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SEVENTEENTH YEAR OF PUBLICATION

The Canadian Mining Review

Established 1882

Vol. XVIII—No. 11. OTTAWA, FEBRUARY 28th, 1899. Vol. XVIII—No. 11.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

The Following Courses are offered

1—Three Years' Course for a Diploma in

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

2—Four Years' Course for a Degree in

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

3—Post-Graduate Course for the Degree of

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

4—Prospectors' Course.

The School offers to Mine Foremen, Assayers, Prospectors and Mining Men generally, Special Courses of Instruction beginning January 10th, 1899, and continuing eight weeks.

5—Extramural Classes for Prospectors and Mining Men.

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

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

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,

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

—AND—

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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 quarts 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.

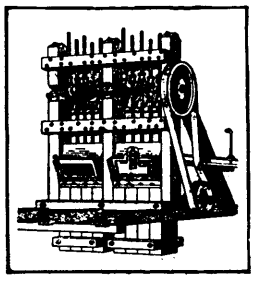
The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou 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.

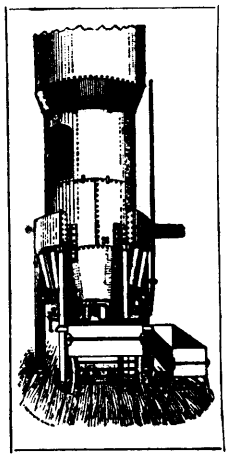
Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.





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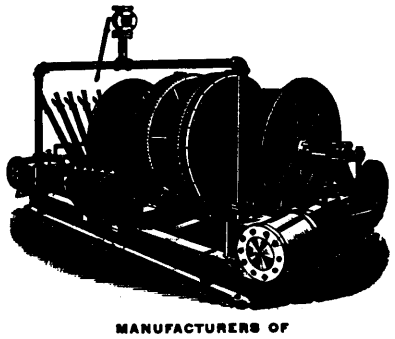

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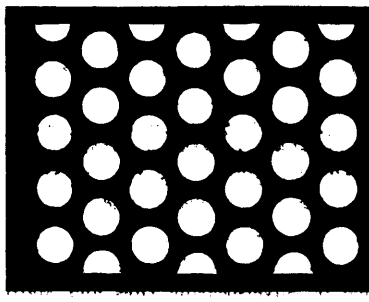

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17th YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

B. T. A. BELL, Editor and Proprietor.
Secretary, Canadian Mining Institute, etc.

Published Monthly.

OFFICES {Slater Building, Ottawa; Windsor Hotel, Montreal.

VOL. XVIII., No. 2. FEBRUARY, 1899. VOL. XVIII., No. 2.

The Smelting of Ore in the Kootenays.

It is now announced that the Canadian Pacific Railway Company will commence, during the coming spring, the construction of a large reduction-plant in the Boundary region. This scheme is in the line of the general policy of the company, as already outlined, namely, to give to the miners in this section of British Columbia the benefit of the lowest possible smelting charges on all classes of ores, thus placing them, as regards the cost of reduction, upon the same footing with the miners of the older camps in the United States. At Trail, this has been already accomplished by the establishment of charges of $7 per ton (and, in some cases, even less) for the treatment of refractory ores, requiring roasting, and containing a high percentage of silica and alumina, while running very low in copper. It may be doubted whether more favorable rates are offered to miners of such ores even in Colorado or Montana.

The policy of building large smelters, which seems to have been adopted and to be in process of energetic execution by the Canadian Pacific Railway Co., with the aid of first-class metallurgical ability in the details of design and operation, has been sometimes criticized as detrimental to the general development of the smelting industry, and thus, indirectly, of the mining industry as well, in the Dominion. It is argued, sometimes, that the entrance into this field of a large corporation, controlling the business and rates of transportation, discourages private smelting enterprises, and thus deprives the miner of the advantages of free competition, such as is supposed to be prevalent in the United States. This is a plausible theory; and it is conceivable that, under certain circumstances, it might be confirmed in practice. For instance, if a large railway corporation, having excluded rivals from the field, should proceed to extort unreasonable profits from an industry at its mercy, there might be reason for complaint. But the remedy of such an evil lies in the nature of the case, even apart from legislative interference as to rates. A simple consideration of the amount of capital invested in a great railroad, as compared with that invested in a smelting works, or a dozen smelting works, will show that the transportation business is far more important than the contributory smelting business, and that no great railroad company can afford to restrict its transportation of ores, bullion and supplies by imposing high rates upon its customers in the comparatively subordinate business of smelting. If the smelting business should be owned by a favored "ring," which sacrificed to its special interest the interest of the railway company, the case, it must be confessed, would present a different aspect. But that evil has its own appropriate remedies; and, as it is not indicated in the situation now under consideration, it need not be considered here.

The general proposition, as to the comparative benefit to the mining industry of a few large smelting works, located at suitable commercial centres, and numerous small works, located close to the mines, has been abundantly illustrated in the United States. All through Colorado, Montana and Utah are scattered the ruins of abandoned smelting works, which have been operated from a day to a year, it being only a question of time, how long they could survive. Not one of them ever reduced ores cheaply. Without exception, they have failed, in spite of high smelting charges, because such small concerns, located with reference to an adjacent ore-supply only, without regard to the larger controlling conditions of success, could not possibly succeed. Only in a very few instances, such as the United Verde, the Anaconda, and the Calumet and Hecla copper mines, or the great New Jersey zinc mines near New York city, can a single deposit or locality support its own reduction works, and furnish them with ore-mixtures adapted to economical reduction.

There is a stage in the development of every new mining region, in which the local rivalry of competing camps demands that each shall have its own "smelter." as an evidence of its permanent progress, and often goes so far as to offer "inducements" to capital, on the strength of which it may, perhaps, undertake the perilous venture. The (usually both ill-advised and inadequate) investment of capital on such conditions speedily comes to grief; and at last it is generally recognized that large smelting works, located at points where fuel, fluxes and ores can be economically assembled and scientifically mixed for the best metallurgical results, and able (by means of their size) to employ the best metallurgical talent, offer to the miner the highest rewards for his labor. Even in instances where small local establishments profess to offer better terms, there is the not uncommon risk that they may "get even" by various tricks of the trade, to which large concerns cannot afford to descend.

In short, the so-called "competition" of small local smelters is a matter which larger concerns in the United States have learned to despise and disregard, knowing that it must die from its own inherent impotence.

Meanwhile, it is a pertinent question: What is the effect of such temporary competition upon the mining industry itself? A small local concern may, for a while, by virtue of the ignorance of its management and the credulity or optimism of its shareholders, go on, in competitiion with larger, better located and better managed establishments, offering rates which it cannot afford to pay, and losing

money without knowing it. There is scarcely any other business in which so great losses can be unconsciously incurred as in that of smelting. The periodical balance sheet is largely an estimate on paper. Values supposed to be contained in ores and by-products on hand are credited as assets; and nothing but an absolute and complete clean-up will demonstrate the actual situation. The management may go on, using up its working capital, for many months after real business failure has been experienced. During such a period, individual ore-sellers may receive, on individual lots often, prices higher than could fairly be paid; but the permanent interest of the mining industry has been really injured; and when the collapse comes, the reaction is likely to more than outweigh the temporary gain.

In a word, the waste incurred by the crude and unskilful smelting of ores in small local works is absolute waste, which does no good to anybody. The saving effected by skilful treatment, under favorable conditions, in properly located large works, is an absolute saving, which involves no loss to anybody, and is large enough to give both higher prices to the miner and fair profits to the smelter. Consequently, the latter system is the more advantageous to both parties, and anything which hinders or delays its adoption is injurious to both.

The Canadian Mining Institute.

If we may judge from the elaborate and handsomely printed programme, which has been issued this month, the meetings of the Canadian Mining Institute, to be held, in Montreal, on 1st, and and 3rd prox, promises to be of an unusually interesting and attractive character to Canadian mining men. Not only does the long list of papers, some thirty-four in number, embrace a wide variety of subjects dealing with mining and metallurgical practice, but quite a large number are to be presented by men who have earned a continental reputation in the mining engineering profession. We understand that the attendance will be in keeping with the high quality of the proceedings, many mine managers and mining engineers from a distance having intimated their intention to take advantage of the single fare rates to Montreal granted by the various railways in connection with the meetings. The circumstances leading up to the organization of the Institute and the excellent work it has accomplished during the first year of its existence, are very well set out in the Report of Council from which we print the following extracts :—

"In submitting this report to the Institute, the Council has deemed it advisable to briefly advert to the circumstances leading to the organization of the Institute out of the Federation of Provincial Societies then in existence. Briefly, this Federation in its two years' existence found that the revenues at its command were inadequate for the payment of its expenses, and the recurrence of a yearly deficit led to the appointment of a Committee by the Council of the Federation to consider how such deficit could be remedied. The report of this Committee was submitted at the meeting held on the 3rd March, 1898, and has been printed and distributed in Volume 3 of the Journal of the Federation.

The result of the thorough discussion which followed the report during that meeting was the organization of the present Institute, and the dissolution of the then existing Federation. The organization of the present Institute is on the same free lines which characterized the Federation, embracing in its membership any and all persons engaged in the direction or operation of mines and metallurgical works, or interested in the development of the Dominion's mineral wealth; and by a decisive vote at the first meeting it was deemed inexpedient to attempt to regulate the practice of the mining engineering profession. It was also deemed best for the Institute, as a body, to refrain from expressing an official opinion on matters purely connected with trade or legislation, as the different provincial organizations still retained their identity, and were best fitted to deal with such questions.

By Section V members in good standing in any provincial association are entitled to membership on payment of 75 per cent. ($7.50) of the regular fee of the Institute, under which arrangement 72 members of the General Mining Association of the Province of Quebec, and 14 members of the Mining Society of Nova Scotia, have joined the Institute. The Ontario Mining Institute has dissolved, but the remaining provincial organizations have retained their identity.

It affords the Council pleasure to congratulate the members of the Institute upon the success which has thus far attended its formation, and to announce that the number of members in good standing has grown from 63 in March, 1898, to 190 at 31st January. The residence of the membership is distributed as follows :

Nova Scotia	16
New Brunswick	2
Quebec	66
Ontario	44
British Columbia	42
N. W. Territories, including the Yukon	5
Great Britain	4
United States	11

Out of this membership it is to be regretted that but two applications have been received for student membership, and your Council has endeavored to obtain the co-operation of the mining schools of the Dominion towards increasing this number. It may not be generally understood by the class of persons eligible for student membership, that the Institute offers advantages to such persons in giving them the privilege of attending the meetings, and taking part in the discussions which may arise; by offering inducements for the contribution of papers; and also the not inconsiderable educational influence obtainable by intercourse with members at the meetings, with the advantages arising therefrom in the opportunities for inspecting mines and metallurgical works.

The Council regrets to record the first loss of a member by death since its organization. The circumstances attending the death of Mr. G. R. Coates while pursuing professional work in the Rainy River district were peculiarly sad. Mr. Coates was a very promising young member, recently graduated from the School of Mines at Kingston, and was possessed of a character which won him the respect and affection of all with whom he came in contact. Many of our members will remember him as contributing with his effective songs to our entertainment at the last dinner of the Federated Canadian Mining Institute.

The Council also regrets allusion to a feature which has occupied its attention at the close of the year, and that is the number of members who are in arrears for subscription. At the last regular Council meeting a resolution was adopted to drop the names of all members in arrears on the 1st day of February, and the membership which has been quoted to you is that only of members in good standing. While recognizing the inequality of the distribution of this world's goods, and equally recognizing the advisability of leniency in certain cases, it has nevertheless been thought best to establish the precedent that only members in good standing shall be counted as on the membership list of the Institute.

The experience of the Council during the year just closed has been that there are several clauses in the Constitution which, in practice, work with friction, or fail to work at all, and the amendments which will be submitted to you and upon which decision is asked to-day, are those which, in the opinion of the Council, are necessary, to facilitate business and to make the machinery of the organization work more smoothly. It will be noted that none of these amendments are of a serious character.

During the year there have been no meetings of the Institute, but there have been five meetings of the Council, the Minutes of which have been printed for distribution. The work which has been accomplished may be briefly summarized as follows:

(1) Through the representations of a committee which went to Ottawa last March, and were granted an interview by representatives of the Cabinet, the Dominion Government made us a grant for the year of the sum of one thousand dollars, to assist the Institute in its work and publications.

(2) An Act of Incorporation was obtained from the Parliament of Canada, chiefly through the energetic efforts of our Secretary, to whom special thanks are due. We are now a legally incorporated body with a Dominion charter, and the advantages of this incorporation will be more apparent each year as our membership, funds and organization increase.

(3) We have been enabled to open and equip Room 4 in the Windsor Hotel, Montreal, as a Library and Reading Room, and general headquarters of the Institute. By purchase, donation and exchange, the Library now includes 268 bound and 161 unbound volumes, besides numerous completed fyles of exchanges and divers pamphlets; also 7 mounted maps of portions of Quebec, Ontario and B.C., with a fyle of the excellent Geological Survey maps of Nova Scotia made by Messrs. Fletcher and Faribault. The details under this head, with list of current exchanges, and a catalogue of the Library, will be found in volume I of our Transactions.

Many members of the Institute have visited and made use of the headquarters as a reading room during their stay in Montreal, and the Council has reason to regard the establishment of this Library with great satisfaction. They take this opportunity of suggesting to members of the Institute the propriety of donating to the Library any duplicate copies of volumes, pamphlets, maps, blue prints or photographs which they may have or obtain, as the funds of the Institute are as yet insufficient to permit of acquiring much of such material by purchase.

(4) The Institute, under the arrangement adopted at its organization, has published Volume 3 of the Journal of the Federated Canadian Mining Institute, embodying some 220 pages, and containing 23 papers, a copy of which has been sent to each member in good standing; also Volume 1 of the Transactions of the Canadian Mining Institute. In addition Certificates of Membership and 1000 copies of the Constitution and By-laws have been printed and distributed.

(5) Information and assistance have been given during the year to 23 persons who have sought our headquarters with inquiries, which have embraced the coal and iron deposits of Newfoundland, the gold and manganese deposits of Nova Scotia, the gold, mica and chromite deposits of Quebec, the gold and mica deposits of Ontario, the oil fields of Alberta, and have had reference to the mineral wealth and maps of British Columbia and the gold fields of the Yukon. To these persons, and to others, have been given pamphlet copies of special papers whenever it has been practicable.

Herewith submitted, duly audited, is the financial statement of income and expenditure for the year ended 1st February, 1899.

RECEIPTS.

Subscriptions, 99 at $10.00	$990 00	
do 87 " 7.50	652 50	
do Students, 2 at $2.00	4 00	
Sales Transactions, 1897	2 00	
Interest on Bank Account	6 17	
		$1,654 67
Grant from Dominion Government		1,000 00
		$2,654 67

DISBURSEMENTS.

