used in the battery, on account of clogging with amalgam. The "aluminum bronze" plates come in sizes similar to the sheet tinned plate, but unpunched, the latter work being done here; they are much longer lived than either of the other kinds, and have the further advantage that when worn out they can be sold for the value of the metal for remelting; these plates are bought and sold by the pound, and are said to contain 95 per cent. of copper and 5 per cent of aluminum. Steel wire screens are not much used, on account of their liability to rust. The life of a screen depends, aside from the manner of feeding, on the width of the mortar, the height of the discharge, and the hardness of the rock. Wide mortar and high discharge are favorable to the preservation of a screen; the form of the perforations—round holes, or slots, etc.—influences the discharge area of the screen.

A good deal of confusion exists in interpreting the numbers of the different kind of screens. Wire screens take their numbers from the meshes to the linear inch, while perforated and slotted screens are numbered from the needle used in punching them, these needle numbers being the same as are used for sewing-machines. The sizes most frequently used in gold milling are from No. 6 to No. 9 of the perforated and slotted screens, and from No. 30 to No. 40 of the wire screens. The slots are from ¼ to ⅓ in. long, and placed alternating or even in the rows, some being burred on the inner side.

The following table gives a comparison of the different varieties, with their numbers:

No. of Needle.	Corresponding Mesh.	Width of Slot. (Inches.)	Weight per Square Foot.
5	20	0.029	1.15 lbs.
6	25	0.027	1.08 lbs.
7	30	0.024	0.987 lbs.
8	35	0.022	0.918 lbs.
9	40	0.020	0.827 lbs.
10	50	0.018	0.735 lbs.
11	55	0.016	0.666 lbs.
12	60	0.015	0.666 lbs.

The proper size required is a matter for the millman to decide at each mill. The character of the ore and the coarseness of the gold have to be considered, as well as the inside dimensions of the mortar; ore carrying extremely fine gold requiring a finer crushing, as the gold must be freed from the quartz matrix in part if the quicksilver is to act on it; but where this would lead to if carried out to its legitimate end may be imagined, when the writer states that he has observed, under the microscope, a particle of quartz that had passed through a No. 9 screen (40-mesh) and still contained several separate but included particles of gold. Sulphide ores, having a much greater teudency to form slimes, should be crushed as coarse as permissible, and where the sulphides predominate largely, amalgamation in the battery is best avoided. The pulp discharged through a screen carries but a small percentage of the size of the orifice; while the largest proportion is much finer, it is possible to use a much coarser screen than the size desired to be obtained without any great detriment, while greatly increasing the output.

The Screen Frame.—It is made from strips of sugar pine, 1½ by 3 in. broad, mortised and reversible; usually they are made to close the entire discharge opening, grooves being cast on the exterior of the mortar for their reception. It is frequently strengthened with one or more vertical ribs across the centre opening, and is faced with iron plate on those portions of the side and bottom that come in contact with the iron keys that hold the frame solid against the mortar. In some mills the frame is made several inches lower than the opening, to permit the millmen to observe the interior of the mortar while in action, and to allow the hand to be introduced to remove any chips that may have passed in with the ore, as these have a tendency to bank up against the screen and interfere with the discharge of the pulp. Where such a screen frame is used the opening above is kept covered with a strip of canvas tacked to a wooden rod, laid on the upper projecting lid, while the loose end of the canvas hangs against the inside of the upper part of the screen frame.

The Plate-block (Chock-block) consists of wooden blocks bolted solidly together, and fitted and keyed to the lower edge of the mortar along the discharge opening, with one part projecting above the other, forming a recess on top to contain the screen frame, and lined with a piece of blanket to make a close joint. The inner side is sloped or rounded off, and fitted with an amalgamated plate. The front and ends are faced with iron plate to protect the wood. Two or more sets of these chock-blocks should be provided, of which one stands 2 in. higher than the other; they are then used alternately, the higher one with new shoes and dies, to be replaced by the lower one when the dies are worn down somewhat, to retain a more even discharge than would otherwise be possible.

The Drop is the height through which the stamp is raised by the cam, and through which it drops when released. Usually it is the same for all the stamps in a battery, although the end and feed stamps sometimes receive a different drop. It is regulated through the raising or lowering of the tappet, and depends mostly on the hardness of the rock. It is one of the factors in determining the speed with which the blows from the stamp shall be repeated. The usual combination of the two in the California mills, is a low drop with rapid motion.

The Discharge is the distance between the top of the die when in place in the mortar, and the lower edge of the screen through which the pulp discharges. It is one of the most important factors in the duty of the stamps and the gold output from the ore. It should be maintained as nearly as possible at an even height through the entire period of crushing; the height of the chock-block or screen frame being lowered to correspond with the wear of the die. A further means used to retain an even discharge is by placing a 2 in. iron plate under the dies, when worn thin. The discharge stands in a certain relationship with the fineness of the screen; low discharge goes with coarser crushing, a high discharge with the opposite. The discharge varies in California from 4 to 10 in.

Water Supply.—Water-pipes of 3 in. diameter are brought along the front of the mortar near the upper edge, with branch pipes 1 in. in diameter, supplied with faucets leading to the feed side of the mortar, to convey the battery water in at the back, or through the plank covering on the top; this water is under moderate pressure. A second discharge pipe is carried down in front to the lower lip of the mortar, where a movable, perforated branch is turned across the front of the screen, discharging along the entire line on the lip; this second discharge pipe also supplies a hose. The battery water should enter both sides of the mortar in an even quantity, and the total amount must be sufficient to keep a fairly thick pulp that discharges freely through the screen. About 120 cu. ft. of water per ton of crushed ore may be considered an average, or 8 to 10 cu. ft. per stamp per hour.

Aprons and Apron-Plates.—The apron is a low table placed in front of the mortar, just below and in immediate proximity to the lower lip of the discharge, for the reception of amalgamated copper plates. It is set on a sufficient grade to permit the discharging pulp to flow over it in an even stream, while affording the suspended amalgam an opportunity to reach, and adhere to, the plate surface. The size, shape, and slope are at the will of the millman; but usually they are rectangular, with the plates screwed down to the table with copper screws, perfectly level and smooth, the sides being secured with wooden cleats. The grade given varies from ½ to 2½ in. to the foot, and the width of the apron is usually the width of the discharge-opening of the mortar. In some mills several of these apron-plates are placed consecutively, discharging from one to the other. They are usually rigid, but in some instances the apron next to the mortar stands on rollers, permitting it to be rolled back and thus giving freer access to the front of the mortar. They should not be attached to the battery frame.

Sluices and Sluice-Plates—These vary from 12 to 20 in. in width, and are placed below the aprons; they are usually set to a grade different from that of the apron. The plates can be fastened by cleats, or are laid overlapping at the ends, and if not wider than 16 in., do not need to be fastened down with side cleats; this permits of their being picked up and cleaned at any time without stopping the battery. The sluices are rarely over 16 ft. long—more frequently in lengths of 8 ft.—and should always be placed double. The width and grade, as compared with the apron areas, are mostly faulty in California mills.

Clean-up Barrels—Large mills are supplied with clean-up barrels, which consist of iron barrels supported bp trunnions resting in bearings on short standards. One of the trunnions is extended to carry a loose and a tight pulley, by means of which it is revolved. A manhole, with tight-fitting cover, is provided for charging and discharging, and below it is a sluice with cross-riffles to receive the pulp when discharged from the barrel. The barrel should make from thirty to forty revolutions a minute, requiring 2½ h. p. It is used to treat the battery sands when cleaning up the mill; also, all the scrapings from the mill floor, as well as sand from the drop boxes and amalgam traps, large pieces of quartz or pieces of broken shoes being added with water and quicksilver to assist in the operation.

Clean-up Pan—This is a small amalgamating pan, 3 to 4 ft. in diameter, operating with mullers with wooden shoes, and is run at a speed of thirty revolutions, requiring 1½ h. p. When in use the pan is half filled with water, and the amalgam put in, with an addition of clean quicksilver, and, if required, also some lye. After sufficient grinding, the muddy water is run out through plug-holes, the mullers stopped, and the contents drawn off in buckets. The iron found floating on top of the quicksilver is removed with a magnet; the sand is washed off with a small stream of clear water, and if any dross be found covering the surface it is skimmed off with a sponge or piece of blanket.

Cleaning-up Room—This is an apartment in close proximity to the batteries and aprons, provided with a tight floor, and with a door under lock and key; the floor is best when laid in cement, to avoid all losses from split quicksilver or amalgam. It should be well lighted, and furnished with a sloping table large enough to place a screen frame on; also, with one or two water-tight boxes about 4 ft. long, 3 ft. wide, and 3 ft. deep, for panning-out purposes; these are supplied with plug-holes near the bottom, to drain off the water, besides water-pipes and fittings to fill the boxes when required. One or two wide shelves should be provided to hold the chemicals, quicksilver, and utensils needed in cleaning up. The latter consist of pans, wedgewood mortar, brushes, scoops, cups, knives, chisels, rubbers, scrapers, and a supply of closely woven drilling or light canvas; the latter is used to squeeze the superfluous quicksilver from the amalgam. A good pair of balances, with a set of accurate weights, capable of weighing the amalgam and the retorted bullion, should also be provided.

The table should be made of a solid plank, or a slab of slate or marble, supplied with a raised edge, and grooved around to drain into a pan placed on a shelf attached below the lower end; some tables are covered with an amalgamated plate. It is sometimes convenient to have a small safe in the clean-up room, but it is always better to have the amalgam delivered to the office.