Incorporation—		
Gemmill & May, costs	176 00	
Montreal Star, advertising	20 25	
Canadian Mining Review, advertising	10 00	
Secretary's expenses	28 20	
		235 05
Library and Reading Room—		
Purchase of Books	259 00	
Simpson & Peel, Book Case	59 05	
Hawthorne, Maps and Mounting	21 50	
Wilson & Co., framing Photos	7 10	
		346 65
Library Expenses—		
Rent to 1st March, '99	300 00	
Salary, Librarian	40 00	
Sundry expenses, casing books, ex. charges, postage	16 00	
		356 00
Insurance Account—		
Hartford Insurance Co. ($1,000.00)		14 25
Printing and Engraving—		
The Mortimer Co., Printing	442 27	
do Engraving	86 25	
Ottawa Printing Co.	9 00	
Charges on Electros	2 10	
		539 62
Secretary's Office—		
Salary Account	400 00	
Travelling and Hotel expenses	153 00	
Books, Stationery, Postage and Telegrams	114 21	
Typewriting	50 00	
Stafford, reporting Meeting	15 00	
		732 21
Treasurer's Office—		
Services	100 00	
Books, Stationery and Printing	30 93	
Postage and Telegrams	29 26	
Bank Commission	20 88	
Cabinet File	30 00	
		211 07
		2,434 82
Cash Balance on hand		$219 82

The meeting which it was proposed to hold in British Columbia last September was postponed on the advice of members of the Council resident in that Province, but as will be seen by the circular which you have already received, your Council is making every effort for a successful British Columbia meeting, to be held during the month of September next. A further circular will be issued containing full details as to the places to be visited, the probable expense, etc., etc.

The Council desires to remind the members generally that the success of the Institute, as an organization, is dependent upon the individual effort of its members; enrolled as members we have a large number of men well able to furnish matter worthy of being printed and distributed. The success of organizations like our own lies chiefly in the value of their literature. Subjects of a practical character, dealing with matters of every day occurrence in the routine of mine, mill or furnace work, are of special value, inasmuch as the discussions provoked are often of greater value than the paper itself."

Unexpected Result of a Shot.

By Mr. J. G. Rutherford, Stellarton, N.S.*

A shift consisting of two miners and a helper are driving one of a pair of levels in a seam of coal at the Albion mines. The levels are 9 feet wide by 8 feet high, in coal of superior quality though of a strong nature. A brattice of ½-inch boards nailed to props is carried at about 3 feet from the high wall to within 12 feet of the face. Props are also set against the high wall at intervals of 4 feet, with the twofold purpose of supporting the roof timber and by the intervention of slabs preventing the sides from spawling. The seam at this particular spot dips at an angle of about 22 degrees.

The explosive used in getting the coal is called flameless powder; is made up in stout paper cartridges of specified capacity, and is manufactured by the Acadia Powder Company, Halifax.

All shots are fired by electricity.

A few days ago the men went to work as usual, but before going to the face disposed of their superfluous clothing in manner following. The helper or loader hung his solitary coat to a nail in a prop. Brown, one of the miners, wore in addition to his ordinary jacket an overcoat and divested himself of both garments at the same time. In the righthand bottom pocket of the overcoat there were three detonators, or caps, as the men call them, with 48 inch wires, and in the outside breast pocket on the left side there was a 9 oz. cartridge of F. P. The coats thus taken off were folded inwardly and placed over a slab immediately in front of a prop and quite close to the helpers coat.

It is not clear that Brown laid his garments over the slab with the cartridge projecting from the breast pocket uppermost, but the most natural assumption would be that in order to avoid damage to it by the weight of the coats, it would be placed in that position.

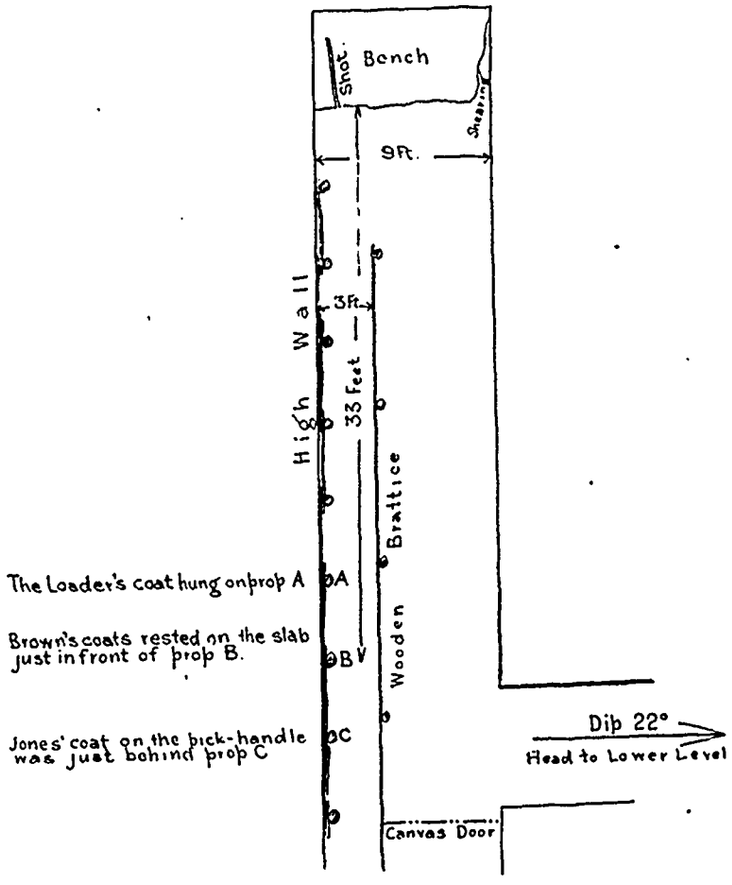
Jones, the other miner, hung his coat with 18 ozs. of F. P. in the pockets over the handle of a pick leaning against the high wall, and sheltered by a prop just four feet out bye of Brown's clothes.

Thus we have the whole of the men's garments on supports against the high wall separated by intervals of about 4 feet, and from 2 to 3 feet from the pavement. All are on the return side of the brattice and a little over 30 feet from the face.

*Paper read before the December meeting of the Mining Society of Nova Scotia.

A high side bench shot close to the pavement and pointing almost directly towards the men's clothing was fired by the proper

Plan of Level shewing the position of the clothing before the shot was fired.



official, after the men had withdrawn to a place of safety. The result of the shot was perfectly normal. No double report was heard, nor the clatter which a heavy discharge of small coal would create, in fact, nothing out of the common occurred to arrest their attention.

Subsequently, say three hours afterward, Brown, the miner, with the two coats and the 9 oz. cartridge in the breast pocket, retired in pursuit of refreshment and on seeking his outer garments discovered to his amazement that they were in shreds. It is reported that his remarks were not in accordance with parliamentary usage.

Closer investigation revealed the following facts: After the shot had been fired, Jones returned to the face along the rise side of the brattrice, and in so doing stumbled over what he at the time supposed was a piece of old brattice cloth, but was in reality Brown's coats. That would tend to indicate their disturbance simultaneous with the firing of the shot. Neither the loader's coat on the nail four feet nearer the origin of the shot, nor Jones' coat on the pick handle further out bye were interfered with. The three detonators originally in the right hand pocket of Brown's top-coat were found on the pavement uninjured, but the 9 oz. cartridge in the left breast pocket had disappeared. The paper end of a cartridge was found close to the spot and together with the damaged coats is herewith presented for exhibition.

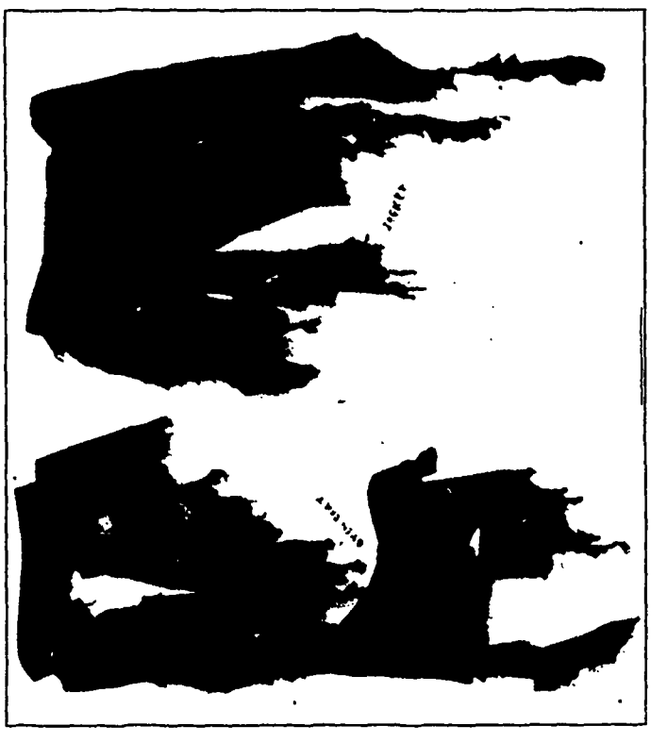
The questions that naturally arise are what destroyed Brown's coats? Was the cartridge in the pocket detonated by a violent blow from a fragment of coal or pyrites which is present in the seam, or was the damage inflicted solely by a discharge of small coal from the bench shot?

In the former case one should expect to find some injury to the support upon which the coats rested, and in the latter an accumulation of small coal might be looked for. Besides, how could the loader's coat escape injury from violently impelled fragments of coal?

The writer personally examined the locality and failed to find indications of either one or the other, but indentations such as could be made by impact with small coal and on a level with the coats, were discernible upon the prop against which they rested.

On examination the coats show that the left side received most injury and there is no indication of burning.

An experiment was carried out on the surface by exploding a 9 oz. cartridge in the breast pocket of a coat placed to represent the



Miner's Clothing after Shot.

conditions prevailing at the time of the actual occurrence, except that a small book was placed in the right hand pocket in lieu of detonators. After the explosion, the appearance of the coat did not differ materially from that observed in the case of Brown; the left side sustained most damage and the book was in the pocket unharmed.

The facts are presented for what they are worth, and the writer while leaning to the opinion that the cartridge was by some means exploded, leaves it to the better judgment of his fellow members to say what what became of the mysterious nine ounces.

On the Proposed Revision of the Mines Act of Nova Scotia.*

By Mr. ALEX. MCNEILL, Halifax.

There is in this country a strange craze for more law With many persons, not merely a single industry—such, for instance, as mining—is dependent upon what our Legislature may do, but the general welfare and prosperity of the whole coutry is by them made to turn upon the action of a handful of law-makers. This false notion is carried to such a degree that there are many earnest and sincere men who believe that more than three-quarters of the evils of this country could be removed by prohibitory law.

But while this is an extreme view, it is difficult to over-estimate the importance of the true relation existing between the laws and the industrial development of the country. In Nova Scotia we have a Mining Law which has both its admirers and its critics. In the letter of "Working Miner," in the October number of the *Canadian Mining Review*, and the spirited paper on a "New Gold Mines Act," read at your last meeting, you have an instance of the favorable comments of the one and the adverse criticism of the other.

The intimate relation existing between the Government and those engaged in the mineral industry in this Province makes it imperative that the laws governing all parties should be stable, equitable and impartial. But it is difficult, it is impossible, to devise a revolutionary change in the law that would not materially affect existing rights. And who is familiar with the legislation and litigation of the past that will seek changes in the law except when absolutely necessary? Let us look at this matter in relation to the important subject of "Surface Rights." You will find Sections 18 to 43 inclusive, of the proposed Act deal with this subject. You may urge that this law is cumbersome, that it it too favorable to the owner of the surface, that it does not give the lessee entry or possession, and many other objections. But against these is the complete, sufficient and satisfactory answer — IT IS SETTLED. It has been tried and interpreted by the highest Court of Appeal. We now know what it means. Leave it there. The well known case of Palgrave vs. McMillan, besides settling the law on surface rights has a valuable lesson for those who seek changes in the law, for it must be remembered that the Palgrave Mining Company suffered, not on account of the law as it appeared in the Act, but because the Supreme Court of Nova Scotia persisted in reading into it things which were not there. We know now, for the Privy Council has said so, that our Supreme Court was wrong in regarding the Warden in this matter as a Judicial Officer, or his appointment of an arbitrator as a judicial proceeding, or that a notice that was not mentioned in the Act should be given. We know that they were wrong in setting aside the award for uncertainty because it could not in the nature of things be made certain. Do we want more capitalists disgusted? Do we want another good, substantial mining company to spend years of time and thousands of dollars to find out what the law *is*? Do we want another fine property such as Hurricane Point to lie idle while the spooks of litigation enjoy a witches' dance with investors' hopes? If we do, get a new law on surface rights, a stubborn surface owner, a valuable property and a wealthy company. Given this combination, we can expect a repetition of Palgrave vs. McMillan.

What miner would exchange a well tried machinery pronounced satisfactory by the best experts, for something new, even if besought by the dulcet tones of a rival agent or the discordant notes of a professional grumbler?

There is another lesson in Palgrave vs. McMillan for those who are forever denouncing our law as unskilfully drawn. Lord Hobhouse, who delivered the judgment of the Privy Council, dealing with one phase of the objection of uncertainty made against the award, said: "It is only important as showing how clearly the framers of the statute saw the uncertainty of the subject they were dealing with"

Turn again to the much controverted question of forfeiture. A careful reading of the cases *Attorney-General vs. Reynolds, Attorney-General vs. Sheraton and Attorney-General vs. Temple* may put us in a Fundy fog as to what the law really means; but one thing is clear enough—the courts are struggling to read sense and consistency into a rapidly changing law. The Legislature, in its evident desire to rid forfeiture of some of its terrors, had made numerous changes. The result was a period of protracted and expensive litigation. The general result of these decisions was, however, beneficial, and as a consequence we hear little lately of forfeitures.

* Proceedings December meeting Mining Society of Nova Scotia.

Let us look at the proposed law to see by what ways a man may lose his lease by forfeiture. The matter is covered by sections 47, 57, 62, 141 to 143, 174, 177, 202, 203, 206, 216 to 218. It will be found that forfeiture is the penalty for failure to—

(*a*) File for a year from the time of application.

(*b*) Pay stipulated royalties except gold and silver bearing material from a licensed mine.

(*c*) To comply with stipulations in the lease.

(*d*) To pay annual rental thirty days after notice mailed.

(*e*) In case of mines other than gold or gold and silver, abandonment for a year.

(*f*) Non-working in certain cases.

(*g*) Fraud and misrepresentation.

Surely, someone exclaims, here are as many pitfalls as were to be seen on the bridge in the Valley of Bagdad. They should all, with possibly one exception, be included in section (*c*), namely, the stipulations in the lease.

This leads us to an examination of what is by far the most important matter for our consideration, namely, the lease. If it is not expedient to have a new Gold Mines Act, it is both necessary an expedient to have a new Gold Mines Lease. In this connection, le us consider what a lease of mines of gold and gold and silver now contains, and what, from the lessee's standpoint, it should contain. A glance at the lease in Appendix A shows that it embodies a series of stipulations on the part of the lessee, but there are no convenants on the part of the lessor. This is not the kind of lease drawn when the lessor and lessee meet and agree upon terms. Look, for example, at the lease between the Government and the Dominion Coal Company, as ratified by Act I. of the Acts of 1893 Here men prepared to go into the business of coal mining upon such an extensive scale as to yield largely increased royalties to the Government, sought for and obtained important changes and provisions in their lease. The most important of these was that the lease should be construed as declaring the respective rights of the parties thereto. And the next most important provision was that the Government promised, and the Legislature ratified the promise, that this relationship should not be disturbed by subsequent legislation. Then there are the important convenants on the part of the lessor ensuring possession and quiet enjoyment, freedom from additional burdens of taxation, guarantees of ownership of the leeses in the coal, and the consequent freedom from city. town and municipal taxation, that the Government will assent to transfers. And in section 6 of the lease is the following:—

"The said lessor further convenants and agrees to, and with the said lessee, its successors and assigns, that the lessor will not during the pendency of this lease, give or grant to any other person, firm or corporation any license to search or work, or any lease to mine any mineral in, over or under the areas hereby demised, except upon the condition that the said person, firm or corporation shall not interfere with any of the powers hereby conferred or the premises hereby demised."