On account of the favorable position of the majority of California mines as regards their proximity to mountain streams and the large ditch systems, the application of water for the motive power of the mills is rendered easy, and where the distance from these sources is remote, electricity generated in such localities and transmitted to the mill is being successfully applied. Where steam power has to be used, the well-timbered western slopes of the Sierra Nevada permit the cost of fuel to be kept at a comparatively low figure. Where both water and timber are hard to obtain, as in the desert regions of the southern part of the State, gas engines have been applied with most satisfactory results.

In applying water power, where the pressure is sufficient, hurdy gurdy wheels are chiefly used; these are vertical wheels with narrow breasts, having buckets of various patterns radially attached to the outer circumference, the water being projected through one or more nozzles against the buckets at a low point of the wheel, allowing the water to pass from the buckets as soon as the blow has been delivered. The principal patterns in actual use are the Knight, Pelton and Dodds; the actual effective power developed by the Pelton buckets is given at about 75 to 80 per cent. Where sufficient pressure cannot be obtained, the Leffel turbine and the overshot wheel are in use. As the Pelton wheel seems to find the most frequent application in California, it may be convenient for millmen to have the following rule, applicable to these wheels: When the head of water is known in feet, multiply it by 0.0024147, and the product is the horse-power obtainable from one miner's inch of water.

The power necessary for different mill parts is:

For each 850 lb. stamp, dropping 6 in. 95 times per minute, 1.33 h. p.
For each 750 lb. stamp, dropping 6 in. 95 times per minute, 1.18 h. p.
For each 650 lb. stamp, dropping 6 in. 95 times per minute, 1.00 h. p.
For an 8 x 10 in. Blake pattern rock-breaker, 9.00 h. p.
For a Frue or Triumph vanner, with 220 revolutions per minute, 0.50 h. p.
For a 4 ft. clean-up pan, making 30 revolutions, 1.50 h. p.
For an amalgamating barrel, making 30 revolutions, 2.50 h. p.
For a mechanical batea, making 30 revolutions, 1.00 h. p.

MILL PRACTICES.

Where the conditions permit, it is becoming the custom to place the grizzly and the rock-breaker in close proximity to the hoist, so that the bucket or car on arriving at the surface is dumped direct on a grizzly, and the crushed ore is then run over the ore-bin in the mill, and emptied therein; where this is impracticable, the grizzly and rock-breaker are placed over the ore-bin in the mill.

The usual practice is to let the coarse ore from the grizzly drop on a platform on a level with the mouth of the rock crusher, into which it is shoveled by hand; by this method the machine is not brought up to its full capacity. A better plan is to convey the coarse ore from the grizzly into the bin by means of a chute, having a sliding gate immediately above the receiving point of the crusher, and which is set so as to keep the space between the jaws always filled. In this way the work becomes automatic, and the services of the man attending the rock-breakers can be utilized in other parts of the mill during part of the time. Under such an arrangement the crusher will require more power, which should be independent from the other machinery. The rock-breaker is usually run during the day time only, as it can crush in that time enough ore for the mill for the twenty-four hours.

The self-feeders, in a similar manner, are kept automatically filled from the main ore-bin. The feeding through the tappet striking on the bumper-rod of the self-feeder, has of late been modified. A collar is fastened below the guides on the feed stamp stem, taking the place of the tappet, thus avoiding the long bumper-rod. The gauging of the feed must be carefully attended to, if the stamps are to work up to their full capacity; there should never be more than about 1 in. of rock between the stamp and die when they come together, or the feed should be just sufficient to keep iron from striking iron. When cleaning up the batteries, the self-feeders are drawn back on a track towards the ore-bins, giving access to the back of the mortars.

In preparing the mortar for ore-crushing, an inch or two of tailings is spread evenly over the bottom before putting the dies in place, as this saves the wear on the bottom plate. After the dies are placed exactly under each stamp, crushed ore and fine rock are banked around them to retain them in proper place until the sands have settled firmly about them. Care must be observed to keep the tops of *all* the dies at the same level at all times, as otherwise, when the stamps are dropping the highest die will strike against iron, while the others are still supplied with sufficient ore; this is known as "pounding."

The stamp-head, or boss, is now placed on the die with the small conical opening at the top, and the stem lowered into it, iron against iron, if it is a close fit, and driven in solid. In case the connection is not tight, canvas strips about 2 in. wide are laid crosswise over the opening before the stem is lowered. The stem, with the stamp-head, is now raised until the latch-finger catches under the lower face of the tappet and holds them suspended, and the shoe placed on the die. If the stamp-head hangs too low to permit this, the stem is raised, and a block placed on top of the finger for the tappet to rest on. Narrow wooden wedges, about 1 in. wide, the length of the neck of the shoe, and of the requisite thickness to fit tightly into the conical opening at the bottom of the stamp-head, are arranged in place and tied with a string. The block and finger are then removed, the stamp-head dropped over the shank, and wedges driven down firmly. This is done best by revolving the cam-shaft slowly, and, while placing the cam-shaft between, permitting the cam to act on the tappet, raising and dropping the stamp until the lower edge of the stamp-head is nearly in contact with the shoulder of the stamp. It is not advisable to permit them to come solidly together, as it tends to loosen the iron ring that reinforces the stamp-head. A quick and convenient method of placing the wooden wedges on the shoe, is to cut a piece of canvas to fit exactly around the neck, and attach the wedges to the canvas by driving a tack through each one into the cloth. By keeping a supply of these on hand it becomes an easy matter to encircle the shank on the shoe and tie them fast, should the shoe become loose and drop off while the mill is running.

The Drop—The next operation is fixing the distance through which the stamp is to drop before striking the die. In most mills this distance is uniform for all the stamps; but, as previously stated, occasionally the stamp operating the feed, as also the two outside stamps, receive a greater drop.

The right height to give depends on the nature of the ore, as also on the speed to be given to the stamps; that is, the number of drops per minute. The tendency in most California mills is to run at a high rate of speed, usually in the neighborhood of one hundred drops per minute. The height varies from 4 in. to about 10 in., generally but little, if any, above the water-level in the mortar.

In arranging the stamps for an equal drop, wooden blocks, cut about ½ in. longer than the drop the stamps are to receive to permit the cams to clear the tappets, are placed on the die, between it and the shoe. Pieces of 2 x 4 scantling, cut to the desired length, answer well for the purpose. The keys in the tappet are loosened with a drift made of steel, the size of the keyholes, and used only for that purpose, and the stem is allowed to slip through the tappet until the shoe rests on the top of the wooden block beneath; or, if the shoe was resting on the block previously, the tappet is slipped up till resting on the latch-finger, when the keys are driven home solid. Care must be exercised not to drive the keys too solid, else there is danger of splitting the tappet. For the convenience of the millman, a chalk mark is made around the stem just above the tappet, which enables him, while running, to at once detect if any of the tappets have slipped. Should this occur it must be immediately re-set, or the battery work will be irregular. The battery-plates and chock-blocks are next put in place and keyed.

The Discharge is next arranged. This is the distance between the top of the new dies and the lower edge of the screen, and to fix the right distance is of importance. The greater the height of the discharge, the greater will be the proportionate amount of pulp and slime, and they also will be retained longer in the mortar. The quantity of amalgam retained in the mortar is also proportionately greater. A low discharge calls for a coarser screen, and naturally results in a larger output of the battery, and with a larger proportion of outside plate amalgam. With a *constant* height of the screen, the natural wear of the die increases the height of the discharge. For ordinary iron shoes and dies, and average rock, the wear of the die is roughly estimated from ¾ to 1 lb. of iron per ton of ore crushed. To counteract the effect of this wear on the discharge height, different sized chock-blocks or screen frames are supplied; the highest being used with new dies, and later replaced by lower ones, thus holding the distance more even than the use of a single size would permit. In some mills, when the dies are worn down, an iron plate, made for the purpose, is laid beneath them to raise them up.

At a very high discharge, besides creating much slime, beats up a larger portion of the gold into float gold than would be the case with low discharge, the choice necessarily influences the gold recovery; this is more particularly the case if the ore carries any appreciable amount of valuable sulphurets. The discharge varies in the different mills from 4 to 10 in., the average being from 6 to 7 in.

Screens—In fastening the screen to the screen-frame, care must be observed to get it on smooth, without any wrinkling or buckling. Tin screens must have the tin burned off before fastening to the frame; it is also well to expose the Russian-iron screens to a quick fire of shavings, to burn off the oil with which they are more or less faced. The edges of the screens are tacked to the frames, and are faced with strips of blanket to make a close connection with the mortar. In fastening a wire-cloth screen, to get it on smooth, a good method is to tack it first along the lower edge, then draw it up tight and even over the upper edge, and nail it before cutting it off the roll. As previously stated, brass-wire screens should not be used in conjunction with cyanide of potassium, as the brass becomes coated and clogged with amalgam. The screen-frame with screen is dropped into the grooves cast on the outside of the mortar discharge, and fastened solid with iron wedges—two vertical (one for each groove) and a horizontal one in the center of the lower lip. The wedges should have a broad head to facilitate knocking them out. After the screen has been fastened in place, a piece of canvas or a board should be hung in front to arrest the outward throw of the pulp from the drop of the stamp, and direct it in an even flow onto the plates beneath. In some mills this board is given a slope toward the screen, and has an amalgamated plate screwed on, which receives the splash. Bolted to the front of the modern mortars is a frame to carry the outside battery-plate and a distributing-box, a few inches above the apron-table on which it discharges.