More than this the lesseee could not reasonably require, and less protection than this it were a disgrace to the lessor to afford.

Section 7 provides for arbitration in case of dispute between the parties thereto. Sections 8 and 9 deal with forfeiture. These are all reasonable and desirable provisions and should be, with necessary changes, inserted in the form of lease in Appendix A. Then there should be a provision that existing leaseholders might surrender the old and take out the new lease.

Especially should every lease contain a promise on the part of the lessor that the rights secured to the lessee thereunder should not be taken away by subsequent enactments. An instance of this kind of legislation may be found in section 148 of the proposed Act.

In the Attorney-General vs. Temple, Sedgwick, J., delivering the judgment of the Supreme Court of Canada, gives as his second ground for holding the declaration of forfeiture invalid in that case, that lessees prior to 17th April, 1889, were in a different position from those holding subsequent to that date as regards forfeiture. Section 148 seeks to remove this distinction, thus taking away a right which, according to the judgment referred to, would have been sufficient to save the lease in Attorney-General vs. Temple. This is manifestly unfair and should be provided against.

It is, however, not very profitable to closely criticise the printed pamphlet before us. It is not the present law, although it is for the most part a copy of it. Nor is it a copy of the Bill that the revisors of the statutes will present to the Legislature. It is only a part of it. And of that part of it the provisions respecting appeal and registration are to be considerably changed. Sub-heads are to be inserted and such other changes as the revisors may deem desirable. But the pamphlet printed by this Society is merely the preliminary draft of one of the revisors. Doubtless when the matter is brought before the "Commissioners for Revising the Statutes of Nova Scotia" many verbal changes and corrections will be made and misplaced sections put where they belong and ambiguous portions made clear. This is the duty of the revisors and they are well qualified to perform that duty.

But if substantial changes are desired by this Society they should be formulated at this meeting.

Does our Society as a body believe that the dual system of location by metes and bounds or by staking is unfair and prejudicial to the best interests of mining in this Province? That a larger gold area should be adopted? That the rental and royalty claims are over-burdensome? That the life of the lease should be still further extended? That protection should be afforded the holders of lease and licenses against other or subsequent holders? That better provision should be made for surveys and inspection?

These are some of the practical questions that should be discussed by men in the business. It cannot be expected that the men in the Department of Mines or the Government, much less the Revisors of the Statutes will undertake to make changes in the law affecting such matters. But if the practical men in this Society see the need for such changes or have learned by experience that provisions in the present law work hardships to the mining industry, this is an opportune time for them to have such changes made. Let those changes be made now and then let agitation for amendments cease. The *Canadian Mining Manual* at page 203 says:—"The Mining Law of Nova Scotia is exceedingly fair and easy to interpret." But still there is a persistent agitation for change. And in the minds of many our Mining Law is wholly inadequate.

Therefore every effort of every friend of the industry in this Province should be directed towards having the law settled once and for all. There is perhaps nothing so important about the Law of Mines as to get clear of the notion that upon it will depend the future of the mining industry of the Province. This mineral industry of this Province must depend for its successful development upon the faith of our own people. Let our people once make up their minds that their prosperity depends upon their efforts to develop the marvellous mineral wealth of the Province and then may we expect Government interest and aid, the assistance of the foreign investor, in a word, we may expect Nova Scotia to continue to hold the proud position she indisputably holds to-day, of being the leading mineral Province in this great Dominion.

DISCUSSION.

THE PRESIDENT.—You will agree with me that the paper is a v y valuable one and contains many hints which will be useful to us in carrying on our discussion. We could not do better than combine our discussion of the paper with the general discussion of the proposed revision. Those interested in gold will perhaps give us their views. Unfortunately we have not a copy of the revised Coal Regulation Act.

MR. WILSON.—I was appointed a member of the Committee to recommend changes desirable from a miner's standpoint. The Committee unfortunately was too large. I communicated with all the members, but I regret to say I only got a reply from one. I got some very good suggestions from one of the gentlemen interested in coal in regard to our gold mines. Practically nothing was done, and there is really no report to put before the meeting. I have looked over the part of the proposed law which refers to gold mining. It is badly mixed up, and perhaps not very carefully drawn. Perhaps after all we should not judge it too severely wherein it does not meet with our views. One thing that struck me was in regard to the size of the area. The Mines Act provides that it shall be 250 by 150 feet. That I think has been considered entirely too small. Of course, the matter has been remedied to a certain extent by the provision which compels an applicant to take up six areas at a time. Why not make the size of an area equal to six of the present ones?

There is another thing to which I would like to call the attention of the Society. Section 161 makes not only the mill owner but every employee as well liable, in case the regulations in regard to mills are are not carried out. It is rather severe that every workman should be obliged to ascertain whether or not the mill has a license. If he sought that information from his employer he might be discharged for impertinence. Whilst the owner or agent should be made responsible, I think the portions of the section affecting any others should be struck out.

I would also call attention to clause 155. It does not state that bondsmen are necessary. If there are to be bondsmen they should have some protection in the way of notice that the proper returns have not been made. The law provides that returns shall be made monthly, but instances are known where persons have been called upon to pay royalties accruing over three years, which were not demanded by the Government until some change such as disposal of the mill had occurred.

MR. FERGIE.—They are easier on the gold miners than on the coal men.

MR. WILSON.—I can state that there was a mill running and crushing quartz in this county for five years without paying royalty, and they did not come down on the bondsmen because the bondsmen had gone to Africa I consider that a bondsman has certain rights as well as the Government, and that if the Government fail to report to him after three months that the royalties have not been paid he should then be in a position to take action which would relieve him from his responsibility. At all events he should not be liable for any claim over three months standing.

MR. AUSTEN.—I have a case in point. I have received notice from the office that I am a bondsman and that they look to me for $2,000.00. They say I am liable under the bond for the penalty, and I have not the means of knowing whether the owner should have made returns or not.

MR. MCNEIL.—You are only liable for the amount due.

MR. AUSTIN.—I cannot determine the amount due.

MR. WILSON.—Last year they got out an alluvial lease. I see that a person can take up 500 acres and then after his experimental term has expired he can make an application by payment of $250.00, which seems to be a pretty good fee. There is something to be said as to whether these leases are forfeitable for non-working. From section 150 one would infer that they were forfeitable for non working.

There are a good many things in the law that from my standpoint I think could be improved, but still when you get one thing improved perhaps you are intrenching on another. The points I refer to I think are important.

MR. AUSTEN.—With regard to forfeitures, I think that persons entering into a bond for others should have some little show. I had no means of knowing whether at this particular mill the returns had been made for the last month, the last year, or the last ten years, but I find that they have not been made for a considerable time, I have no doubt I will get out all right, as my man is a very good one and a member of this Society.

MR. ARCHIBALD.—I must confess to not having examined this new law with great attention. I have been much pleased with the paper read, and I would move a vote of thanks to Mr. McNeil. It is regrettable that there are not more members present. There are some absent who always take a great interest in the laws relating to mining, and they should be here this morning to discuss the subject. It is a question whether it would not be as well to have this discussion adjourned. The best way would be to make an outline of the different points for discussion and take them up one by one. Then the discussion would be more intelligible. I move a vote of thanks to Mr. McNeil for the able paper read.

MR. WILLIS seconded the motion which was put and carried.

MR. WILLIS.—There are two matters about which I would like to say something. One is in regard to the size of the area. I think the time has come in Nova Scotia for the size to be increased. If you look at the mining map of any district you will find that it is cut up into a nunber of leases of one area each. Under this law a man takes a prospecting license say for fifty areas. At the end of the year he takes up six areas under lease, and up to a short time ago he could take up one. If a man wants to buy a property he has to buy up a large number of these areas. Six areas are too few to allow anyone to take up at one time. In other countries the areas are 1,000 by 1,500 feet along the vein, and no man should have an opportunity to take up these small blocks.

The other remark I wished to make was in regard to the rental. Before the law was changed, which was I think in 1892, a man who was working a mine actively could commute his labor. So many days work in each year was required to be done per area, and if this provision was complied with for ten years that was sufficient to make the lease non-forfeitable for the balance of the term. At the Oxford mine fifty times the amount of labor required was done in the first five years, and Mr. Reid took the lease to the Commissioner who put a clause in it making it non-forfeitable for the remainder of the term. Could we not have a provision under the present system of rentals by which a man by paying a large sum in advance could have his lease made non-forfeitable?

MR. FERGIE.—Would they not say that you were locking up that property?

MR. WILLIS.—If a man paid a lump sum in advance they would have the use of the money for twenty or forty years, as the case might be. They have changed the days of payment and we do not know when our rental is due.

MR. FERGIE.—If you are paying royalty that pays you rental.

MR. WILLIS.—You have to pay your rent in advance and you get it back if you pay your royalty.

MR. FERGIE.—Our lease says it shall be forfeited if the rent is not paid. We pay our royalty every three months.

The Act speaks of the magnetic meridian. I think the base lines should be the true meridian.

MR. WILLIS.—The reason of that is because they cannot lay out true the meridian. An amendment was passed some five years ago substituting the true meridian. They tried it for one year, but not having a man competent to lay it they repealed the amendment the following year.

One word more in regard to the size of the areas. There is no reason why these areas should be laid 150 feet east and west, and 250 feet north and south. The longest way should be on the lead. In Cow Bay all the leads run north and south and they have the long way there. In the United States the areas are 1,500 by 1,000 feet, and they have to remain that way. The sections between areas can be taken up.

MR. WLSON.—In section 158 the royalty is placed at two per cent. on silver at one dollar per ounce, which makes it about four per cent.

MR. POOLE.—One difficulty I see in the way of changing the s... of the areas is this. There are so many taken up under the present arrangement that a change would lead to confusion.

The magnetic meridan of twenty years ago will not be the same as to-day, so that the standard line will have to be implied.

Section 193 speaks of "other materials" and yet there are only six or eight minerals retained by the Government and they are all mentioned there. It seems to be the idea in this Province that if we only have legislation everything will run itself, and that no official need be appointed to carry it out.

On motion the following gentlemen were appointed a Committee to wait on the Committee of the House, when the proposed Mining Act came up for consideration, and present the views of the Society: Messrs. Poole, McNeil, Wilson, Willis, McInnes and Graham Fraser.

MR. FERGIE.—There have been two or three opinions as to the size of the areas. Mr. Willis thought they should be increased to 1,000 by 1,500 feet.

MR. HAYWARD.—I agree with Mr. Willis that it would not be too large, and it would be of more benefit to those taking up claims for the sole purpose of working.

MR. WILSON.—I concur in that view, but the question will arise how the Government will appreciate that. It might cut off their revenue. When a man has to take such a large amount and has to pay a proportionate price for the large area it is going to cut out a great many small investors. They are a kind of milch cow for the Government and it is a question whether they would receive the thing very kindly or not. The principle, however, is undoubtedly sound.

MR. POOLE.—My view is that although I think the areas too small, owing to the trouble of making the change and the slowness with which the change could be inaugurated, we should rather work for the maintenance of established rights.

MR. HAIGHT.—By blocking smaller areas into the larger the areas might be limited.

MR. FERGIE.—Mr. Andrews intended to advocate bondship in some company instead of individual securities. I would like to call the attention of the Society to Section 184.

MR. MCNEIL.—The provision I mentioned in the Dominion Coal Company's lease would limit that.

MR. FERGIE.—Mr. Willis has suggested that by paying a sum down your property should be non-forfeitable.

MR. MCNEIL.—There should be no such thing as forfeiture outside the terms of the lease.

MR. FERGIE.—We seem to be unanimous about the base line, that it should be the true meridian. Mr. Andrews called my attention to the fact that the section as to the division of property is not in the draft If there was any intention of altering it he said he did not think it should be altered.

MR. CARRUTHERS asked what provision there was for the filing of plans and workings of mines

MR. POOLE.—There was a provision for the filing of plans showing the depth and extent of the workings of all gold mines but it entailed too much trouble on the Mines Department and it was struck out of the Act. It would be well to ask the Government to restore that clause of the Acts of 1895 which compelled maps of the extent and depth of the workings to be furnished to the Government. I move that the committee ask the Government to restore clause 5 of the Acts of 1885. This motion was seconded by Mr. McNeil and passed.

MR. FERGIE.—Are Government officials allowed to act as consulting experts and use information they get as officials?

MR. AUSTEN.—That is a new clause which was put in a few years ago, in view of the case of Mr. Fairbanks.

MR. MCNEIL.—They were held to be entitled at that time, but made a mistake in taking out the lease, and this clause was inserted to make it clear that they could not take up areas.

MR. FERGIE.—I think it should be distinctly understood that they be not allowed to take fees or give information of any such kind.

MR. POOLE.—The following should be inserted: "Nor shall they receive any fee or consideration of any sort for services or information relating to mines or mining properties in the Province."

The latter part of section 17 should be modified to read "as between the Government and the lessee himself only."

MR. MCNEIL.—There is no provision in section 105 for renewing.

MR. FERGIE.—Would it not be better to add "with the option of renewing.".

MR. FERGIE.—What is the general opinion as to interferring with the size of the area?

MR. AUSTEN.—I do not think it should be interferred with.

MR. FERGIE.—I take it that this clause should not be interferred with. I think it is a mistake to make recommendations unless they are absolutely necessary.

MR MCNEIL.—I think it would be well if there is time before the revision for the Society to obtain the report of the Commissioners of Queensland in regard to this matter.

MR. WILLIS.—With regard to a gold mining lease covering all the minerals contained in that block of ground, it seems to me that is a matter demanding attention. A man may take up gold areas and there may be next to his quartz a vein of platinum or copper. There is nothing to prevent somebody covering his area "for other minerals." On page 23 of the Act of 1896 there is a new feature in regard to taking up alluvial ground. It seems to me that the only way to settle it is to enact that if a man takes up areas for gold his lease should cover all minerals.

MR. MASON.—As a matter of fact the Government would not give a license to search for other minerals over a lease.

MR. MCNEIL.—The clause I referred to in the lease of the Dominion Coal Company would cover that and should be embodied in all leases.

MR. POOLE.—I am of the opinion that the "working" clause should be reinserted in the Act.

MR. FERGIE.—I take it that is the voice of the meeting.

MR. MCNEILL.—If you have that provision you must have regular inspection.

MR. POOLE.—We suggested inspection to the Government a year ago. They did really mean to appoint an inspector but there was such a host of political friends after the position that they could not give it.

Metallurgic Standards.

By FREDERICK T. SNYDER, Vancouver, B.C.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

It is perhaps because of its great antiquity and the force of established custom that modern scientific methods have been so slowly adopted in metallurgic work. The other industrial branches that have to do with the transformation of power into useful results are found to have standards of comparison complete in proportion, as the industry is young; perhaps the most complete being the youngest of all, the commercial utilization of electricity. There is available in the transactions of various associations of mining interests, a mass of records covering the operation of many plants under a wide variety of conditions; records that just miss being of great value, because they are expressed in units that are not standard, making the utilization of the experience they record impracticable. Speaking for my own department of the metallurgy of the precious metals, the great need is a group of standard units by which the results of one establishment may be utilized in planning and operating another under somewhat different circumstances. The most pressing of these are:—

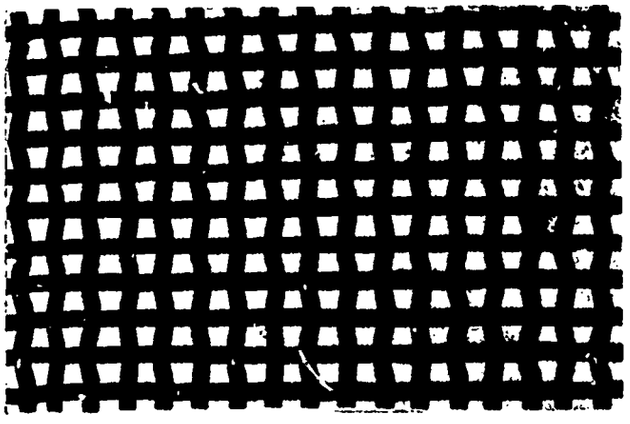
1st. A unit of weight.
2nd A scale of sizes for crushed ore.
3rd. A coefficient that shall represent the mechanical condition of the ore.