When everything is ready to drop the stamps, the self-feeder is rolled to its place, the cam-shaft is set to revolving slowly, the water is turned into the battery, and the millman, standing on the platform above, grasps the hand-hold of the first finger or prop and introduces, with the other hand, the cam-stick between the tappet and the revolving cam; by this means the weight of the stamp is taken off the prop, which is pulled back and rested against the edge of the platform. This operation is repeated with each stamp until all are working. To carry out this operation when the shaft is revolving rapidly, without injuring the operator's hands, requires practice. The cam-stick mentioned above consists of a piece of wood about 2½ ft. long, 1 in. thick at the point, running up to 2½ in. near the handle, and faced with strap iron or a strip of belting. It may also be made entirely of strips of belting, 2 in. or 3 in. wide, nailed over each other and attached to a wooden handle. To hang up the stamps, the hand-hold is grasped, the knee pressed to the latch-finger, and the cam-stick introduced between cam and tappet as before, and the latch-finger pushed under the tappet.

Before dropping the stems the face of the cams should be lightly lubricated, for which purpose axle grease or specially prepared compounds are used; a very useful one is a mixture of graphite and molasses; in some mills, to avoid the use of grease, the face of the cam is rubbed with a bar of common soap.

Grease.—It being essential, for good amalgamation, that the presence of grease be avoided in the battery, care must be observed in lubricating the cams, the stems where passing through the guides, and the shaft bearings. In many mills, trays made from old oil cans are fastened beneath the bearings, cloth aprons are tacked from the under side of the guides to the floor above; rings of rubber packing or old belting also encircle the stems at the lower edges of the guides. The millman should diligently wipe off the stems and any part of the battery frame, where the presence of grease is indicated, at least once during a shift. Grease in the mortar is indicated by a black, dirty appearance of the surface of the plates, as also by the adhesion of more than the usual proportion of the amalgam to the iron castings inside the mortar. The usual remedy is to shut off a part of the battery water, for a short time, while adding a lye solution; or to add fine wood ashes to the ore.

The Amount of Water Required for the proper working of the battery depends on the nature of the ore; clayey ores, or such as have a high percentage of sulphurets, requiring the most; but while in the former case a greater amount is needed inside the mortar, the latter condition permits a part being added outside the screen, on the lip of the mortar. A small sluice-box, with plug-holes, is placed across the front in this case, or the water is conveyed by means of a half-inch perforated iron pipe, attached to the vertical supply pipe by an elbow joint, permitting it to be turned either way as required. "The amount of water used per ton of ore stamped varies from 1,000 to 2,400 gallons, with a mean amount of about 1,800 gallons per ton of rock crushed."* Most of the mills in actual practice figure roughly on one miner's inch of water, more or less, per twenty-four hours for each battery of five stamps. To obtain the largest amount of crushing of clean quartz from a battery, only sufficient water should be used inside to keep up the regular, even swash of the pulp, and if that be not sufficient to keep the plates on the outside clear from accumulating pulp, more may be added outside the screen. The pulp, in passing down over the apron-plate, should roll in successive waves, corresponding to the back and forth wave-motion inside the battery, rather than flow in an even sheet, as affording a better opportunity of contact for the particles of amalgam.

Where the temperature falls low in winter arrangements should be made to deliver the water in a tepid condition, as better amalgamating results will be obtained, through keeping the quicksilver in a lively condition. Where steam power is used, this can be easily arranged; but when using water power a separate heater is required.

* See VIIIth Report of State Mineralogist, p. 710.

Feeding.—Hand feeding has become nearly obsolete in California. It is only practiced in small concerns, or where a temporary mill has been put up for prospecting purposes. The advantages of a machine-fed mill are numerous; the chief of these are (1) that the wear of the iron of the shoes and dies is less and more even-faced; (2) that from 15 per cent. to 20 per cent. more ore can be crushed in a given time; and (3) that the labor expenses are reduced. The machines should be carefully gauged and watched to insure a steady, low feeding of the stamps. In order to insure a good splash in the mortar attention must be given to the succession in which the stamps are made to drop. A good splash is one that shows a wave passing along the lower edge of the screen, moving backward and forward from end to end, or a similar wave-motion that has its initial point from the centre stamp. The succession most frequently adopted in California is, 3, 5, 1, 4, 2; 1, 5, 2, 4, 3; 1, 3, 5, 2, 4, and 1, 4, 2, 5, 3; the last spreads the pulp very evenly from end to end. The greatest amount of discharge is obtained, apparently by dropping the centre stamp first; while the most crushing is done, other things being equal, by dropping the end ones first. Any arrangement of the stamps will answer, however, that distributes the pulp evenly and discharges it well.

The Apron should be set immediately in front of the mortar, but independent of the battery-frame, to exempt it from the jar of the stamps; it should be arranged to permit of the grade being easily altered if necessary. The size, shape and grade of the apron-plates differ widely, depending largely on the millman's preferences and experience. The usual form of the apron is rectangular, of the width of the discharge, and any length desired, but usually from 4 to 12 ft., forming a level (transversely) smooth surface, set on a grade varying from ½ to 2½ in. to the foot. Sometimes the surface is divided by steps, with or without distributing boxes. These are usually from 1 to 2 in. The apron should never be drown in at the lower end, for reasons given farther on; and the steps should not be too deep, as otherwise the plate next to the drop will show mostly bare copper through scouring.

On examining a plate that is in use under good working conditions, it will appear that the upper portion, immediately below the mortar, say for a distance of 18 in., carries at least 75 per cent. of all the amalgam caught on the apron, the largest accumulation showing along the line of impingement next the lip of the mortar. Now if the apron-plate were discontinued at about 2 ft., and continued again on a lower level of about 2 in., a second line of accumulation would result, naturally on a smaller scale; hence the advantage of the step form. Another advantage in this style of apron, is that by fastening these sections to the table by means of wooden buttons on the sides instead of cleats and screws, and having one extra plate on hand, the scraping and dressing of the same can be performed at any time, without stopping the crushing of the stamps, by removing the plate and substituting the extra one.

The grade of the apron-plate should be such as to keep the surface clear from any pulp accumalations, but not steep enough to obtain a scouring action. It will depend on the coarseness of the pulp, the nature of the gold, the amount of water available, and the percentage and nature of the sulphurets. Where a battery-plate is in use above the apron, it is usually given a grade of from 1½ to 2 in. to the foot. Grades for the apron proper vary from ½ to 2½ in. to the foot, but the average is about 1¼ in. The apron-plates are usually silver-plated copper plates, which have largely superseded the copper amalgamated plate of former days—chiefly on account of the readiness with which the former plates do their full duty from the first starting, which is not the case with the copper plate; also, on account of their freedom from discoloration by oxidation. If silvered plates be used when running a very low-grade ore, the plating soon wears off, requiring a replating about every six months. The usual amount of silver put on plates is one ounce to the square foot. The usual thickness of copper plates is 1/8 to ¼ in. In preparing them for amalgamation they should first be carefully heated to a black heat, and plunged into cold water, which makos them soft and more ready to take up quicksilver. They are then scoured bright with fine tailings-sand, moistened with some cyanide of potassium and applied with a block of wood; then dressed all over with a weak solution of nitric acid, or with cyanide of potassium and quicksilver, with sodium amalgam sprinkled over and brushed or rubbed into the surface. Before final use, it is well to give them a coating of fine gold amalgam; or, if not convenient, silver amalgam will answer. In using the cyanide of potassium solution, care must be taken not to use it too strong, especially if the quicksilver is not applied to the plate immediately, otherwise a coating is formed on the surface that will not take up the quicksilver. Where the ore is of a fair grade, after a long period of continuous use the plate will have absorbed an amount of gold that will not yield to scraping unless the plate is immersed in boiling water for a time before being scraped, or heated over a fire and hammered with a mallet on the reverse side, in which case care must be taken not to dent the plate.

As the saving of amalgam on the apron and sluice-plates is largely a matter of gravity, the conditions under which the pulp passes over the plates should conform to the laws relating to the falling of a body through a moving liquid medium; hence the proper shape of the apron, and the flow and consistency of the pulp, should be well considered. If, as was formely the almost universal custom, the lower end of the apron be contracted (and in numerous cases this contraction was as great as four to one), the depth of the pulp spread over the surface of the plate increases as it passes down; the flow of the water across a given section becomes uneven, forming at the sides a swirl, along the edge of which sand is precipitated, covering and rendering that portion of the plate useless, from its inability to come in contact with the particles of amalgam, while producing scouring currents at other parts. The proper method is to spread the flow over a wider surface as it passes from one plate to the other, and lessen the grade, which may require an addition of clear water.

(To be continued.)

MINING IN BRITISH COLUMBIA.

(From our own Correspondents.)

Trail District.

The great Iron Horse group, situated on Monte Christo hill, has passed for the second time out of the hands of the original owners to the Iron Horse Mining and Milling Co., an American corporation, of which A. E. Humphreys is the president. It will be remembered that this company defaulted on a payment due in January last, and it was thought had relinquished all control of the property; however, subsequent events proved that they had a hold on the property that enabled them to purchase this magnificent group for $24,000 less than anybody else. On March 20th, Harold Kingsmill sold the property for the owners to Daniel Simpson, of Helena, Mont., for $75,000. Mr. Simpson transferred his option to the British Columbia syndicate, who, when they came to fulfil the conditions of their option were restrained from so doing by Humphreys. Subsequently, Humphreys rebonded the property for $51,000, of which $2,000 was cash and the balance in 60 days. Work has been commenced on the property, and already miners are at work sinking on the big ore chute in the main tunnel. There is a great deal of satisfaction expressed that this property will now be continuously and systematically mined.