Of these, the second has to do with milling work alone; the first and third underlie the operations of both milling and smelting.

The unit of weight is in much the most satisfactory condition. To the extent of which it is individually a factor, results can be expressed in terms whose accuracy lies within the limits of error of the ordinary observation. Its usage and form leave much to be desired. The common unit of weight in metallurgic work is the ton. The question at once arises in considering a record, which of the four tons in extended use is it? Especially as their variation is too small to admit of the question being answered by a direct consideration of the records themselves. Fortunately, one of them, the metric ton is rapidly driving the others out of use. It is desirable that forethought should be used in aiding its introduction, that multiple standards of weight may end as soon as practicable. Of the value of its decimal notation little need be said. Its close correspondence with the present English long ton (2,205 lbs. in place of 2,240 lbs.) involves in its introduction the minimum change in one's standards of experience. An additional feature, of distinct value from our present point of view, is the correspondence it brings about between laboratory and mill calculations. It is desirable that all weights in metallurgic practice should be "dry weights," and that a definite statement of the determination of moisture should form part of each record. It should be understood that competent assays and analysis are always made on dried pulp, and that they are of value only as applied to "dry weights" of ore. The practice of obtaining the weight of ore by calculation from volume is to be condemned. Estimates made in this way are practically worthless as records. Fallacious values that lead to disappointing investments can frequently be traced to this practice. A scale can so readily be introduced at some point in any process on which the pulp can be actually weighed, that a desire to avoid complication can hardly be urged in extenuation.

When we turn to a consideration of units of size, for crushed ore, we are at once in contact with the illusive question of "mesh."

These concentrates were crushed through a thirty mesh screen. What does it mean? That it was a screen having thirty wires each way per lineal inch? Possibly that was originally what it meant, but the screen that these concentrates came through had no wire at all. It was an indented slot screen. Even if it had been a wire screen, who is going to tell how much of each thirtieth of an inch was wire and how much hole. Then was it a woven screen or a sewed one? If woven, was it double crimped or single? But grant that these are all known and made matters of record; that the available free area of the holes has been ascertained by a *Round* taper needle, will this tell what sized tetrahedron of quartz will go through that same hole. The accompanying enlarged photograph of a forty mesh screen, taken at an angle of sixty degrees to the surface of the screen, will illustrate the point. It also illustrates the point that the maximum area of the hole is not at right angles to the surface of a woven wire screen, especially so in the



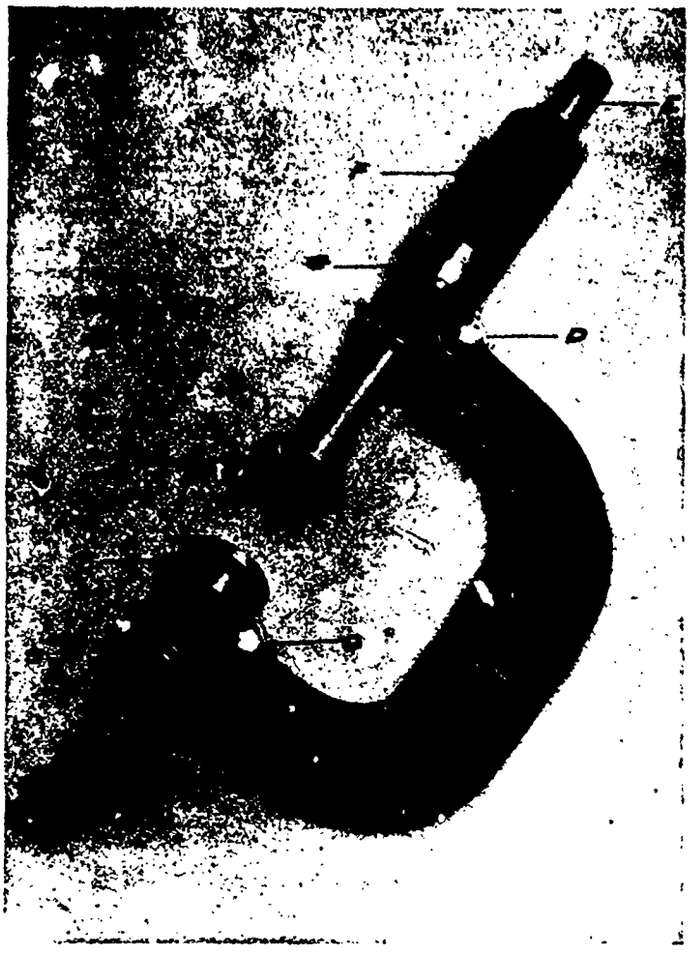
Forty-mesh Screen—Angle of 60°.

case of a double crimped screen. It is the almost universal use of this type of screen in laboratory check work that makes its consideration of importance.

The angle at which the material strikes a screen is a factor in determining the size of the particles that go through. This has been taken advantage of in that meritorious device, the Bertelett screen, by which forty mesh pulp (whatever that may mean) is produced by a twelve mesh screen by throwing the material against it at a small angle; a feature of great importance to leaching plants, where the possibility of dry crushing and screening often means the difference between success and failure. It serves to illustrate most pertinently, how wide a range of ratios the mesh of a screen has to the maximum size of the product passing through.

In stamp mill work another indefinite factor is the height of discharge. With the same screen the average size of the issuing pulp can be halved by doubling the height of the discharge. How are we to compare results? Because one battery with a thirty mesh screen and a four inch discharge, saves sixty per cent. of the gold in an ore on the amalgamated plates below, is it an inferior machine, because the next battery with the same thirty mesh screens, but an eight inch discharge saves seventy per cent. of the contained gold? A proper screen analysis of the pulp would explain the difference, and again illustrate what an indefinite standard "mesh" is, when taken alone.

The necessity for definite data in my own work has led me to abandon screens entirely as primary standards of size, and to measure the minimum diameter of the ore particles directly, by a specially constructed micrometer. As shown in the accompanying photographs, the special features consist in tipping the calipering points with disks one centimeter in diameter, the surface of which are parallel within one thousandth of a millimeter (one thirty thousandth of an inch) and in making the lower disk movable. In use, the micrometer is held vertically, the lower disk slid down and the ore particles, wet or dry, put upon it. It is then raised until the stop on the handle comes in contact with the adjustable shoulder S. The lower disk A is then locked in position, by the screw C. A series of tests has shown that this lower disk can be repeatedly replaced in the same position within one five hundreths of a millimeter, when working rapidly and without especial care. The upper disk B is then unlocked by the screw D and



by the handle E is screwed down upon the ore particles. When the pressure on the ore particles reaches a predetermined and uniform pressure a ratchet in the handle E slips and the rotation of the barrel F and advance of the disk B stops. The amount of disks are separated and then read in hundreths of a millimeter on the scale at G. The upper disk is retracted by rotating the barrel F and the lower disk withdrawn and the ore particles removed. The range of the instrument is from one hundreth of a millimeter to about four centimeters, the precision being uniform over the entire scale, at about one five hundreths of a millimeter for groups of ten observations. It has been used so far entirely in the calibration of laboratory screens. A given material, to be examined, is screened and the minimum diameter of the maximum sized particles passed by the screen is determined by the micrometer. This is then marked on the screen and used in records where the mesh of the screen was formerly recorded. It should be noted that the screen will not calibrate the same for different materials, having different systems of cleavage, such as coal and quartz. Independent constants should be determined for each. The following screen analysis of tailings from the Belmont Mine, Ontario, stamped through smooth slot screens, called 50 mesh, taken September 27th, 1898, will illustrate its use :—

Milligrams.	Per cent.	Maximum Size Millimeters.	Through corresponding mesh stamped on screen.
5,640	100	.83	(on 40
636	11.3	.50	40
432	7 7	.23	60
4,570	81.1	.17	80
5,638	100.1	...	..

Concentrates crushed on a mortar through a one hundred mesh Greening wire screen gave an average of fifteen hundreths of a millimeter. It should be noted that from the construction of the micrometer and its method of use, that it is the size of the largest particle or the actual free area of the screen that is determined.

A definite unit of size once available, it becomes of interest to determine whether some coefficient cannot be arranged that will permit of legitimate comparisons being made between the work of different mills under different conditions.

Other conditions being the same, it is evident that the amount of gold that will amalgamate from any given ore will be proportionate to the total area of surface exposed by crushing. In a given weight of ore the number of particles is inversely proportional to the cube of the diameter of each particle.

$$N=\frac{C'}{d3}$$ Where C' is a constant.

The area of each particle is proportional to the square of the diameter.

$A=C''\,d2$ C'' being a constant.

Therefore the total surface area of the particles in any given weight of ore is inversely proportionate to the average diameter of the ore particles.

$$S=A\ N=\frac{C'}{d3}\times C''\,d2$$

$$=\frac{C}{d}$$

In a leaching proposition the metal dissolved is proportionate to the area exposed, other conditions being equal, so that in this case also

$$S=\frac{C}{d}$$

Where S may be called the coefficient of surface, C is an arbitary constant, and d the average diameter of the ore particles. It is evident that the work done in crushing ore is proportionate to the surfaces separated, so that in this case also

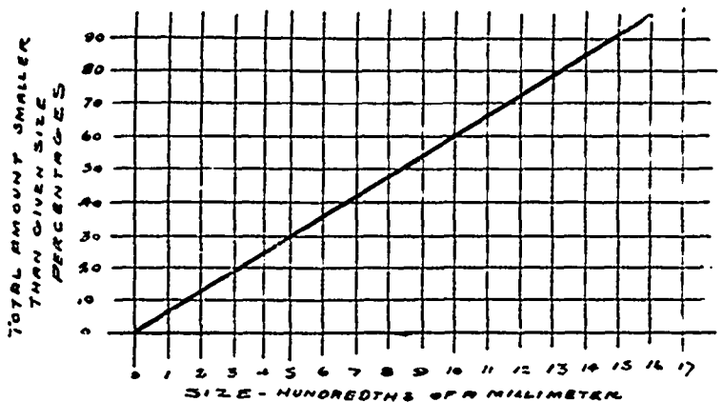
$$S=\frac{C}{d}$$

The ratio between (W) the work done and (S) the surface produced will represent the efficiency (E) of any crushing appliance.

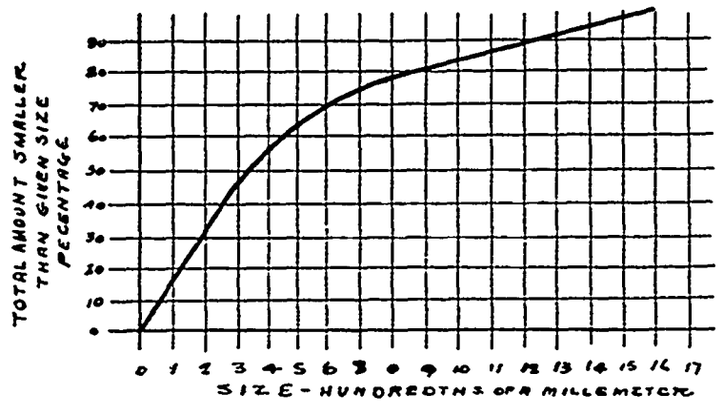
$$E=\frac{W}{S}$$

Heretofore there has been no way of definitely stating such a figure.

If the ore particles graded uniformly in amount from the smallest to the maximum size, it would be simply necessary to divide the sum of the diameters of the largest and smallest by two. Such a condition would be plotted by a straight line as Curve I.



The customary condition is more complicated, the characteristic curve being as in Curve II.



In this case it is necessary to divide the area under the curve into a series of sections and obtain the average diameter in each, afterwards weighting the diameter so obtained to correspond with the influence of the amount of that particular size.

The calculation from the screen analysis given above for Belmont tailings is as follows :—

$$\frac{.50+.25}{2}=.365$$

$$\frac{.23+.17}{2}=.20$$

$$\frac{.17+.0}{2}=.085$$

$$11.3 \div .365 = 31.0$$
$$7.7 \div .20 = 38.5$$
$$81.0 + .085 = 953.0$$

Coefficient of surface.....1022 5

By taking percentages in place of weights, the constant C can be neglected and a figure obtained, that will for all screen analysis be proportionate to the actual surface of the ore particles. And also a constant, under equal conditions from which the efficiency of any crushing, amalgamating or leaching processes or appliances can be definitely determined.

In this connection, attention should be called to the present indefinite methods of plotting screen analysis. The same data in the hands of different plotters would show very different results.

The difficulty is usually a failure to clearly state what the percentage units represent, whether it is the amount that passed through the screen, the amount that stayed on it, or the total amount that was larger than the given mesh.

In conclusion, it is desirable to emphasise the need of having the Institute by resolution warrant with its authorization, the use of such metallurgic standards as are sufficiently determined.

On the Establishment of Science Classes, &c.

By A. H. Holdich, Nelson, B.C.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

It is right to state at the commencement of these few remarks, that the ideas therein contained are not intended to apply to large and well populated cities, where far superior arrangements can readily be made, but rather to the small and scattered towns that help to make up this vast Dominion.

The inestinable value of, amounting really to a necessity for, Technical Education will hardly be disputed, and the question now seems to be, by what means can it be best supplied. In the larger cities of the Dominion this offers no difficulty, as the various well known universities can amply supply all needs; but in the less populated districts—British Columbia perhaps especially, no city is yet powerful enough to support a properly constituted and equipped School of Mines, or College for Technical Education, nor could students be moving about from one town to another except at a prohibitive loss of time and money. But the fact remains that this special education ought to be afforded, so that all whose tastes or occupation incline them to take advantage of it should have no difficulty in so doing at the minimum of inconvenience and expense.

If, as the writer ventures to think, these statements will not be disputed, it may not be time wasted if some of it is spent in considering the matter seriously, always of course making use of experience that has been gained in other countries. In England for instance, science classes are held in every town of any pretension, and pretty well all branches of sciences are taught besides Technical Education in the chief industries of the district, *e.g.* dyeing, tanning, carpentery, weaving, and many other allied subjects. In many of these schools, well fitted laboratories are to be found, where the students can carry out practically what they have learnt in theory, and also make experiments in their own particular branch under the guidance of the teacher; and nothing is so productive of permanent knowledge as carefully and thoughtfully performed experiment. In some of the larger institutions there are in addition, fully equipped workshops for making engines, electrical apparatus, and such like machinery, a thorough knowledge of which will ensure a decent living to any ordinarily clever man. It is not my purpose here to refer to the still larger educational establishments such as the Royal School of Mines (London), Owen's College (Manchester) or the Liverpool University, all of which are far beyond our means, if not our wants, (and indeed it has been forcibly brought home to me that fine work is not wanted, or at least not appreciated in British Columbia—the rougher the better, usually), but merely to see what can be done with the limited means at our disposal, and it seems to me that the establishment of Science classes in all towns where there appears to be a desire for them will prove a comparatively easy task.