The Lily May, famous as the first location on Trail creek, changed hands twice inside of 24 hours on the 9th March. Frank Watson bonded the property for $15,000 from Oliver Bordeau, the locator and sole owner of the property. He, in turn, sold it to Messrs. Bolles and Raymond, of the Riverdale Mining Co., of Baker Co., Oregon, for $23,000. Men were at once put to work on the tunnel, and have been drifting on 2 feet of $50 ore ever since. Notwithstanding its hitherto chequered career, the Lily May bids fair to become a most valuable mine.

The explosion that occurred in the well-known Centre Star mine on the 14th ult., by which four men lost their lives, was most deplorable in every respect. The coroner's jury brought out the fact that it was wholly chargeable to a miner's carlessness in preparing giant powder for blasting, and that the management were entirely free from any blame in the matter. The explosion badly wrecked the tracks and air pipes from the compressor in the tunnel, as well as doing considerable damage outside at the mouth of the tunnel. Repairs have been fully made, and the mine is again running full blast.

The Morning Star Mining Co., composed of Rossland and Butte men, has been formed to work the Morning Star claim, which is situated some 2 miles to the north of the town. The shaft, which is a good one, is now down 80 feet, and the bottom of the shaft shows a solid face of chalcopyrite ore in a quartz gangue, that will average $40 in gold to the ton. The Morning Star is a prospect of more than usual excellence, and the owners have great confidence in their ability to make a mine of it. A first-class sinking pump (Cameron) and a hoist will be put in as soon as the 100 foot level has been reached. Contracts for 200 feet of shaft will then be let.

The recent strike in the Jumbo has done more to prove the two great characteristics, that Trail Creek's ore bodies increase in size and value as depth is attained, than any other yet made in the camp. The crosscut tunnel has uncovered an ore body 30 ft. in width, a solid mass of sulphide ore, that will average $20 per ton in gold. With the possible exception of the deepest workings of the Le Roi this strike stands unrivalled in the annals of British Columbia mining. The claim will be an easy one to work, as there is room for two more adit tunnels, which will give a vertical depth of 350 ft. before sinking will have to be resorted to. The Rossland and Trail tramway line is being extended to the mine, and it is the intention of the company, which has just been formed in Spokane, to work the property for all it is worth during the coming summer.

The Trail smelter has again blown in, and is working to perfection in every respect. About 80 tons of crude ore are being run through daily, and a carload of matte is the daily result. Shipments of matte have been going to Butte for the past week.

Although the contractors on the Rossland and Trail Tramway confidently assert that the line will be in operation by the first of May, their statements are given little credence here, as with the amount of work yet to be done, it is a moral impossibility to have the road in operation by the time fixed. In fact, Rosslanders will be more than pleased to see it in operation by the first of June. The engine and four cars have arrived at Trail, and tracklaying is going on from the smelter end of the road with all possible speed.

In consequence of the impassable state of the roads, and the consequent inability of the mines to work full regular crews breaking ore for shipment, the camp just at present has an idle appearance that ill becomes it. This state of affairs is liable, in fact is sure to last until the completion and successful operation of the railroad.

It now transpires that Rossland will be the Mecca of at least two additional railroads during the coming summer. It is now authoritatively said in Rossland that both the C.P.R. and the Nelson and Fort Sheppard will extend their lines into Rossland this summer, and that the work of construction will be commenced as soon as the snow goes off the hills sufficiently to permit the graders to be put to work. It is a sure sign of the importance of Trail Creek's mineral wealth to see so many railroads competing for its tonnage.

Since my last writing branches of both the Bank of Montreal and the Bank of British North America have been duly opened in Rossland. A mining camp is necessarily a place of strange sights, but the climax was capped when the representatives of two such conservative banking institutions as the above mentioned made a race to see who would be open for business first. The Bank of B. N. A. won the race, as they opened up in a barber shop on Saturday—ready to shave checks from 9 a.m. to 1 p.m., while the barber had a notice up announcing that he would resume business and shave chins for the balance of the day. The Bank of Montreal is temporarily installed in a hardware store.

March has been a month for the consummation of large deals, and the last property to go for a practically cash consideration is the Georgia, which is situated to the north and east of the well-known Iron Horse mine. The property went to Joseph L. Warner, the manager of the O. K. Mining and Milling Co., in the interest of outside capitalists, for $25,000. The terms of the deal are as follows: $1,000 cash; $9,000 on Monday, 13th inst., and the balance of $15,000 within fifty days from date. Mr. Warner in his bond stipulates to start continuous work at once. The claim is owned exclusively by Rossland men.

The North Star, owned by the same people as the Georgia, has also been sold to a Victoria syndicate for $15,000. A wire has been received from Victoria that the final payment will be made on Monday. The North Star is an excellent property, and by shaft development shows up a large body of high-grade auriferous sulphide ore. Work will be started at once.

The owners of the Gold Star have placed a deed in escrow with a local bank for the sale of their property for $20,000 cash. The Gold Star is situated in the north belt, some four miles from Rossland, and has a most wonderful surface showing of pyrite and chalcopyrite ore. Assays from the surface have yielded a uniform value of $15 to the ton in gold.

The opening of the Colville Indian reservation for mineral location by the U. S. Congress has been productive of much good already to the great mineral resources of this section of British Columbia. Some magnificent looking claims have already been located, some of which deserve mention. A partnership of Rossland prospectors have secured some first-class locations within five miles of the International boundary line, and have brought their ore here for assay. The ledge is 30 ft. wide, and general

average samples from the whole cropping give $8 in gold per ton. On the foot-wall of the vein there is a 6 ft. streak of solid sulphide ore—a mixture of iron pyrites and galena, which on assay gives a combined value in gold and silver of $160 to the ton. Marcus Daly, general manager of the great Anaconda Copper Company, has made the owners of the group a very handsome offer on a bond for the property. This offer is now under consideration.

The Commander, the highest grade copper property in Trail Creek, and at one time under option to the owners of the Trail Smelter, has been bonded to C. P. R. officials for $40,000. The first payment comes due on the 20th inst. The investment of Canadian capital in the district is greatly welcomed by everybody here, and it is thought that the C. P. R. men will find a mine in the Commander.

The attention of the investing public has been directed to the shares of Trail Creek mining stocks, both in Spokane and New York, and as a consequence half a dozen brokers are doing a lucrative stock broking business. For the information of the REVIEW's readers, a list of Trail Creek stock companies is here given, and the prevailing prices at the time of writing. [No stocks are listed in this column unless the property on which they are founded has been fully paid for and the title perfected.]

	Bid.	Asked.		Bid.	Asked.
B. C. Syndicate*	—	—	Josie	.48	.50
Centre Star	1.25		Le Roi	4.00	5.00
Evening Star	.10	.12½	O. K.	.28	.30
Gertrude	—	—	Phœnix	—	.06
Good Hope	—	.04	Poorman	.12	.15
Great Western	.10	.12	St. Elmo	.12	.15
High Ore	—	—	Trail Mining Co.	—	—
Idaho	1.00	1.25	Virginia	.30	.35
Iron Mask	.60	.65	War Eagle	1.60	1.75

* Prospecting syndicate.

All the above stocks have a par value of $1 per share, except the Le Roi and British Columbia syndicate, which are $5, and the Trail Mining Company, which is $100. With the exception of the Trail Mining Company, which has 2,500 shares, the British Columbia Syndicate 20,000, the Josie 700,000, and the Evening Star and O.K. 1,000,000, all the above companies have their capital stock divided into 500,000 shares.

Boundary Creek.

Probably in no other district in America does such a variety of ores exist as in Boundary Creek. They vary from the heavy massive sulphides of iron and copper (and the oxidized deposits of copper oxide and native copper), to highly siliceous milling ores; the gradations between these two classes being represented by all manner of concentrating ores. There are also some high grade silver-lead ores.

A description of these ores would be best served by a description of the principal camps of the district, considered separately. I will begin with the most northerly, as well as the most recently discovered camp, Long Lake.

This is probably the highest grade gold quartz camp in the Province. It was discovered the latter part of April, 1895, and lies about 16 miles north of the mouth of Boundary creek (at the boundary line). Quite large areas of granite occur south of the camp and again on the north, but the camp proper consists of a series of schists, quartzites and dykes of diorite, with numerous bodies of trachyte intruding irregularly. The quartz veins all lie in these schists and dykes and strike about N.N.E., dipping all (at least on the surface) slightly to the east. The veins vary in width from 1½ to 6 ft., and are mineralized with iron and copper pyrites and galena. In the "Lakeview" two tellurides have been discovered, one of lead in October last, and quite recently one of silver (Hessite). Their analyses gave: (1) Lead, 52·20 per cent; silver, 1·20 per cent.; tellurium, 46·46 per cent. (2) Silver, 60·68 per cent.; gold, 2·29 per cent.; tellurium, 37·33 per cent. Hessite has since been found across the lake in the "North Star" and "Gold Drop." Average assays from the better claims run from $20 to $100 in gold and 20 to 80 ozs. silver. Nine ounce assays in gold are obtained from moderately well mineralized samples of the "Silent Friend." While at present the ore is well adapted for milling and concentration, it is probable that in the case of many of the veins moderate depth will change it to a straight concentrating ore. Among the most promising claims are "Lakeview," "Jewel," "North Star," "Rio Grande," "Silent Friend," "Electric," "Gold Drop," "Rhoderick Dhu." No great depth has as yet been reached on any of the properties. On the "Lakeview" a tunnel is in 75 ft., under contract to be continued to 125 ft.; on the "Rhoderick Dhu," a 50 ft. shaft; on "North Star," a shaft of 40 ft. on a contract for 75 ft. Shafts from 10 to 30 ft. are on the other properties.