The beginning must of course be on a very limited scale; there is no need to build a huge structure till the enterprise is able to afford it; but most towns can find a large room furnished with all that is necessary in which lectures could be given on various scientific subjects, and possibly some practical instruction as well. A "rough outline" so to speak of a chemical laboratory can be easily and cheaply fitted up, a vast array of uniformly sized bottles with complicated glass apparatus, and any amount of paint and varnish while unquestionably pleasing to the ordinary eye, being totally unnecessary. It is not the bottles and apparatus that do the work, but the man who knows how to use them. The difficulty is that not much experimenting can be done at night—in the 3 hours usually assigned to such work—it is not at all easy to see just what you are doing, and what has actually happened as the result of your experiment, by artificial light. But lectures can easily be given at that time, and possibly a few hours of daylight can be spared during the week as well, for experimenting only. The study of minerals indeed, which is a most important branch, can only be carried on properly by daylight—unless at least some form of electric light can be introduced that is in all respects equal to daylight. However, these and many other points which are liable to crop up at any moment, must be left to be dealt with after the suggested classes are formed and in working order—the first thing is to have such classes organized for the benefit of those who are unable to attend the larger universities and colleges, in the more out of the way towns in this Dominion. The question naturally arises, "who is going to pay for this teaching"? And it is a question that must be answered, as it is the lot of very few of us to be out here exclusively for the benefit of our health.

How then can the expenses be met? Well, let us hope that our provincial governments will be able to see their way to assist; and let the pupils themselves pay a certain fee, more of course where laboratory practice is included, and let there be regular examinations (perhaps annually or even twice yearly) upon the results of which the teacher shall receive some grant from Government. The fees to be paid by the pupil probably might have to be varied in different localities, cost of living, &c., being an important factor in the calculation, but the Government grant should be at least equal to such fees, dependent on the condition that the pupil passes a satisfactory examination. The grant might very reasonably be graded, so much per head first class; and so much less for second class; then the teacher would have a very strong incentive to teach the subject thoroughly.

It is very much easier for one man to travel (if he must) 10 or 50 miles once a week so as to teach his particular subject at different centres, than it is for pupils to travel that distance; and it is quite possible that in every town some one man can be found who can teach at least one special subject and do it thoroughly; the same being true of more than one man and more than one subject. In any case, the matter appears to me to be well worth attention, and there are some grounds for hoping that the British Columbia Legislature will take the scheme into consideration at an early date.

Perhaps some members of the Institute will offer their own opinions and suggestions as to the feasibility of starting up even on a small scale some such classes as I have attempted to outline.

In close connection with this subject is the urgent need of some kind of association of analytical chemists and assayers, to prevent the too commonly utterly incapable man from misleading those who innocently come to him for advice. It has fallen to me more than once in British Columbia to find a man professing to do assays (and even analytical work) who was ignorant of the first principles—and often had quite unsuitable balances. While the assay for gold and silver is not very difficult (but it wants to be performed correctly), yet copper is not quite so easily estimated and requires decidedly more skill and experience, and I have met assayers out here who candidly acknowledged that they could not assay a sample for copper. Can we not join together and insist on a man proving himself capable, before allowing him to practice? or would it be "interfering with the liberty of the subject"? Some action ought to be taken, and it is my sincere hope that these rather random notes may be considered and discussed and that the hoped for good results will follow.

An Improved Method of Introducing Feedwater to the Stamp Mill Mortar

By Bernard MacDonald, M.E., Montreal.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

The vertical cross-section and plan of the mortar shown in Figs 1 and 2 illustrates the method used by the writer in feeding the water supply to the mortars of the stamp mill batteries at the Dufferin Mine in Nova Scotia. This method has proved so satisfactory and effective that it is thought a detailed description of it would be found interesting to the members of the Institute.

The points of superiority of this over the customary methods may be seen best when viewed in contrast with the latter, a brief description of which will be given first.

In considering this question it should be understood that a continuous and uniform stream of water is required in the mortars of the stamp mill to mix with and form a *thin pulp* of the ore as it becomes pulverized beneath the blows of the falling stamps and in this condition (thin pulp) to carry it in suspension until discharged through the screen meshes.

It is customary to introduce the water required for this purpose over the top of the mortar in iron pipes or rubber hose. Thus introduced the water falls about three feet before it reaches the top level of the pulp mass in the mortar where it is still about seven inches above the crushing surfaces of the shoes and dies. On reaching this position it will be seen that a large portion of it must of necessity be discharged from the mortar before it can be mixed with the ore as it is pulverized. Therefore such portion fails to effect the purpose for which it was introduced. But perhaps the greatest defect in this system is the fact that the feedwater falling on the pulp mass has a tendency to settle the fine sands and slimes below the discharge level which not only lessens the discharging capacity of the mortar, but subjects the fine sands to further pulverization after having reached the proper degree of fineness to pass through the screens, thus producing loss by sliming the pulp and unnecessary abrasion of the free gold particles.

The points of superiority claimed for the "improved" method are that the water being introduced below or on a level with the crushing surfaces of the shoes and dies under a static head sweeps off at once from the dies and between them such portion of the ore as has been reduced to a sufficient degree of fineness and carries it upward into the pulp mass, where it is immediately presented with the most favorable opportunity of being "splashed" through the battery screens. This removes to a very considerable degree the cause of sliming the pulp for which the stamp mill has been noted, and, as will readily be seen, increases the discharging capacity of the mortar and hence its crushing capacity. In thus washing away the fine sands and slimes from around the dies leaving only the coarser particles of ore to occupy these spaces a favorable receptacle is provided into which the coarse gold may settle and be protected from unnecessary abrasion. Were the water introduced in the customary way the spaces around the dies would be packed with an impenetrable mass of silt which would offer no hiding place for the coarse gold which would be lashed hither and thither through the mortar losing by abrasion with every contact between the stamps and dies or with the sharp quartz. Summed up the points of advantage in this method are:

(1) Increase of crushing capacity.

(2) Decrease of sliming.

(3) Preparation of the bottom of the mortar to retain and protect the coarse gold from abrasion.

Details of fixtures for the Method Shown in Figs. Nos. 1 and 2.—(*a*) The main feed water pipe 3" in diameter fitted on end with a blow-off plug as shown, and connected with B.

(*b*) The 1½" connecting pipe fitted with globe valve to admit or shut off the feedwater. This valve would reduce pressure of feedwater entering the mortar, if required. Between it and A is a ¾" pipe connection to which is attached the hose for washing the plates.

(*c*) The 3" distributing pipe to which is connected by tapping the six ¾" feed pipes. This pipe is fitted, as shown, with a blow-off plug on end.

(*d*) The six ¾" feed pipes connected to holes tapped on mortar, as shown, and each fitted with a globe valve to regulate the amount of feedwater and also with a piece of hose to prevent the vibrations of the mortar from being communicated to the piping.

(*e*) The holes tapped in mortar feed steel liner to admit the feed-water.

(*f*) The top level of the pulp mass at rest.

(*g*) Level of discharge from mortar.

(*h*) Shortest line from entry of feedwater to discharge of pulp.

(*i*) Shortest line from entry of feedwater to discharge of pulp if introduced over top of mortar.

It was feared at first that the holes for admitting the feedwater to the mortar might become choked up with pulp inside the mortar, but one month's continued operations without any symptoms of trouble from this source, has proved these fears groundless.

The blow-off plugs in pipes A and C provide facilities for cleaning out grass, leaves or mud that might be deposited from the feedwater.

The six regulating valves on pipe when once opened to admit a sufficiency of water are never touched afterwards, the feedwater being admitted and shut off by the 1½" valve on B, which is turned wide open or shut off as desired, whether shut off or otherwise the water for washing the plates coming from between this valve and A is not interrupted.

The head under which the water flowed to the mortars in the case under consideration was 30 feet.

Across the Pitch versus Up the Pitch.

By O. E. S. Whiteside, Anthracite, N.W.T.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

The above title, tersely, directs your attention to a comparison of the getting of coal from breasts driven across the pitch, nearly in the direction of the strike, and parallel with the gangway, with the same operation in breasts at right angles to the strike, or straight up the pitch, under a few of the conditions that obtain in pitching seams.

In the Cretaceous measures at Anthracite and Canmore, the pitch may be said to vary from 30° to 50°, although at some parts worked, the seam is flat, and at others, pitches 90° from the horizontal, while, anticlinals and synclinals of coal are no uncommon thing.

Slopes are sunk to the depth desired on the seam, and in most cases it is necessary to do considerable grading to obtain a three hundred foot slope without a knuckle, or roof roller. Gangways are then started to the right and left, their course being directed by the proper gradient, and, the varying strike of the seam. The method adopted, for lowering the coal to the gangway, is in the main, by means of chutes, although back-balances or self-acting planes are, in special cases, resorted to. On the upper levels, where the "up the pitch," system of work had been adopted, gangways were driven twelve feet wide, and chutes eight feet in width were started up the pitch, leaving gangway stumps thirty-two feet along the gangway, by twenty feet up the pitch. These chutes were then widened to twenty feet, for the remainder of the way up, leaving pillars twenty feet wide, through which crosscuts eight feet wide were driven at intervals for ventilation. In this manner the coal was worked towards the boundary, the pillars being left to pull on the way back.

After working this system for some time, it was deemed necessary, if possible, to adopt some other which would lend itself more readily to the cleaning of the coal within the mine, and thereby lessen the cost of handling and transportation.

In a paper on "Subsidence Caused by Colliery Workings," by Joseph Dickinson, F.G.S., in the Transactions of the Manchester Geological Society, and reprinted in "The Science and Art of Mining," the author, in speaking of pillars left for support, says "Pillars for horizontal seams may be either square or oblong; but for inclined seams, oblong pillars lengthways between rise and dip are preferred, especially where well defined cleavage or slips run level course."

This "up the pitch" system then, left the preferred supports, the pillars were not so liable to be over-ridden and run out on a steep pitch as oblong pillars with their length across the pitch, especially where the coal is full of slips, and more especially if there is a well defined cleavage in the direction of the strike. Breast cars were not needed, the coal fell to the chute without handling, and if the chutes were kept full, neglecting the sizes in which it was mined, and the first ought to have been delivered to the gangway, with a minimum of fall, breakage for chute delivery.

The other system which made it an easy matter to separate the rock and other refuse from the coal at the working face, with ample room to gob the same, made it necessary that the length of the oblong pillars should be in the direction of the strike. Working the coal in this manner across the pitch, requires less labor and lumber for chutes, and as it is necessary to have a wall to separate the gob from the road-way, the ventilation of the face is accomplished by the same process, and the Ordinance requires the air to be kept within twelve feet of the face. This method reduces the work more nearly to that necessary on a flat seam and consequently does not require the skilled labor necessary for "up the pitch" work. This matter of skilled labor probably counts for more with us than in some older districts, because laborers from the ranching country are always plentiful, while miners are very often scarce, especially those skilled at working up a steep pitch.

With regard to the strength of the pillars, a defined cleavage was not a marked feature of any of the seams we have worked, consequently the change of system did not effect us as it might have some of the pitching seams of Pennsylvania.

In the "across the pitch" system adopted, narrow work was in some cases, where the seams were not close together and the coal without a well defined cleavage, dispensed with. Here the gangways were driven twenty feet wide, chutes twenty feet in width were started up the pitch, with pillars one hundred and fifty feet long between them, and every thirty or forty feet up the pitch breasts twenty feet wide were worked across the pitch to the inside chute. In this way oblong pillars were blocked out with their length across the pitch, one hundred and fifty feet long and thirty or forty feet wide. In all breasts across the pitch and most gangways, the road is carried on the low side and the gob and return air on the high side.

The seams worked are from five to ten feet in thickness and a row of props is carried close above the track. These props are lagged, the coal shovelled into the cars, and the refuse and rock stored above, and in most cases there is enough to completely cover the props and make a good air course.

Two seams lying rather close together gave some trouble, partly on account of the measures between thinning out locally. Before starting work on these seams, the rule was laid down that all breasts up the pitch on the lower seam should be driven by sights directly under those on the seam above, and those across the pitch directly under those above, in the direction in which a prop should be placed. It was also decided that these places should first be driven on the overlaying seam, and followed later by those on the lower one. This latter rule was not strictly lived up to, owing to the intervention of faults and the demands of the market for some few months after the commencement of this work, but no trouble was experienced for a considerable time after the pillars had been blocked. Finally the floor of the upper seam commenced heaving, and the pillars started to run, so we slowed up work on the lower seam and started pulling the pillars of the one above before they had time to run out. In a great many cases where one breast had broken through into another, we found the thickness of the measure between to be only six feet and in one case they actually run together, whereas, the thickness we had previously was fourteen to twenty feet.

From now on we intend to push the solid work of the overlying seams, and immediately follow up by pulling the pillars, and then after the removal of everything except the stumps, to mine the lower seam by a similar process

Considerable might be said as regards the waste in mining and handling the coal in these two systems, also concerning the pulling of pillars, but the writer will leave this for the discussion of members, or for future consideration.

Metallurgical Machinery.

A. C. McCallum, M.E., Peterborough, Ont.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

The matter contained in the following monograph, is presented with the hope that it may prove of interest to the members of the "Canadian Mining Institute," provoke healthy criticism and be of more than a passing benefit; further, that it may result in some effort to specify a standard of dimensions, that will harmonize with the demands of service, and conform to some canon of style for appearance.

In the matter of the design of Metallurgical Machinery it must be admitted, with reference to Rolls, Crushers, Stamps and other machines employed in the reduction of ores, one is almost led to believe that they are not suceptible of as exact an analysis as a Bridge for example. In the following remarks it is purposed to deal with the most familiar machines employed by mining engineers, such for instance as Crushers, Rolls, Stamps, and Feeders. To deal with them from the designer's point of is my purpose.

Considering in the first place Crushers, the introductory remarks anent them are applicable to most all of the other machines mentioned.

It will readily be admitted that many designs of Crushers, show by the distribution of the material within them, that the designer neglected to take advantage of a method of analysis, commonly employed by designers of bridges, and other large structures, a system of analyzing quite applicable to mining machinery, namely by that of graphics.

The construction of a graphic diagram of stresses within any machine under design is most essential; as upon it the designer elaborates his working drawing.

The benefits to be derived from such a process of designing cannot be overestimated, it impresses upon the designer an intimate and exact knowledge of the acting forces and their distribution throughout the parts of the machine in the process of design; there may be many problems which are extremely complex and frequently unsolvable; it is necessary however, to possess definite knowledge of the resistance of the materials employed in the construction of the machine to those complex forces.

Knowledge of this kind can only be used as a guide by the designer, and in all probability he will be mainly influenced chiefly by experience and precedent, rather than altogether by calculation.

The usual resource of the merely practical man is precedent, but the true way of benefitting by the experience of others, is not by blindly following their practice, but by avoiding their errors, as well as extending and improving what time and experience have proven successful. A continual effort should be made to advance mining machinery design to that of a science, not merely executing or copying what has already been done. We must look for marked improvement, as new applications of scientific principles for the reduction of valuable ores are brought forth, bringing with them change and simplification of design in the machinery required to perform the work needed to be done.

It has been sometimes remarked that skill and good workmanship are not essential features in the make-up of mining machinery, but the idea is false, more plants built for the purpose of ore reduction, have been failures; due in large measure to the fact that the enterprise was handicapped by machinery ill adapted for the purpose.

It is to be much regretted that many engineers in the purchase of mining machinery estimate the superiority of the machines to be purchased, by the dead weight, regardless of how the material is utilized and distributed.

Discussion will not alone settle the question finally in all cases without elaborate and unprejudiced experimental work.

Most careful investigation is necessary in many instances to discriminate between real improvement and the impractical.

Logical theory is confirmed by correct intelligent practice.