Mr. Turner, of the Montreal and Vancouver Prospecting and Promoting Co., is actively developing the "Gold Drop," Greenwood camp, which he bonded in the winter. A 110 ft. tunnel, driven (as they supposed) to cross the vein, is in extremely good copper-gold ore throughout, and the other wall not yet reached. Mr. Turner is also bringing in a diamond drill to more effectually prospect his properties. The intention is to use it on the "Snow-shoe" at once.

It is authoratively stated that the "Copper Mine" copper camp is bonded by the American Exploration Co. Mr. Weir is expected in another week to commence operations. This property is a very large deposit of copper oxide and native copper, averaging about 10 per cent. copper and a little gold and silver. The bond is not known, but the owners have been holding it at about $40,000.

MINING IN NOVA SCOTIA.

We have received from the Geological Survey department the summary of the Report for 1895. Mr. Fletcher has been occupied in making fresh surveys of the Sidney coal fields preparatory to new issue of geological map sheets for that district, while Mr. Faribault has continued his surveys of the gold bearing formation, which have become so popular in this province.

In addition to the regulation maps, drawn to a scale of 1 in. to the mile, Mr. Faribault has plotted maps of Tangier, Mooseland, Moose River, Caribou, Oldham, Montigue and Waverley, on a scale 500 ft. to the inch. On these maps it is intended to show the quartz veins, giving the width, length, the extent to which they have been worked, both in depth and along their cropping, the direction and dip of the pay chute and that of the anteclinal axis, and the average richness when ascertainable. These maps will not only be invaluable to those working in the district at the present time, but they will be a considerable aid to capitalists who may be investigating any district with a view to purchase, and bearing the latter in mind we would suggest that the amount of gold taken out of each district be also added. We were sorry to see one note in Mr. Faribault's report, namely, "Owing to the limited amount of exploration fund at my disposal, field operations had to be discontinued at the end of August, and consequently the Waverley sheet numbered 67 and the Halifax city sheet numbered 68 have not been completed." Surely here is a chance for the Provincial Government to aid an industry which brings more grist to mill than all the other sources combined. Every mining engineer in the province will agree as to the value of these maps, and it would be a wise policy on the part of the local Government to assist the Geological Survey department in getting the whole gold bearing districts plotted as soon as possible.

Professor Bailey, of Fredericton, has also put in a short time in the south-western part of the Province, where he has done some useful work.

The Mooseland Gold Mining Co's property and plant were sold to A. A. McKay, who, we understand, bought it on behalf of some of the members of the old company. The price paid was $1,100. We assume that the company will start up again with a *clean sheet* smiling.

The Beaver Dam mines were sold to Mr. J. M. Chisholm for $1,270. A discussion was raised by Mr. Turnbull, who contended that a higher bid had been made. He said he had no intention of letting the property go at such a low figure. His objection was, however, overruled.

The Cape Breton Copper Co., Ltd., propose increasing its capital from $1,000,000 to $2,000,000.

It is with a feeling of the deepest regret that we have to announce the death of Mr. S. F. Andrews, which occurred on the 2nd inst. at Caribou mines. Mr. Andrews left Halifax apparently in good health a week earlier, and the news of his sudden death came as a great shock to all. Mr. Andrews has been connected with mining in this Province for close upon thirty years.

Mr. Baker has started work again at Golden River, Chester Basin. 56 tons of quartz crushed last month yielded at the rate of 2 ozs. per ton.

The Brookfield Mining Associates crushed 156 tons of quartz and 275 tons of shale last month, the total yield being 330 ozs. of gold. Mr. Libby is now turning his attention to his concentrates, 100 lbs of which have been sent to F. H. Mason, of Halifax, to report on, and a ton to Carolina for a commercial test, while the company are experimenting themselves at the mine. The experiments have not been concluded on going to press, but we hear that up to date everything points to the concentrate being easily treated by chlorination, and it is probable that a plant will be erected almost immediately. Mr. Libbey has upwards of 6,000 tons of tailings, which give high assays, so it is probable that the very respectable returns from North Brookfield will be considerably increased, which will place this mine as the first amongst the producers in Nova Scotia. The Brookfield Associates have in the past, and are still showing a great deal of enterprise, for which they are being justly rewarded.

The additional 20 stamps at the Richardson mine have produced the desired result, the yield last month being just about double the usual returns. This property is now paying its shareholders over 70 per cent. per annum.

There are at least five mines in Nova Scotia which are paying over 50 per cent. on the capital invested in them, and it will not be long before foreign capitalists turn their attention to so promising a field for investment. The returns received at the Mines Office for the month, which appear elsewhere, are over three and a quarter thousand ounces, including some back returns. This, of course, compared with other gold producing countries, will appear small, but considering how few of our mines are worked to anything like their full capacity, and the total disregard which our mines have in the past shown to anything but free milling gold, those of last month are most encouraging. It must be a source of regret to those who have the welfare of the gold mining industry of this Province at heart, that more work is not being done in the Sherbrooke district. In the table of returns for the various districts of Nova Scotia between the years 1862 and 1891, which appeared in our last issue, it will be noticed that this district produced 119,946 ozs. 17 dwts. 22 grs. of gold, the average yield of the ore being $13 99 per ton. To those who have a knowledge of this district and know how little development work has ever been done, and the methods of mining employed in the past, it is clearly one of the finest openings in the Province for a large and systematically worked plant, and there could in our opinion be only one result from the erection of the same, namely success; always provided, of course, the management is in capable hands.

Mr. W. L. Libby has gone to South Carolina to personally witness the treatment of the concentrates sent there. Push is evidently the motto of the Brookfield Mining Associates.

The returns from the Modstock mine for the months of January, February, and March are 361 oz., 7 dwt., from 743 tons of ore, while those of the New Egerton Mining Co. for the same period, 1,034 oz., 15 dwt., from 1,570 tons of quartz.

The returns from the Tudor Gold Mining Co. for the six months ending March 31st, are 248 oz., 10 dwt., from 1,598 tons of quartz.

Messrs. Davidson and others have started work again on their property at Wine Harbor. The ore is running over half an ounce to the ton and with capable management this property should turn out well.

We recently had some specimens given to us from Peter Dunbrack's find at Brookfield, Queen's Co. The quartz is unlike anything we have ever seen in Nova Scotia before. It is absolutely yellow with very fine gold; it carries some oxide of iron, but no sulphides, although of course these would be likely to appear at a greater depth. The ore at present is certainly a free milling one, the only question in our mind being whether some of the fine gold might not escape the battery plates.

CORRESPONDENCE.

The Mount Adams Mines, B.C.

To the Editor:

SIR,—I notice that you have mentioned the report that the Mount Adams group of mines in the Slocan district of British Columbia have been sold. Knowing your love of accuracy, I write to say that this is not correct. You are right in saying that Professor Penrose examined the mines and reported favorably. Through his recommendations proposals for the property have been made, but the owners feel that it is good enough to keep, and the Mount Adams Mining Co. is now being incorporated for the purpose of working the property productively. Operations will commence under the direction of Walter C. Adams and Robert Cordick, as soon as the thawing of the snow will permit.

Yours, &c., ROBT. C. ADAMS.

Montreal, 2nd April, '96.

The Quebec Gold Field.

SIR,—In your REVIEW of February, '96, I read a discussion on a paper by Dr. Ells on the Slates and Quartzites of Quebec, read before the G. M. A. of Quebec. J. E. Hardman, M.E., who was present, made some remarks about the slates and quartzites of the County of Beauce, which I think are not according to facts, and if you will allow me a small space in your valuable journal, I would like to say a few words in regard to what he said, and if you think any remarks I may make will benefit the mining community, please publish the same. But before I say any more, I may state that I spent about 20 months on the Gilbert river in 1878-79. I sunk a shaft close to the St. Onge shaft, where Mr. Fitzpatrick says they got so much gold. Our shaft was known as the Forgie shaft. I am only saying this to give you an idea that I know a little about the Gilbert river. I have been in Nova Scotia for a short time, mining for gold, but it was in a conglomerate, and I have seen some of the slates and quartzites there, and I must say that Dr. Ells, is perfectly correct in saying that the slates and quartzites of Quebec are similar to those of Nova Scotia. Perhaps Mr. Hardman has never sunk a shaft on the old river bed (I am speaking with regard to the Gilbert river); if he had he would find the bed-rock there similar to the slates in Nova Scotia, at least in that part where I was, and that was in Gay's river, where there is a large body of conglomerate overlying them, the lower part of which is gold-bearing; between the conglomerate on the bed-rock and the conglomerate above it, there is a bed of sand (now sandstone) which is quite distinct from the conglomerate below; that bed of sandstone forms a bottom for the upper conglomerate. And if Mr. Hardman is sinking for any of the old river beds in the Chaudiere district, he will find something similar; it may be not cemented, but he will find a change in his sinking before reaching pay dirt; if he does not, he will get very little gold. In the shaft I sunk on the Gilbert river, I went through a fine body of silt, about 40 ft. in depth; some of the miners called it clay, but it was a beautiful fine silt, evenly deposited, and lying on top of the *pay dirt*. That silt formed a bottom for a drift which rested on top of it, and it was from that drift where the most of our water came from. A short distance to the side of the main channel, the sinking was through tough clay, some of it like leather, and no gold underneath, which the same St. Onge Co. knew to their cost. I think Mr. Lockwood will bear me out in what I say, for he was there at the time. As a general rule, the softest and easiest sinking is over the deep ground in alluvial sinking, and hardest if lava rock takes the place of alluvial; at least that is my experience on the Ballarat gold fields of Australia. And I must say, the old river bed of the Gilbert river resembles the old river beds of the Ballarat in every particular. And I may here remark that in sinking a shaft in alluvial for gold, and when getting close to the pay dirt, if you don't find the different strata evenly deposited, very little gold will be found. The pay dirt should have a clean appearance, the boulders cleanly washed, the same as if a good current of water had been playing around them; but it takes a little experience to be able to tell the difference between clean and dirty pay dirt. The depth of the present river beds is no indication of the depths of the old ones, for they are generally deeper than the present beds. The main old river bed at Ballarat is hundreds of feet below the bed of the present one. And if any party sink for the old channel of the Chaudiere, they will find it a great deal deeper than the bed of the present one. Mr Hardman instances a well being sunk at St. George on the north side of the Chaudiere, 59 ft. below the present channel and still in clay. I think that proves the old channel to be much deeper than the present one. And if any party sink on the north bank of the Chaudiere, say between the Gilbert river and St. François (that is ground I know), they will find the old river bed much deeper than the present one, and I am sure they will get gold, but whether payable or not I can't tell; and perhaps by doing so they will find payable quartz reefs. That is how some of the best paying quartz reefs were found out in Ballarat and district. Some of the companies in that district sunk through nearly 400 ft. of lava rock, which lay on top of the alluvial deposit, lying on the bed rock; that was their pay dirt, ond some of it was very rich. In working out the deposit on the old river bed, they came across quartz reefs, and it is some of these they are working now, after taking out and washing all the alluvial that was payable, and at last accounts are now working these reefs at a depth of nearly 2,000 ft. Mr. Hardman, in speaking of quartz, says that if he requires a glass to see gold in it, he does not care for it. Now, I take exception to that remark, and I'll give an instance of very rich quartz where gold was not easily seen in it. The Caledonia mine in New Zealand, about 26 years ago, struck very rich quartz —so rich, that within two months from the time of striking it, a debt of $100,000 was paid; and still very little gold could be seen in the quartz, for the gold was coated with something of a blueish color and could not be seen. In your February number of the REVIEW you will read of quartz taken from the Lake Harold mine, Rainy river, which did not show gold, but yet assayed well. Ricketts & Banks, of New York, made an assay of it, and as the test was a high one, and no gold to be seen in the ore, they repeated it, the result showing $314.00 per ton. So after all, although gold can't be seen in quartz, still it may be payable. Mr. Hardman also says that the ordinary miner in past years has done nothing but fossick and dig gopher holes. I think he can't say that of the miners of the Gilbert river, for they had to sink and drift in the old river bed before they could get much gold. Hoping I have not trespassed on your space too much.

Yours, &c., WILLIAM TODD.

Louisburg, Cape Breton, April 21st, 1896.

SIR,—Reading Professor Hardman's remarks in your February number on Dr. Ells' paper on Gold in Quebec, I have been astonished that he should not have referred in any way to the history and bibliography of gold mining in the Province of Quebec as recorded in detail in the publications of the Geological Survey of Canada.

Your readers might be referred to the Geology of Canada, 1863, pp. 518-520 and pp. 739-745; also to subsequent reports by Mr. Michel and Dr. T. Sterry Hunt, Vol. 1863-1866, also to my own report, Vol. 1871, on the gold fields of Quebec and Nova Scotia.

Mr. Hardman might perhaps learn some facts from a careful perusal of the reports referred to, which his remarks on Dr. Ells' paper justify me in supposing he has never read. Neither in Dr. Ells' paper nor in Mr. Hardman's criticism of it are there any new facts advanced affecting the practical development of the Quebec gold mines.

Dr. Ells makes no statement respecting them that would not be made, and indeed have not already been made by others who have "*specially studied* the economic minerals of the County of Beauce," Logan, Hunt and myself included, all of whom have done so, and may be presumed to have some knowledge of gold mining.

Mr. Hardman's contempt for quartz in which the gold could not be seen without a lens can only be regarded as an indication of his very limited experience in the matter of gold quartz mining.

ALFRED R. C. SELWYN, F.R.S.

Ottawa, 28th April, 1896.

Mr. Hardman Replies to Dr. Selwyn and Mr. Todd.

SIR,—Your favor of April 9th, enclosing copies of letters from Dr. Selwyn and Mr. Todd, and requesting a reply for the next issue of the REVIEW, has been received.

I am not at all sure that I can comply without discourtesy to the General Mining Association of the Province of Quebec. Dr. Ells' paper and my discussion were a part of the proceedings of the association at its regular meeting in January, and were published in the REVIEW solely because that paper is the association's official organ, and not in any guise as "copy" or newspaper material. Therefore it seems to me that any further discussion should properly be first submitted at some meeting of the association before publication; and if an apology is needed for the following it must come, Mr. Editor, from yourself, as the Secretary of the association.

Dr. Selwyn's letter embodies five statements, viz.:— First, his "astonishment" that I did not refer to the "history and bibliography" of the subject under discussion; second, that I have never read the references he gives, or I would have learned some "facts"; third, that neither in the paper itself nor the discussion were any new facts advanced "affecting the practical development" of Quebec's gold resources; fourth, that Logan, Hunt and Selwyn "may be presumed to have some knowledge of gold mining"; fifth, that because I expressed a desire to see visible gold in the veins of Beauce, I must have had a "very limited experience in the matter of gold quartz mining."

I will take these statements up seriatim. (1) I fancy the Dr's "astonishment" will be exceeded by that of such of your readers as are members of the technical societies, when they learn that a member who *discussed* a paper is supposed to give the "history and bibliography" of the subject. I had always fancied myself (and it has been my experience) that if any "history and bibliography" were wanted its proper place would be the *paper itself*, and not *discussion*. If the venerable ex-Director will go so far out of his usual path to read the papers and discussions of other technical societies his "astonishment" will increase and have plenty to feed upon, but he will find I am in good company. (2) I beg to inform Dr. Selwyn that the Geol. Survey Reports for 1863, 1866 and 1871 are on my shelves, together with Mr. Michel's report and many others which the Dr. does not mention; that I read his references carefully several times before, during and after my visit to Beauce; that I did learn some facts from such perusal, and that I learned also a lot of facts which are not contained in those volumes, and some facts which are not in accordance with the *speculations* to be found therein.

(3) Dr. Selwyn is unconsciously correct in his third statement, for there *is* no "practical development" to be affected by "facts," "new" or otherwise. *Practical development* is what is wanted to *furnish* facts, practical development is what Beauce county never has had, and the whole mass of writing, theories and surmises constituting the "history and bibliography" of this region must be taken on trust until development proves or disproves it. Beauce has had geologists galore, and what there is to know from present facts is fully and admirably set forth by Dr. Selwyn in "Report of Progress, Geol. Survey of Canada, 1870-71." What is now needed is a period of development by practical men, educated engineers, who shall accumulate a store of *new* facts for the geologist of the immediate future.

(4) The fourth statement, that Logan, Hunt and Selwyn may be presumed to have had some knowledge of *gold mining* is debateable; that all of them are past masters in geology goes without saying; that any of them ever had any *practical knowledge* of mining invites proof.

(5) Had Dr. Selwyn attended the evening session on January 8th, as well as the afternoon session, he would have known that my remarks concerning visible gold in quartz referred entirely to Nova Scotia quartz, and the Quebec quartz characterized by Dr. Ells as "precisely similar." In the condensed stenographic report of my discussion this is not so clear as perhaps it should be. However "limited" my experience for the last nineteen years in various parts of the North American continent may appear to Dr. Selwyn, it has been long enough to teach me that the vast majority of paying gold quartz mines in North America have been discovered through the finding of outcrops carrying visible gold; I am not talking of auriferous pyrrhotite nor smelting ores, but of free-gold quartz.

It is perfectly true that we may look over tons of rock from the Alaska-Treadwell, from the "Belt" in the Black Hills, from the "sugar quartz" of Georgia, Alabama and the Carolinas, from many of the Bodie mines and others in California, without seeing a "color," and yet have the same rock contain a paying amount of gold, but it is equally true that if you cannot see the "color" in Nova Scotia quartz you are pretty sure of a loss and not a profit.

For nearly 50 years the "history and bibliography" of the Beauce district has been recording "assays" of quartz veins, running from a trace upwards; for nearly 40 years intelligent *habitants* have been searching for a paying gold quartz vein; for nearly two years past a three stamp mill has been testing the veins of one locality, and what is the sum total of results? No paying gold quartz vein has yet been found in Quebec. If superannuation has not prejudiced Dr. Selwyn let him read p. 92 of the Summary Report of the Survey for the year 1895. The utter unreliability of an *assay* of free-gold quartz never had better exemplification than the past record in Beauce.

As to Mr. Todd's letter a few words will suffice.

He acknowledges that his experience in Nova Scotia is confined to a short period on the Gays river conglomerate, hence I must question his knowledge and ability to compare the gold series of Nova Scotia with the Cambrian of Quebec.