"We who write at this late day are too much indebted to our predecessors, whether we know it or not, to complain of those who borrow from us," and each of us is only able to make his relay, taking up the work where others left off.

The *sine quo non* of good machine design, from a structural point of view is the presence of sufficient material of the proper kind, in the right place.

There are many types of Crushers upon the market, and there is no doubt that the majority of them were originally intended for breaking road ballast. The demand within recent years for crushing machinery in mining regions is primarily the cause of their being advanced to the front as crushing and pulverizing machines.

There is no doubt that the "Blake" type of Crusher stands preeminently for service and has been generally adjudged the most efficient and economical in use; perhaps the reasons most readily advanced for such, lies in the fact that for a given capacity the first cost is less, the cost for repairs is also less, and they are idle for repairs much less of the time.

The "Blake" type of Crusher has developed few changes from the original design. The first type of "Blake" Crushers had the crushing jaw pivoted at the bottom, as at present in general use the jaw is pivoted at the upper end. It is a matter of choice, to do a given amount of work by either of the types of machine; one with the working jaw pivoted above, the other below. For the jaw pivoted at the bottom, the plea is used that a more uniform product is obtained, and that finer crushing, when that is desirable can be secured. The concurrence of preference however if guaged by use, is in favour of the modern "Blake" design with over hung jaws, when that type of crusher is chosen. Experience upon this point from the members present would prove of interest and value to the Canadian Mining Institute.

The presentation of the graphic strain, diagram Fig. 1, discloses many interesting points to the student of Statics. The graphic method

of analyzing strains recommends itself at once. It is hoped that the sketches will appeal for themselves and become easy of elucidation to the reader. I cannot hope to enter at any length into a discussion of the diagram, suffice it to say the composition of the forces may be easily calculated throughout any machine, given forces may be fully represented by straight lines, if the three following conditions are complied with.

1st. Magnitude, which can be measured by scale of equal parts.

2nd. Location. The lines representing a force being either parallel to or coinciding with the line of action of that force.

3rd. Sense, being the direction in which the force tends to move the body affected, and being indicated in some one way.

A general summary of Crushers upon the market if analyzed by the method shown, would reveal the important fact of a want of harmony amongst the various types of similar dimensions. The dimensions of the openings are not called in question, but like pieces within different makes of Crushers. So far as the openings of the jaws are concerned, those dimensions are not by any means arbitrary, but have been fixed by experience. Quartz generally breaking in sizes which can be suitably crushed by ore breakers of such standard dimensions as 10 x 7 in., 15 x 9 in., 20 x 10 in.

Mining engineers in charge of plants are well acquainted with the many faults developed in Crushers, under their care, broken frames, pitmans, jaws and other parts are known.

What then are requirements of a good Crusher?

In order that the Crusher shall run easily, cool, and prove serviceable, it is requisite that all of the journals be in correct alignment one with the other. Rigidity, strength, and sufficient weight must be found in the frame, so that the vibrations created while crushing may become absobed. This must be advanced as the reason for the failure of the many types of steel plate frames, they easily yield to the strains within the machine, thus causing the working parts to become out of proper relation one with the other, and resulting in heating, and running hard.

According to the nature of the product to be crushed, we must have a certain direction of stroke, length of stroke, and relative angle in the position of the jaws, and to procure these conditions various means are employed, which methods are well known to mining men. But it has appeared to the writer that simplicity of construction may be secured by abolishing from the type of Crusher under consideration, Fig. II, the wedge block so common, and employing other means of adjustment, for instance by means of the Toggles. Change of Toggles can be effected as readily as by means of the adjustable wedge. The movement required can then be made by rearrangement of the Toggles. The machine being provided with a set of Toggles giving the requisite maximum and minimum openings.

It is necessary that the shaft supporting the jaw should be securely fastened to the jaw, not by means of set screws, a preferable method of fastening is that of the Gib and Key. The jaw shaft is then required to move in the bearings of the machine. This overcomes the pounding and jumping due to lost motion, which readily developes when the jaw moves upon the shaft. The caps of the bearings can then be tightened whenever wear renders it necessary.

Within the pitman much trouble is often created, perhaps no other feature within the make up of the pitman creates more trouble than the adjustable devices provided to take up wear, when the eccentric shaft has worn out of round, due to the strain upon it being constantly in one direction. In the cut of Crusher, Fig. II, it will be noticed that no provision is made to take up the wear, simply an eccentric babbitted bearing within the pitman has been provided for the shaft. It requires a man of good judgment to set up the Gib usually provided, and trouble once experienced within this bearing from heating cannot be readily cured, without stopping down the machine. By the application of a first class lubricant, and employment of a high grade babbitt, the life of the bearing here should compare favourably with any other within the machine.

The use of heavy wrought iron bolts through the machine taking the entire strain when crushing is a desirable feature, but care must be exercised to so employ them within the frame, that their value as tension members, cannot be called in question as in Fig. III.

Fly wheels as commonly fastened to Crushers are at fault.

By employing them as a means to prevent serious injury to the working parts of the machine, owing to sledge hammer heads falling into the jaws, or other causes, we may so fasten the fly wheel upon the shaft that in case of accident the belt may slip and the Crusher stop while the fly wheels exhaust their motion. We may use taper keys round to suit the shaft, but a better method may be suggested, namely, that of splitting the hub as shown in Figure IV.

The matter of the application of Lubricants is an important one. Professor Thurston of Cornell University, says:—

"The art of economical employment of lubricants consists mainly in the determination of their adaption to specific purposes, and in the application to each machine—or to each part of a machine in which pressure on lubricated surfaces of widely differing amount is found—of precisely that quality of unguent which is best adapted to that particular place, and, above all, applying to it in the best possible way."

The employment of oil does not appear to be profitable. Grease is more economical, but a feature worth knowing in using grease is the matter of a proper kind of cup to hold the lubricant. The type of grease cup found most suitable is one in which the whole shell can be removed or unscrewed from the base, filled with the lubricant, then placed back in position. This does not necessitate the unscrewing of the entire cup from off the machine. the replacing of which is oftimes an annoying matter, where machines are placed in badly lighted places.

As to the nature of cast steel jaw plates being superior to those of chilled cast iron, I am led to decide in favour of chilled cast iron; the first cost is less; the length of life of the chilled cast iron jaw plate compares favourably with that of cast steel; they can be procured almost upon order; with cast steel plates it is often a matter of many weeks before they can be procured. Foundry men experienced in the art of making chilled castings, can produce an article that will give the utmost satisfaction, not all foundries throughout the country can do so as chilling cast iron is certainly an art.

Crushing Rolls.

The reduction or granulation of coarse particles of ore by means of Rolls, has been given much consideration during the past few years.

The variety of Crushing Rolls are many and various in type and construction.

Machines for this class of work have largely been envolved by American engineers, and proof of their superiority is to be found in the fact of their having gained admission to almost every large metallurgical work throughout the world.

Notwithstanding the many changes that have been made during past years in all the various designs known to us, no special one has met with general approval.

The most potent change has been in the adoption of steel as the material for use in the construction of the shells.

The construction of the frame in one piece, having sufficient weight and strength to absorb the vibrations set up within the machine, and closer study has been given to the matter of the strains with the structure.

Marked improvement over the older forms of Crushing Rolls has been made in the design of Journal bearings, methods of lubrication, and the facilities for dismantling the machine if required.

Considerable ingenuity has been displayed to obtain complete and satisfactory methods for keeping the lateral adjustment of the rolls correct.

The adoption of springs for that of levers and dead weights within the machine, to give crushing power to the rolls is an important improvement, affording as it does, a much more uniform product.

The adoption of some form of housing obviates the wasteful and disagreeable nuisance of dust, usually found around rolls employed in dry crushing, and length of life to the machine is ensured.

The most marked change within recent years has been along the line of increased peripheral speed, by the employment of rolls of larger diameters, and narrower faces. The results being decrease of journal friction, increase of crushing surface, and reduction of spring pressures. Those changes are undoubtedly the direction in which modern practice is tending.

Peripheral speeds of 600 to 1000 feet per minute are now found to be practicable, but this change in speed has also brought about many of the improvements already mentioned.

The aggregate spring pressure is now greater, ranging from 2 to 3 tons per inch width of face of roll shells.

Change has also been made from gears to belts, proving a much more preferable method of driving.

In the earlier form of rolls, the spring pressure was carried along the main tension bolts, making it a matter of considerable labor to adjust the rolls. The method now in use consists of enclosing the whole nest of springs between two washers, and constructing them so that each nest forms a complete washer, of an inelastic nature, until such time when the maximum pressure is reached, further compression taking place, relief is afforded to the rolls, by the deflection of the springs.

Chilled iron shells in all probability will be displaced by steel shells.

In the design of rolls presented all the above mentioned improvements have been embodied simplicity of construction, fewness of parts, and interchange ability is to be found

The hopper underneath the rolls is constructed in such a manner that no pockets are permitted, all four sides declining towards the bottom at an angle of 45 degrees, thus affording cleanliness at all times within the machine.

The matter of sliding versus swing bearings for the removable roll, was decided in favor of swinging roll bearings. The wearing surfaces become reduced by means of their adoption. Any wear about the bearing surfaces of sliding roll bearings is an evil, which may result in damage to the frame of the machine; it is easier to maintain the alignment of the swinging bearing than in the sliding type of bearing.

In design for rolls, a feature worthy of consideration is that of the disposition of the bolts employed for the purpose of bolting the machine together, it is a desirable feature to have as few as possible, and so arranged that should they by any means become loose, they may not fall within the machine. The use of common nuts is not desirable, and recourse must be made to lock nuts or elastic nuts; this provision prevents the bolts becoming loose, and may help to preserve the machine from injury.

Mortars.

The construction of mortars will always prove interesting to mining men. It is not necessary to describe at any length the two mortars herewith presented. .

The sectional mortar contains a feature new to the writer. It is usual in the construction of sectional mortars to make the ends in two pieces. In this particular mortar, to overcome making the ends in the above way, they were carefully designed (not to exceed 350 lbs. in weight) and in making the ends of cast steel the joint usually found was eliminated, and considerable strength has been thus added. The drawing shows the construction clearly. This type of mortar was designed for the Ben D'Or Mine, Bridge River, B.C.

Fig. O. shows a 3-stamp double discharge mortar. The lower guides of the battery are to be found in the upper part of the mortar, water supply is carried to and around to each of the heads. The pulp from back screen running through a channel cored in base of mortar and joining to that of the channel from front screen is then carried by a pipe and distributed over the amalgam table. This type of mortar was designed for the Oro Fino Mill of Fairview district, B.C. Fig. O. delineates the battery framing for above mortar.

Amongst designers of mining machinery the ore feeder has been taken in hand, and it doubtless has been observed in recent designs presented for public favor that of the suspended type, shows many marks of improvement in design, utility and simplicity of construction. Fig. O. shows a type of ore feeder recently constructed, and calculated to handle the heaviest class of ores. By its use considerable room is now afforded around the back of mortar, and it can be readily placed away from mortar when desirable. The action is similar to that of the well known "Challenge" type.

The marked changes in this feeder are to be seen in the abolition of the adjustable mechanism to the feed lever, the lever adjustment being made by means of a collar on the stamp stem, or by the bumping rod. Gears are not employed at all, thus resulting in quiet running.

One could, perhaps, make extended remarks with regard to other machines in process of design and manufacture.

I feel I have not done justice to the subject, it is much too wide for a single paper. Papers on metallurgical machines to be of real benefit to the Institute should be divided into sections, treating of the design and dynamics of each machine in separate papers. Should it be the pleasure of the Institute I would willingly contribute my small quota. Publication of data thus collected may not be considered of much moment by the busy outer world, but it clarifies the writers' ideas, and brings into compact form and small bulk, a large amount of knowledge otherwise unattainable. This information adds much to the making of the routine work of profession more productive and pleasuteable. The figures or cuts mentioned in the paper will be presented upon the screen, affording better opportunity for examination of details.

A Notable Canadian Deposit of Chromite.

By J. T. Donald, M.A., Montreal.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

Chrome ore mining in Canada was begun in 1894. About 10,000 tons have been extracted up to the close of 1898. Mining has been carried on in the most primitive fashion, the only appliance in addition to hand labor being horse derricks. This is largely because the deposits thus far worked have seemed to be pockets of very limited extent, and therefore, not warranting an outlay for labor saving plant.

The object of this paper is to call attention to the most important deposit of Chrome ore yet discovered in Canada, a deposit that has already yielded about 3,000 tons, and certainly yet contains at least several times as much as has been extracted, that is to say, a single deposit that alone contains as much Chrome ore as has thus far been produced from all other sources during the five years since the inception of the industry in Canada.

This remarkable deposit of Chrome ore is the property of Mr. H. Leonard, of D'Israeli, Que., and associates.

It occurs on Lot 26, Range II, Coleraine, Megantic County, which lies near Little Lake St. Francis, and about six miles eastward from

Chrome Siding on the Quebec Central Railway, between Coleraine and Black Lake Stations, *i.e.*, about 160 miles from Montreal, and 86 from Quebec.

The writer examined this property twice in October, 1898, and found the ore traceable as a belt in the Serpentine for a distance of about 260 feet, in a general south-east and north-west direction and outcroppings appear at intervals over a breadth of some sixty feet.

The ore occurs on the slope of a ridge that rises gently towards the north-west The surface serpentine is much shattered and even at the greatest depth lines of cleavage are numerous, so that mining is not difficult.

Without entering into the question of the origin of Chromite, it may be said that the *appearance* of the deposit is that of a great mass which, thrust up from below and following lines of least resistance, has spread itself out through fractures and fissures in the serpentine, forming a network of pockets connected by bands of greater or less width. What seems to be the main band is from six to ten feet wide in places, and at one point reaches a width of nearly twelve feet on the surface.

A number of samples representing different portions of the deposit, have been analysed in the writer's laboratory,—the percentage of Chrome oxide ranged from 37.93 per cent. to 44.93 per cent.

The ore is in excellent repute with and is constantly being used by makers of Chrome steel, both in Canada and the United States, the larger quantity of course being used in the latter country.

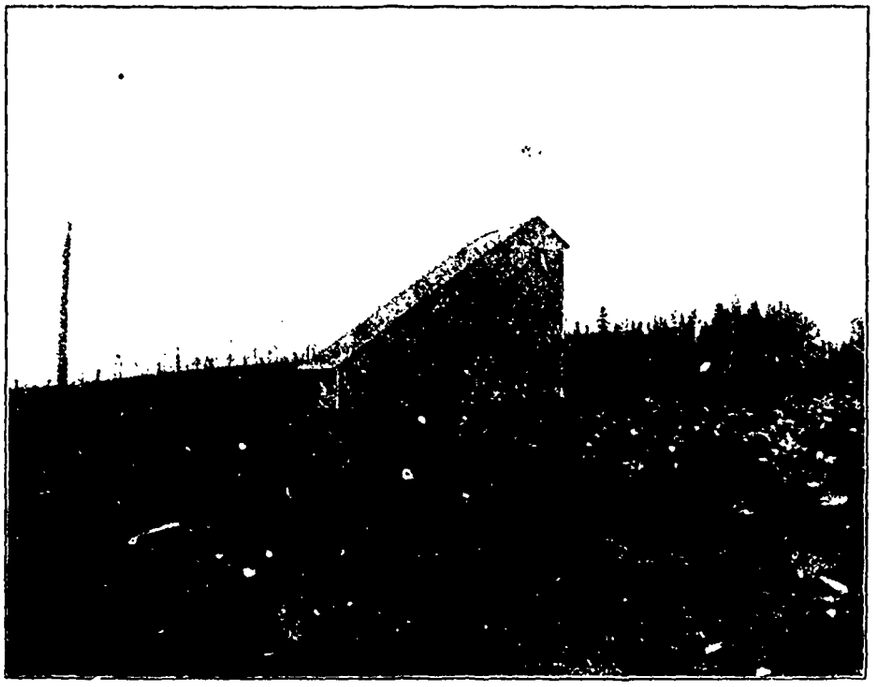
Tests have been made to learn the extent to which this ore is amenable to concentration, and with most satisfactory results.

In one case ore, assaying 39.58 per cent., was found after concentration to test 48.80 per cent. Chromic oxide.

In another case, crude ore assaying 40.50 per cent., was experimented with; the concentrates amounted to 63 per cent. of the ore, and tested 52.60 per cent. Chromic oxide

The latter test was obtained by A. R. Wilfley, of Denver, on his "Wilfley Table," whilst the first mentioned one was made by Obalski, the Provincial Government Mining Engineer, on experimental plant set up for the purpose by the E. P. Allis Co., of Milwaukee.

As a consequence of the good showing made in these tests, the Eastern Townships Chrome Iron Mining and Milling Company, Limited, have begun the erection of a concentrating plant at Chrome Siding, the shipping point for the ore from this mine, and it is probable that this Little Lake St. Francis ore will be largely mined and concentrated into high grade material in the future, since the higher prices offered for the high grade mineral would seem to allow a reasonably large margin of profit after cost of concentration is deducted.



CHROME SIDING—Piles Chrome Ore from Little Lake St. Francis.

Notes on the Occurrence of Quicksilver in Canada.

By A. J. Colquhoun, Savonas, B.C.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

The principal quicksilver producing countries so far have been Spain, Austria, Peru, California, China, Russia, Mexico and Tuscany. These countries have all added their quota to the world's production and I predict that in the near future when Canada has the benefit of the capital and brains required to make a great financial success of the working and treatment of low grade cinnibar ores, which has been the case in Russia and California, she will take her rank among the foremost in this important industry.

For the benefit of the prospector before proceeding any further, it will not be out of place to describe the ores from which quicksilver is produced.

Cinnabar.—This is the chief ore from which nearly all the quicksilver of commerce is derived. In colour the mineral is of a cochineal red with a lead grey and scarlet red tarnish, but has an unmistakeable scarlet read streak identifying it from the ochres or iron oxides, which, although brilliantly coloured, often give a dullish brown streak with the penknife. The composition is 86.2 per cent. of Mercury, and 13.8 per cent. Sulphur.

Native Amalgam is of rare occurrence, but in the mining of quicksilver ores is met with in Mexico.

Mercury Iodide is also rare and is met with in Mexico, having a reddish brown colour.

Selenide of Mercury has been found by many of the searchers for this metal and the writer has identified some crystals from the mercury properties of Hardie Mountain, Copper Creek, B.C. The ores of South America are dark steel grey in colour.

Cinnabar was first found about four years ago as float on the north side of Kamloops Lake at Copper Creek, but owing to the

ignorance of the original finder, the specimens lay around the Savonas Hotel until an enterprising and learned prospector identified the ore which resulted in the location of the group of claims now owned by the "Cinnabar Mining Co."

The formation in which the cinnabar occurs in this section of the country consists of casalic and dolomitic dykes traversed by veins of quartz and calcite in which the ore is found in some instances in a pure state, also finely disseminated through the gangue associated with pyrites and other foreign elements.

These dykes and deposits have a general direction of N.N W. and S.S.E. through what appears to be diabase porphyries, but it is impossible to determine the true nature owing to the surface decomposition.

To the north of the company's properties cinnabar is also found in altered conglomerates on Hardy Mountain and in fine grained sandstone on the Caledonia, to the east it is found in fine scarlet spots. Associated with the cinnabar we also find copper sulphide and carbonates and on the Hardie Mountain, as aforementioned, selenide of mercury which invariably carries a gold and silver assay.

During my trips in the Kamloops district last summer I discovered a deposit of cinnabar, some fifteen miles south, proving the southern extension of the belt, so that considering the Criss Creek deposits to the north we can state that the belt has been traced for thirty miles.

Notwithstanding the fact of the existence of large bodies of medium furnace ore 0.56 per cent. to 2 per cent. and over, exposed by the development of the "Cinnabar Mining Co." and other deposits of high grade ore hitherto untouched, they have not made a success.

It seems a pity that through the fault, ignorance and gross mismanagement of the concern the whole district should be held back in its progress.

About $50,000 has been thrown away in work and the erection of a Granza furnace, tramways, etc., and has only produced 128 flasks of quicksilver; of this amount 121 was produced by means of *cast Iron retorts* and 7 flasks by the Granza furnace.

As instances of successful treatment, the following data will be convincing.

At the Almaden works in Spain during one season of 197 days, two channel furnaces were kept running continuously, treating 17,210 tons each in 24 hours or 3,103,102 tons in all, at a cost of 60 cents per ton. The quantity of quicksilver produced was 178.25 tons. The expenses of calcination were as follows:

Labour about	$881 00
Coal	936.00
	$1817.00

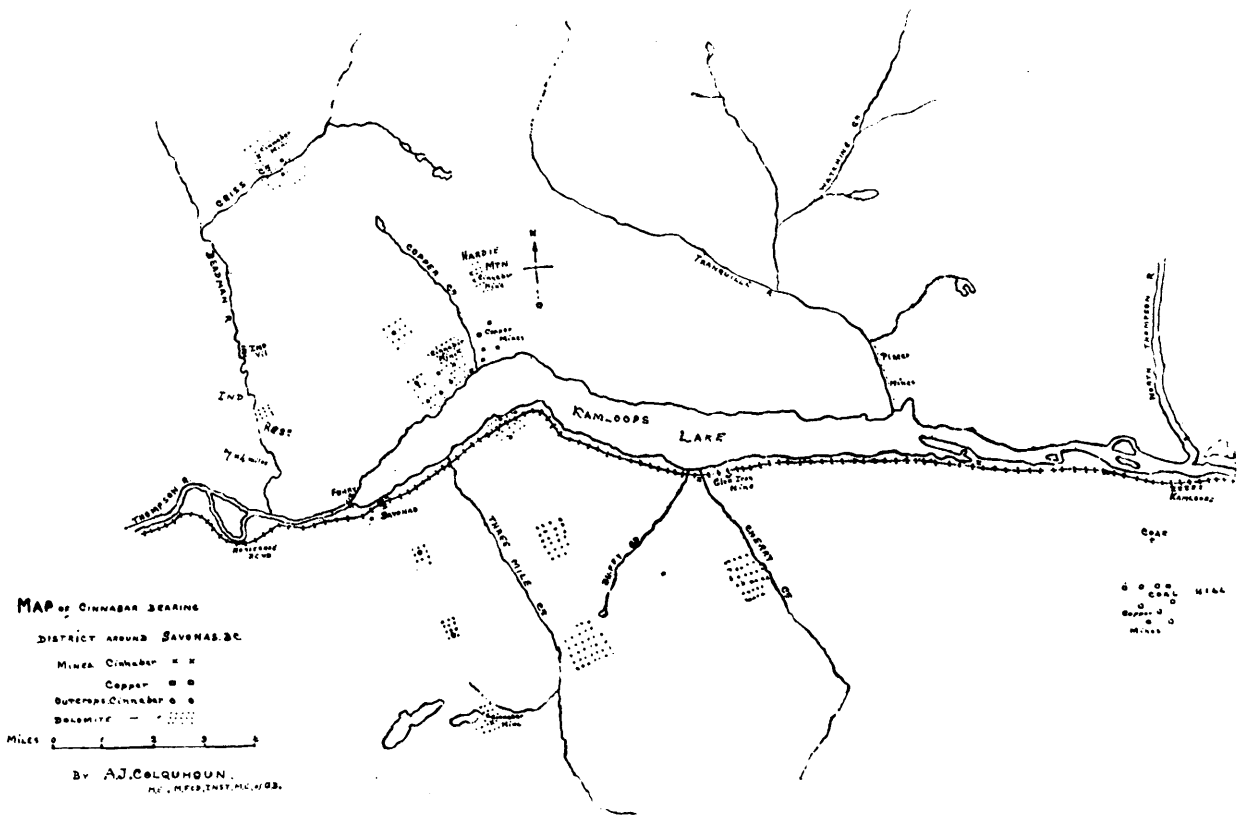
Tuscany—At Monte Amiata the cinnabar bearing tufta carries from 0.35 per cent. to 30 per cent. and upward. The Carmak Spirck roasting oven is in use and is said to treat 0.4 per cent. ores at a profit.

In other parts of Tuscany the ore occurs in bedded marts and limestones in a very pure state also scattered through a network of fissures filled with calcite and averaging from 2 to 30 per cent. Here they treat the ore by washing in rectangular boxes with rakes and retorting the resulting mineral with an admixture of 20 per cent. lime to desulphurize and liberate the mercury.

Peru.—The famous Huancavelica cinnabar mine has given a yield of 104,045,200 lbs. of mercury valued at $67,629,380 at a cost of $10,587,000.

In conclusion it is evident from the data given that low grade ores, of even one half per cent. can be profitably worked, and British Columbia only awaits the advent of a concern which can put this latent industry on its feet again by the employment of competent men who understand the business and are capable of overcoming the many difficulties attendant on the treatment of the different grades and classes of ore to obtain the best results.

The district surrounding Savona is of peculiar interest to the geologist and miner, especially the occurrence of native copper and other copper ores in the tertiaries of Copper Creek and I believe another year will see both cinnabar and copper mines in full working order.



Swedish Iron Metallurgy and its Application to Canada.

By Dr. James Douglas, New York.

(To be read before Canadian Mining Institute, March 1st, 2nd and 3rd.)

Iron, its production and its manufacture, is even more essential to the industrial progress of a nation than sulphuric acid. The former is the bone and sinew of the mechanical arts, the latter of the chemical. The vitality of the nations of the world may be guaged by the amount of iron and sulphuric acid they can absorb and assimilate. Tried by this standard, Canada is certainly not conspicuous for energy. Many reasons, some valid and some futile, can be educed as arguments to account for her backwardness. The most cogent apology for the inferior postion she occupies in the list of iron producers, is found in the absence of coal in Quebec and Ontario. But as these sections are supposed to contain iron ore of exceptional purity, to be covered with almost boundless forests, and to possess sulphur ores rich enough for export, a comparison is irresistibly suggested with Sweden, where exactly similar conditions exist and which is nevertheless one of the most notable iron producing and manufacturing centres of the world. Climatalogically, and in many of its geological and physical features, Sweden not only resembles, but is identical with Canada.

The iron deposits of Sweden exist in two groups. The largest, rivalling in size, though not in purity of ore, those of Michigan or Minnesota, are in the extreme north, at Galliware, Luossavaara, Swappavaara and Keranavaara. These ores, abundant in quantity, rich in iron, but highly phosphoretted, lie within the Arctic circle, where till lately there have been no means of transportation and no open ports in winter, where population is scanty, and where no mineral fuel is available for their reduction. But a railroad, from the Galliware mines to Lulea on the Baltic, now gives egress to the ores of this mine. At that port some of the ores, richest in phosphorus and poorer in iron, are subjected to concentration, with the view not only of securing a product higher in iron, but a valuable bye-product in the separated apatite. But these mines will rise into still greater prominence when the railroad projected across the Scandinavian Peninsula, to a winter port on the German ocean, has been built. At that point iron furnaces will be erected to be fed with English coke, and thence ore will be shipped at all seasons to foreign markets. Already over one million tons are shipped from these Norrbotten mines, which even in 1876, were treated by Akerman in his report "On the State of the Iron Manufactures in Sweden," as worthy of only passing notice, for, as he says, "These iron ores in consequence of the difficulty of transportation, and the extreme sparseness of the population in these regions, have been utilized to a very inconsiderable extent, or not at all." Yet within twenty years they have become one of the most important factors in Swedish industrial progress. Their enormous reserves may be estimated by the size of four only of these deposits, which reach the horizontal area at surface of 1,275,000 sq. yards. As distances are being obiterated by ever cheapening appliances for carriage. Such ore deposits on one side of the German Ocean are as available for use in Britain as though they existed within the bounds of the little island itself.

By all accounts Canada has large deposits of manganiferous iron ores on Hudson's Bay, and still larger deposits of higher grade ore on Ungava Bay. The Newfoundland iron ore beds are notable for size and accessability. If these ores from the hyperborean forests of Sweden can be profitably procured to feed the furnaces of Europe, why not yours? For to the modern sailor the Atlantic is no wider than the Baltic or the German Ocean.

It is not to these iron ores which Sweden exports, but to these she treats at home, and to the methods she employs for overcoming her metallurgical deficiencies, that I want to draw your attention.

Through Central Sweden, with a general trend to southwest and northeast, is a band of Azoic rocks, the equivalent of our Huronian, about 100 miles in width and 200 in length. Forest covers most of this tract Within it are the mines, which during the 17th and 18th centuries, produced the ore that made Sweden one of the most important factors in the iron and copper markets of the world. When cheap coal and coke became the fuels of the iron and steel makers, Sweden's prominence waned. For a time after Bessemer's great invention was introduced, Sweden's pure manganiferous pig iron was almost the only material to which it could be successfully applied. But improvements in the process and subsequently the adoption of basic converter lining, deprived Sweden of the advantage which in this respect her pure ores afforded her. Yet nothing daunted Swedish industry and metallurgical skill prevailed, and to-day she has resumed, not her former commanding position as one of the largest producers of that period of iron and steel, but her former importance as the manufacturers on a large scale of the purest grades of those metals in the world.

The intelligence and the flexibility with which Swedish iron masters have adjusted themselves to new conditions and new requirements, is one of the most interesting phenomena of modern industrial life, and one well worth studying by Canadian metallurgists. Again and again Sweden has led the way in certain directions, and been deserted from that path by the invasion of her markets by more favorably situated competitors, and yet she has as often found a new outlet for her energies and her wonderful products. To-day more than ever, quality, not quantity, is the aim of her iron masters.

The ore in the central zone of Sweden is not all of exceptional purity, or equally low in sulphur and phosphorous and high in iron. Moreover the mines which yield the present ores, are not the largest, and as the exceptional excellence of the product is secured, not only through the purity of the raw material, but also by dint of infinite care in the manufacture. The mining and metallurgical operations of even the large manufacturing concerns are conducted on what would be regarded on this side of the Atlantic as an insignificant scale. The total output of Sweden in 1879 was:

Pig iron	533,800	metric tons
Charcoal iron blooms	189,500	"
Bessemer steel ingots	107,500	"
Siemen-Martin ingots	160,800	"

The furnaces and plants generally are on as comparatively diminutive a scale. The furnaces in blast in 1897 were:

Blast furnaces	111
Charcoal hearths	292
Bessemer converters	27
Siemen-Martin steel furnaces	38

The charcoal furnaces are small, the height being from 11 to 18 meters, or 36 to 59 feet. The average annual prodnct of each blast furnace is 4,800 tons, or only 13.1 tons a day, and that of the largest at (Domnarfert) 40 to 45 tons daily. (Akerman Swedish Mineral Industry, Iron and Steel Institute, Aug., '98.) Akerman gives the production of wrought and ingot iron and steel as follows by decades from 1833 to 1887, from which I extract the extremes:

Date.	Quantity produced in metric tons.	Exported.	Percentage of export to production.
1887	463,147	209,756	45.29
1833	67,795	60,039	88.56

It speaks well for the steady growth in production of the country that similar figures for every decade since 1830 show not only a gain in production, but a reduction in exports, and therefore a healthy development of its internal resources.