Mr. Todd's reference to visible gold is answered above

I have never *sunk* a shaft on the Gilbert, but I have seen the slates of the "Old River Bed" *en situ* there, and have seen the "bed-rock" of other old channels in other parts of Beauce, and I agree to differ with Mr. Todd upon this matter. Furthermore, it was precisely these old workings in the Gilbert district rather than anywhere else which led me to use the words "fossick" and "gopher," to which Mr. Todd objects.

What the occurrence of "lava" and "alluvial" in Ballarat, and how the pay dirt should appear, and kindred topics, have to do with my discussion of Dr. Ells' paper is not apparent to me, and calls for no reply.

Yours, etc.,

JOHN E. HARDMAN.

Montreal, April 30th, 1896.

COMPANIES.

Bell's Asbestos Co., Ltd.—The eighth ordinary general meeting of the shareholders of the Bell's Asbestos Co., Ltd., was held last month at the Cannon Street Hotel, London, Eng., under the presidency of Mr. Henry Heywood. The secretary (Mr. Geo. W. Giles) having read the notice convening the meeting, the chairman said:—Gentlemen, when I had the pleasure of addressing you at our last annual meeting, I ventured to express a hope and belief that the year we had just entered upon would prove as satisfactory to you as the previous year had been. Our business in Southwark Street was increasing month by month, the demand for crude asbestos at the mines was good and everything pointed to a satisfactory financial result at the end of the year. It is therefore with the greatest disappointment that the board and myself have to come before you today with so great a diminution in the profits resulting from our year's trading, although such result has been brought about certainly through no fault of the board or of your managing director. The report states that for some reason or other our old friends, the firm with whom we had dealt for many years, the H. W. John's Mnfg. Co., of New York, refused to take deliveries of crude material which they had purchased from us. The reason of this I cannot say, but you will naturally understand that if, after making contracts extending over a considerable period, and having mined that material and prepared it, deliveries are not accepted, a serious loss must result and our best efforts must naturally fall to the ground. The refusal of that company to accept deliveries of course caused a considerable amount of discussion on our part and your managing director proceeded to New York for the express purpose of making some satisfactory arrangement, if such an arrangement could be made. But as this visit ended in failure, there was no alternative but for us to take legal action, and law proceedings have been commenced against the company I have referred to for damages, the results of which, of course, we have to await. The business which we have done during the year in Southwark Street—which is the head and centre of all our business—has been, on the whole, perfectly satisfactory. That business has increased during the year, as I think you were aware it was increasing at the commencement. The turnover has been very much greater; but naturally, as with all companies paying good dividends, we have encouraged, so to speak, competition, and that competition has been very severe, so that prices have not been maintained. Still with the increased business, although we have reduced prices, we have fully maintained our position. One of the events that has occurred during the year has been the formation of a small company, the Bell's Asbestos West Australian Agency, Ltd., to whom we have granted the exclusive concession of selling our manufactures and things in which we deal in Western Australia. A consideration has been paid for this concession which will appear in one form or other in our next balance sheet and which I doubt not will be satisfactory to you. Turning to the accounts you will see that £5 shares have been reduced to £1, and we consider that this alteration will add materially to the advantage of the company, inasmuch as we have a greater number of partners, all of whom, I hope, are anxious to push the business with which we are connected and anxious of course for its success. We have reduced the number of bonds from 582 to 557, and therefore we owe on debentures £54,800 instead of £57,524; and I have no doubt that those who are bondholders will be very pleased to hear that those bonds are unobtainable under 110. The item of creditors stands at £11,483 against £10,020 last year; the reserve fund is £60,000 against £55,000; and the machinery reserve fund is £1,500 against £750. On the credit side the first three items naturally follow the amount of profit which has been made during the year—the cash at the bankers, the bills receivable, and the debtors. They all show a great reduction in consequence of the loss of profits. Stock-in-trade has been reduced from £28,000 to £22,000. The estates in Canada show a slight increase, because we put down additional machinery there. During the year your managing director paid his usual visit to the mines and reported that they had opened out a good deal of the asbestos material, and that so far as he could judge, the deposit was still very considerable, and would last an indefinite time; he also stated that the machinery was all in good order and that everything was in a perfectly satisfactory state. The freehold premises in Southwark Street stand at £25,895. The result of the year's operations show a net profit of £3,200, to which we have to add the amount brought forward from the previous year, £3,582, making £6,800 in all. With these observations I beg to move the following resolution:—"That the report of the directors and of the auditors, and the financial statement submitted to this meeting, be and the same are hereby approved, adopted and confirmed."

Mr. A. J. Burnett seconded the resolution. In reply to questions the chairman said he did not know the reason the John's Mnfg. Co. refused to take deliveries. That company said they (Bell's Asbestos Co.) were rather late in tendering the material which the John's Co. had bought. That, however, the directors denied. The reserve fund, as he had before informed the shareholders, was practically trading capital. The resolution was carried unanimously, and the payment of a dividend of 3 per cent. free of income tax was approved.

Mr. T. B. Lightfoot and Mr. W. C. Johnson were re-elected to the directorate, and Messrs. Cooper Brothers & Co. were re-appointed auditors, the proceedings closing with a cordial vote of thanks to the chairman and directors.

The Roche Percee Coal Co., Ltd., seeks incorporation by letters patent under the Companies Act, Revised Statutes of Canada, for the purpose of carrying on the business of colliery proprietors, coke manufacturers, iron masters, manufacturers of bricks, pipes and tiles of miners and engineers in all their respective branches. The chief place of business is to be in Winnipeg, Man. Capital stock $50,000, in 500 shares of $100 each. Directors: H. E. Mitchell, Chas. H. Cordingley, T. H. Gilmour, Clifford B. Deacon, all of Winnipeg; and Robt. Rogers, Clearwater, Man.

Anglo-Canadian Mining Exchange, Ltd., seeks incorporation under the provisions of the Companies Act, Revised Statutes of Canada, for the following purposes. To carry on the business of general agents and dealers in mines, mining locations and mining lands in the Dominion of Canada; to buy or take on lease and then to sell, exchange, grant leases or deal in any way whatsoever with any mines, mining lands and mining properties, or to obtain options thereon for the same purpose; to examine, inspect, and investigate all such properties for the better placing of the same upon the market. Chief place of business, Toronto, Ont. Capital stock, $50,000, in 5,000 shares of $10 each. Directors: John J. Kingsmill, E. Mackenzie, Henry O'Brien, Jas. Gunn, Geo. P. Plunkett Magann, A. Fraser, Geo. Gurd, Jacob Dolmage, all of Toronto, Ont.; and J. G. Dixon, Shirley, Southampton, Eng.

Londonderry Iron Co.—Most discouraging is the financial statement of the Londonderry Iron Company of Nova Scotia for the calendar year 1895. The profit and loss account for the year shows a balance of $4,512.93 on the wrong side. This, added to the deficit of 1894, makes $60,306.47 to be carried forward as debit of profit and loss. In the first half of the year the works were only operated three months and expenses exceeded income by $7,770.36. This loss was further swollen by bad debts to the amount of $3,501.21. During the second half there was a gain of $6,758.64, so that the total net result at the close of the year was, as already indicated, between $4,000 and $5,000. In addition to the extremely low prices of the first half, the company had to contend against the temporary disadvantages of inferior fuel and drought. A dirty seam of coal having been struck by the Acadia company, who furnished the coke, the operations were greatly retarded and the furnace more or less impaired. Then during July and August the unprecedented drought told on the water supply and caused frequent stoppages. All this not only affected the furnace, but also the quality and quantity of the iron. The total yield of iron during the 293 days the furnace was blown was only 15,801 tons, or an average of less than 54 tons per day. Forty per cent. of the make was Nos. 3 and 4. But during the latter half the company drew their fuel from other sources and had no scarcity of water. More than half the coke they now use is made from their own ovens, while a little of the other half is bought from the Acadia company. As the furnace has never fully recovered, however, from the effects of drought and bad fuel, it is proposed to blow her out this month, which will be the more easily done as stocks of ore and all raw material are about exhausted. The company's rolling mill, which had been shut down during 1895, was started again in January and is working on a considerable list of orders for puddled bar. But the company have on hand, and have carried for some years, a large stock of mill iron on which an embarassing loss of interest is suffered, from which it is hoped to obtain some relief this year. The pipe foundry barely paid its way, but it is reported to be now doing better. As to the company's mines, it is found that they can be depended on to yield a larger supply of ore than was estimated, and that the furnace can be run without much call on outside sources. After the utmost allowance is made for the specially unfavorable circumstances of last year—the depression with its attendant low prices, heavy cost of carrying stock, and load of bad debts, the drought and the inferior fuel—the position of the company remains serious and is, but little brightened by the hopes of greater prosperity this year, for the financial situation is becoming critical. Their current indebtedness exceeds their floating assets by $44,285.54. Their fixed capital having failed to earn a profit, it will be hard for the company to raise money enough to pay off this floating indebtedness and to make needed improvements by issuing more stock. The directors have endeavored to induce some of the leading shareholders to come to the assistance of their enterprise by taking up a moderate issue of bonds upon the security of the property, which is unencumbered, but the proposal has not met with acceptance. This would be really of the nature of a reconstruction. Only by some internal arrangement does it seem possible that the company can right itself. To draw more money from outside seems to be out of the question. The company have had so many vicissitudes that even if their present situation were less grave, investors would scarcely care to place their money in their industry. If they are able to continue, it will only be by a system of contraction which may cut down indebtedness, but must mean a smaller scale of business and no profits. The company seem to be less favorably situated than the New Glasgow and Ferrona concerns, which have evidently passed through their experimental stage and have demonstrated that iron can be profitably produced in Nova Scotia.—*Iron Age.*

Milne, Coutts & Co., Ltd.—Has been incorporated under the laws of New Brunswick, with an authorized capital of $25,000, in shares of $100, to quarry and deal in granite and stone. Head office: St. George, N.B. Directors: Alexander Milne, Wm. Coutts, Charles Johnson, Jr., all of the parish of St. George, N.B.

Victoria Granite Co., Ltd.—Has been incorporated with a capital of $5,000, in shares of $100, to carry on the business of quarrying in the Province of New Brunswick. Directors Caleb C. Hennessy, Stephen Conley, O. F. Bogue, J. R. O'Brien, J. H. Frauley, and H. F. McDougall. Head office: St. George, N.B.

The Saw Bill Lake Gold Mining Co., Ltd.—Has been incorporated in Ontario with an authorized capital of $100,000, in shares of $1.00. Directors: J. H. Tilden, Hamilton; Wm. Southam, Hamilton; F. C. Bruce, Hamilton; G. T. Marks, Port Arthur; T. W. Lester, Hamilton; H. N. Kitson, Hamilton; H. Beckett, Hamilton; John Hoodless, Hamilton; H. A. Wiley, Port Arthur; F. S. Wiley, Port Arthur, and W. H. Plummer, Sault Ste. Marie. Head office: F. S. Wiley, Managing Director, Port Arthur, Ont. Formed to acquire mining locations 313 X and 314 X, situate on Saw Bill lake, an arm of the Seine river, in the Rainy river district, Ontario, and for the further purpose of fully equipping the property with mining and milling machinery for its development.

Ontario Miners' Development Co., Ltd.—Is being organized with a capital of $75,000, to acquire gold mining properties in Western Ontario. The Secretary of the company is Frank McPhillips, 11 Quebec Bank Chambers, Toronto.

Victoria Tripolite Co., Ltd.—Has been incorporated in Nova Scotia with a capital of $7,000 in shares of $10 each, to mine for tripolite and other minerals or clays in the Province of Nova Scotia. Directors: J. D. Copeland, Antigonish; Frank T. LeMoine, North Sydney, and W. J. B. Bingham, St. John, N.B. Head office: North Sydney, Cape Breton, N.S.

The Silica Barytic Stone Company of Ontario, Ltd.—The Guelich Silica Barytic Stone Company of Ontario makes application to the Ontario Government to change its name as above. Head office: Guelph, Ont.

Mount Adams Mining Co.—This company has been organized with an authorized capital of $150,000, in shares of $1. Trustees: Capt. R. C. Adams, New Denver, B.C.; R. B. Kerr, New Denver, B.C.; W. C. Adams, Sandon, B.C. Directors: Peter Lyall, Montreal; A. W. Stetson, Boston; J. C. Haynes, Boston. The company has been formed to acquire and work the Mount Adams group of

claims, comprising the "Mammon," "Chamblet," "Slater," "Bretomarte" and "Midnight," situated on Mount Adams in the Slocan district, Province of British Columbia. The property is seven miles from the town of Three Forks and three miles from the town of Sandon. Dr. R. A. Penrose, Jr., Chicago, the well known authority, who inspected the property last year, writes :—

"The ore consists of silver-bearing galena, varying from 50 to 130 ozs. per ton in silver, and from 50 to 80 per cent. lead. So far as the assays at present in hand go, it is probable that the pure ore will average 100 ozs. or more of silver per ton, and about 70 per cent. lead. These estimates, however, are derived from only three samples taken by myself. A large number of samples taken by your son, Walter C. Adams, are now on the road, and when assayed will give a much closer average of the value of the ore than the few now available.

An ore of the quality mentioned is of extremely high grade, and is one very much sought after by the smelters, so that it always finds a ready market.

Its value would average approximately $100.00 per ton, and if future explorations show it to be in large quantities, a net profit of of $50.00 a ton or more should be made over and above all costs of mining, hauling, freight, duty into the United States, and smelter charges.

Much of this ore could be shipped direct to the smelter without previous concentration, but in mining such ore, a large amount of lower grade ore would be produced, which could be concentrated and then shipped.

The ore occurs in veins intersecting a series of interbedded slates, limestones and quartzites, and occupying well-defined fissures dipping steeply and traceable on the surface for very considerable distances. The main vein has been opened on the south side of Mt. Adams on the Chamblet claim, and has been traced thence over the summit and down the north slope, through the Slater, Britomarte, and on to the Midnight claim—a distance of about a thousand feet. More or less ore is found throughout this outcrop, and in some places it is several feet in thickness. Frequently the ground along the outcrop of the vein is honeycombed by interlacing seams and irregular bodies of ore; and in a number of places branch veins, varying from a few inches to a foot or more in thickness, radiate from the main vein, and could be made a profitable source of ore aside from the main vein.

The main vein and some of the branch veins have been thoroughly prospected on the surface throughout the property, though but little underground work has been done. The largest underground work is a tunnel about 200 ft. long, on the Chamblet claim, run in on the main vein. Ore was not found here until the tunnel had entered the hill for about 150 ft., when it appeared and gradually increased in thickness to the end of the tunnel, where it now measures between one and two feet in thickness. Besides this tunnel, several other smaller tunnels and cuts have been made, most of which show promising outcrops of ore."

Pittsburg and Cariboo Gold Dredging Co., Ltd., has been registered in British Columbia to carry on gold dredging in the Fraser river and its tributaries. Authorized capital, $500, in shares of $100. Head office: Pittsburg.

Georgia Gold Mining Co., Ltd., has been incorporated to purchase the Georgia mineral claim in the West Kootenay district, B.C. Authorized capital, $1,000,000. Head office: Victoria, B.C. Directors: H. H. R. Chapman, J. L. Warner, and Joshua Davis.

Helen Gold Mining Co., Ltd., has been registered at Spokane, Wash., with a capital of $600,000, to carry on mining in British Columbia.

Rochester Gold Mining Co. has been registered with headquarters at Spokane, Wash., and an authorized capital of $600,000, to carry on mining in British Columbia.

Quadra Mining and Milling Co., Ltd., has been incorporated to acquire within the Alberni mining division on Vancouver Island, the claims known as the "Ophir" and "Last Chance." Authorized capital, $500,000. Directors: G. A. Kirk, Thos. Shotbold and John Bryden. Head office: Victoria, B.C.

Antler Creek Mining Co., Ltd., has been incorporated to acquire the placer mining claims held under leases, or for which leases have been applied for in the district of Cariboo, in the Province of British Columbia, by the following:—On Cunningham creek, D. Patterson; in Cunningham Pass, Thomas Dunn, R. G. Tatlow, I. Oppenheimer and D. Oppenheimer; on Antler creek, J. Patterson, D. Oppenheimer, I Oppenheimer, R. G. Tatlow, T. Dunn, D. Patterson, S. Oppenheimer, L. Doucet, W. H. Kennedy, C. F. Barker, H. Miller, K. Miller, R. McLelland and W. D. Burdis; on Little Valley creek, D. Patterson, T. Dunn and R. G. Tatlow; on French creek, I. Oppenheimer; on Canadian creek, D. Oppenheimer; either for money or fully paid up shares of the company. Authorized capital, $1,000,000, in shares of $5. Directors: David Oppenheimer, R. G. Tatlow, and Thomas Dunn. Head Office: Vancouver, B.C.

Abraham Lincoln Gold Mining and Milling Co.—This company has been organized under the laws of the State of Maine, to take over certain gold areas at Gold River, Lunenburg County, Nova Scotia. Authorized capital, $1,000,000 in shares of $1.00. Head office: Equitable building, Boston. E. H. Dunbar, Sec.-Treas.

New Egerton Gold Mining Co., Ltd.—is seeking incorporation in Nova Scotia with an authorized capital of $200,000. Head Office: New Glasgow. Directors: J. D. McGregor, Peter A. McGregor and John Yorston. The properties are at Fifteen mile stream and have been successfully worked for many years.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

The following Courses are Offered

1. *Three Years' Courses for a Diploma in*
   - (A) Mining Engineering.
   - (B) Analytical Chemistry and Assaying.
2. *Four Years' Courses for a Degree in*
   - (A) Mining Engineering (M.E.)
   - (B) Chemistry and Mineralogy B. Sc.)
   - (C) Mineralogy and Geology (B. Sc.)
3. *Post-Graduate Courses for the Degree of*

   Doctor of Science (D. Sc.)

   For further information see the calendar of Queen's University for 1894-95, p. 117.
4. *Prospector's Course.*

   The School offers to Mine Foremen, Assayers, Prospectors and Mining Men generally, Special Courses of Instruction beginning January 8th, 1896, and continuing eight weeks.
5. *Extramural Classes for Prospectors and Mining Men.*

   Lecturers will be 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 recently built the operations of Crushing, Amalgamating, Concentrating, etc., can be studied on a large scale.

The BRUCE CARRUTHERS SCHOLARSHIP (value $200 per annum) will be awarded in May. Its object is to aid one who has had some experience in amalgamating, etc., in acquiring a good education in Mining Engineering. The conditions of the award will be made known on application to the Director or the Bursar.

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,

SCHOOL OF MINING, - KINGSTON, ONTARIO.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

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

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

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

MINES OTHER THAN GOLD AND SILVER.

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

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

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

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

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

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

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

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.