All the furnaces in Sweden make yearly only as much pig iron as one of Carnegie's great Duquesne stacks pours forth weekly. And yet so intimately interwoven is the iron trade of Sweden with other of her staple industries, that the wealth of that thrifty little land, with a population (4,824,150 in Dec. 31st, '93) rather less than that of Canada, depends in no small measure upon it.

Sweden's present prosperity is in great measure due to the association of three great branches of industry under common management, namely: I. Iron and steel making; II. Lumbering, and III. Wood pulp manufacturing. Dissimilar as these three pursuits seem they are in reality closely allied. The high character which the product of the furnace possesses, is attributable to the use of wood fuel alone. Not a breath of sulphur gas is allowed to taint the iron and steel during its reduction or subsequent manufacture. The iron companies which treat the purest ores find it more profitable to make a moderate output of extraordinary quality with wood as fuel, than to treat large quantities with mineral fuel. But in order to secure wood good enough for metallurgical purposes at a permissable cost, the iron companies own large forest reserves and convert the better grade and larger sizes of timber into dimension lumber and wood pulp. As an example: The largest works in Sweden are those of the Kopparberg Co. (the Stora Kopperberg Bergslags Aktiebolag) whose property is situated in the Province of Dalicorlia. The company produces about $\frac{1}{10}$ of the total output in iron and steel of Sweden. The forests cover an area of 736,000 acres. Its sawmills are on the Baltic at Skutskär. There the highest grade of lumber goes to the pulp mills, the second quality to the lumber mills, and only inferior and small lumber to the charcoal kilns for use in the blast furnaces, while mill refuse and sawdust are converted into gas for other metallurgical purposes. In 1896 the company's mills turned out 57,369 St. Petersburg standard= 113,590,620 ft. broad measure and 5,500 tons of pulp. The pulp is made by both the sulphites and mechanical processes, the latter being possible through the possession of water power of 15,000 h p. capacity. The sulphurous acid for the sulphite process, comes from the old Falun copper mines, from whose ores, in addition to the sulphurous acid for the pulp mills, over 2,000 tons of sulphuric acid are made annually.*

But the lumber trade of the company's activities is insignificant compared with its iron and steel operations. These are best described in the company's own circular, prepared for the Stockholm Ex, in 1897:

In the year 1733 the company built their first iron works, Svartnäs, based on the then discovered iron mines at Vintjärn; one iron work after the other was later on added, each intended for its own particular specialty so that the company has manufactured iron at some 20 places in all.

So many difficulties met, however, in economically carrying on the manufacture at so many places on accouut of the expensivé communications existing, that it was decided about 1870 to concentrate the iron manufacture and for that purpose build new works for which place was selected at one of the big waterfalls of Dala River. This new works is Domnarfvet, which is the largest iron works in Scandinavia and the largest in the world based on charcoal as fuel. To it belong 160 iron mines and a number of waterfalls together capable of developing about 50,000 horse-power, of which however only a small part at present is utilized. The works consist of the following departments:

Charcoal making plant with 8 large kilns.

Blast furnace plant with 5 blast furnaces, 6 Westmans roasting furnaces, regenerative blast heating stoves, etc.

Bessemer Works with 5 converters, etc.

Siemens-Martin works with 4 furnaces of 15 tons each, etc.

Rolling mill plant for sheet iron and plate, wire rods, rails, beams, channels, angles and all kinds of merchant iron.

Forge for hammering tool steel and miscellaneous tools.

Plate pressing works for boiler heads and similar articles.

Horse shoe nail factory, etc., etc.

The whole iron and steel manufacture is, as before said, exclusively based on charcoal by the aid of which is produced from the purest ores:

The highest grade of steel for cutting and other tools, for springs, coining dies, etc.

The principal manufactures at Domnarfvet are:

Pig iron, extra pure.

Ingots, blooms, billets and slabs of Bessemer and Siemens-Martin steel.

Billets specially made for seamless cold drawn tubes.

Projectile steel in large quantities for the English and other armies and navies.

Bars in various shapes and nail rods, wire rods, rivet rods, of Bessemer and Siemen-Martin steel and Swedish Lancashiue iron.

Hammered bars of Swedish Lancashire iron.

Rails.

Boiler and ship plates.

Sheet iron, corrugated and smooth.

Pressed and flanged work of plate.

Machine straightened shafting.

Hammered steel (miners drill steel, tool steel, shear steel, spring steel, file steel, pin steel, machine steel, file blanks, etc.)

Stone cutting tools, hammers, anvils, etc

Horse shoe nails, etc.

The products from Domnarfvet are to a large extent exported to the great countries of Europe, to America, to Australia, the East Indies, China and Japan.

The company furthermore owns two other works, Korsa and Ag, where especially soft Swedish charcoal wrought iron is made. The annual production of iron and steel is:

55,000	tons of	pig iron.
35,000	tons of	Bessemer ingots.
26,000	"	Siemens-Martin ingots.
4,000	"	charcoal iron blooms
47,000	"	rolled and hammered iron and steel of all kinds.
1,000	"	horse shoe nails, bolts and nuts, spikes, etc.

For the works are yearly used 450,000 cubic metres of charcoal (of these are 150,000 cubic meters made in the kilns at Domnarfvet and Skutskär.

Although rails are enumerated as one of the many articles into which their crude material is manufactured, comparatively few are made. Swedish steel is too precious to be turned to such vulgar use, and therefore in the very yards of the steel works themselves one generally sees English or Welsh rails.

It is by thus combining these reciprocally related interests that it is possible to make all three remunerative. Yet even thus, the life of all would be short, in fact that of the iron trade would have been extinguished long ago, but for the practice of strict economy in the consumption of the vegetable fuel, and the application of the rules of scientific forestry.

NOTE.—The area of Sweden is ..... 445,080 kilometers.
Of this there is covered by water..... 37,380 "
And by forest..... 300,000 "

* These Falun copper mines, which have been worked for 700 years continuously, have yielded since opened 500,000 tons of copper, and were in the 17th century probably the largest producers of copper in the world. They now yield only 400 tons of copper annually, with a large list of bye products.

Only about 13 per cent. of the total area is under cultivation and yet she exports to Britain $8,000,000 worth of dairy produce. In tr velling through the country the farms are so scarce and so hidden away in the valleys of the vast forest clad ranges, that one wonders where even the 50,000 kilometers of agricultural land are, and still more, how what there is can be made to yield such a balance of agricultural exports, considering how large a proportion of the population is engaged in mining and manufacturing pursuits, and is therefore a home consumer. By far the most extensive forests are in the north, and are not available for the fuel supply of the great metallurgical establishments of the middle zone. The forests within reach of the furnaces have therefore, been replanted and recut many times over during the centuries of mining and metallurgical activity. It is found that the most economical life of the coniferous trees is 40 years, within which period they attain a diameter of from 8 to 10 inches, you seldom or never see a larger tree in Sweeden or Norway. Calculating from the statistics alone, to make 55,000 tons of pig iron and charcoal blooms at the Kopparberg furnaces, there are consumed 450,000 cubic meters of charcoal, or approximately 9 cubic meters to the ton of ore, or 1 ton of charcoal to the ton of iron of both grades; for one cubic foot of pine charcoal weighs 5 lbs. to 7 lbs., say 6 lbs., therefore, 1 cubic meter weighs 210 lbs., and if 55,000 tons of iron ore are made at the Domnarfert works with 450,000 cubic meters of charcoal, each ton of iron consumes 8.2 cubic meters of charcoal, or 1,722 lbs. One cubic foot of pine weighs 18.9 lbs., and therefore, a cubic foot of charcoal weighs approximately 33 p.c. of the weight of 1 cubic foot of the same wood, but taking the reduction of bulk into account, the charcoal from 1 cubic foot of wood weighs only from 20 to 25 p.c. of the weight of the original wood, or 5.04 lbs. Akerman (In Swedish Mining Industry Iron and Steel Institute, 1898) gives the consumption of charcoal per ton of pig iron at from 4.8 to 8.2 cubic meters, a very large margin of difference for different ores, different charcoals, and different establishments. This therefore, rather conforms to above calculations of 8.2 cubic meters per ton of pig and charcoal blooms, at the works of the Kopparberg Co.

American practice agrees with these figures. J. A. Church (T. of A. I. of M. E., Vol. IV, 119-1875) gives:

1,922 lbs. of charcoal as consumed to the ton of pig in the Bay Farm Furnace, Michigan.

1,911 lbs. of charcoal as consumed to the ton of pig on the Morgan Farm, Michigan.

2,456 lbs. of charcoal as consumed to the ton of pig on the Deer Lake, Michigan.

1,760 lbs., or 80 bushels of 22 lbs. each make 1 ton of iron at the Hinkle Furnace.

But the weight per bushel would indicate coal of exceptional quality (Potter T. of A. I. of Mining E. 23-371). The weight and not the bushel measure is the only reliable standard; for according to Wetherbee, (Eggleston T. of A. I. of M. E., VIII, 384) the weight of the bushel of charcoal from different woods is as follows:—

White pine	9.8	White ash	16.3
Spruce	11.2	Beach	17.3
Poplar	12.2	Yellow birch	18.7
Hemlock	12.8	Maple	18.9

T. Sterry Hunt, in the Geological Survey of Canada Report for 1869, p. 247, quotes the experiments of François in the Pyranees, who gave as the mean for hardwood charcoal 21.9 lbs., and for softwood charcoal 16.4 lbs. per bushel of 2,150.42 cubic inches. Also the result of Marcus Bull's investigation on American woods, which gave per bushel of:—

Red cedar	12.52	Ash or birch	19.25
White pine	15.42	Maple or oak	21.23
Yellow pine	17.52		

The wide discrepancies indicate the extent to which variations in manufacture influence results. Similar incongruities of statement meet us as to the yield of wood and charcoal per acre. Sir Lothian Bell (Iron Steel Inst. in America in 1890) states on the authority of Chevandier, that the forests of the Vosges yield 72 cwt. of dry wood per hectare = 2,471 acres, or 29.2 cwt. per acre. Assuming even this high figure to be correct, Sir Lothian demonstrates easily, the impracticability of running a large furnace that would consume 40,000 tons of fuel yearly on charcoal; 217 square miles would have to be cut over, and yet, if using coke, 1.33 square miles of a 3′ seam would feed the furnace for half a century.

Birkenbine in T. of A. I. of M. E., VII, 149, tries to reduce the consumption of charcoal to the standard of cord wood and arrives at the conclusion that 4 cords of soft wood will make 1 ton of pig iron. If therefore, only 1 cord of wood, as he states, is the yield from an acre of replanted timber land, and 4 cords are considered as making 1 ton of pig, to make the output of 500,000 tons of pig 2,000,000 acres must be cut over annually. In fact, however, when a large quantity of charcoal iron was made in the U. S. the forest lands around the furnaces were stripped and yielded about 30 cords to the acre. Forest conservation and careful cutting and re-planting are not practiced.

Akerman in his report for the Philadelphia Exhibition on the Swedish Iron Industry, gives still lower figures for the yield of Swedish forests. He states that 2.8 hectares, or 6.92 acres must be cut over annually to yield a ton of pig iron. Since the Centeninal year Swedish methods of both forestry and metallurgy have improved. Of course, on their system of cutting the forest is perennial, unless distroyed by fire or wind. Moreover, in the above estimates, the assumption is that only the large wood is consumed, whereas with modern kilns good charcoal is made of inferior material, and in the producer, saw-dust, and large twigs and anything that will burn is turned into gas, and thus made into as valuable a fuel as the best of wood. Nevertheless, only in very favorably situated districts, can large quantities of iron be made with charcoal. Such a district would seem to be the original seat of the iron smelting industry of the *old regime* on the St. Maurice, Province of Quebec, whose waters are said to drain 200,000 square miles of forest land, and at the same time literally breed bog ore, so that the mineral and the fuel to reduce it grow simultaneously side by side. (Griffen T. of A. I. of M. E., XXI, 974.)

Yet if there be pure iron ore accessible to a territory covered by good timber, and intersected by water ways and provided with abundant water power, the establishment of such combination of enterprises would confer a national benefit and should be profitable, for the value of such iron and steel is not to be measured by the price of common pig or ordinary steel. At present the price of most Bessemer pig in the U. S. has been about $10 at the furnaces, whereas Swedish charcoal pig iron is worth £5 cif., Swedish malleable iron bars are quoted at £9.5 cif., and hollow steel ingots, such as are used for bicycle tube making are quoted at $120, duty paid into the U. S. But such complicated enterprises as those of Sweden, can no where be carried out profitably unless the same economical methods are adopted which Sweden applies. If they can be duplicated anywhere it is surely in Canada. For Canada like Sweden possesses boundless forests, intricate water ways, immense water power, pure iron ores, and sulphur mines.

But should the fuel or iron ore not be available for work on such a scale as the operations of the Kopparberg Co., there are ores accessible to the Ottawa in treating which the saw-dust and waste lumber of that river, might be used. Whether the iron ores of Ontario and Quebec within easy reach of the Ottawa are as abundant as some claim I cannot of course decide, but the analyses published certainly represent ores of such remarkable purity, that they compare favorably, not with the best, but with the average of Sweden's Bessemer ores. In the following table 1, 2, 3, are examples of the purest Domnarfert

Bessemer ores; 4, 5, 6, 7 of good Swedish ores of second grade, and 8 to 16 are examples of Canadian ores from Quebec and Ontario.

No.	Name of Mine.	Sesquioxide of iron.	Peroxide of iron.	Protoxide of iron.	Protoxide of manganese.	Magnesia.	Lime.	Alumina.	Silic acid.	Sulphur.	Carbonic acid.	Iron.	Phosphorus.
1	Johannisbergs grufvan	61.57		5.34	5.96	4.68	2.20	0.44	0.60		12.10	53.80	0.003
	"	64.42		6.13	6.88	4.72	1.62	trace	1.30	0.036	13.60	51.42	0.002
2	Bisphergs Stor grufva I	89.64	4.48		0.14	0.78	0.60	0.32	4.46			68.05	0.003
	II	73.75	6.54		0.13	0.94	0.60	1.60	16.20	0.013		58.00	0.008
3	Norbergs parish D : o Lilla Bads tugrufvan.		79.25		0.05	0 15	0.50	1.00	18.80	0.009			0.021
4	Norbergs faltet new Skacelbergs grufvan		8.51		trace	0.11	1 30	0.18	13.00	0.076			0 011
5	D : o Old Stora By grufvan		69.05		0.05	0.30	1.65	0.60	28.25	0.021			0.034
6	Risbergs faltet spellal		71.35		0.15	0.10	2.25	0.50	25.70	0.006			0.003
7													
8	Hunts iron & iron ores, 1866-1869. Hull Bed ore		66.20	17.78		0.45	3.42		10.46	.2180		58.76	.015
9	" Black ore		73.90			1.88		.61	20.27	.085			.027
10	North Crosby		90.14			.84	.82	1.33	5.25	.120		64.90	.007
11	Belmont		72.80			6.46	2.75		14.73			52.41	.035
12	Madoc		89.22						10.42	.073			.012
13	McNab		84.42			1.04	5.40		7.16	.065			.030
14	Harrington 1873-74—Bristol		65.44	14.50					11.45	1.40		58.37	
15	Khodes & Co. A. I. of M. E. XX, 411. Levant		63.73						4.466	0.032			0.028
16	Glendower		62.32						10 67	0. 39			0.01

Analyses are given of other Ontario ores by T. D. Ledyard on some Ontario Magnatite, Vol. XIX, page 30, T. A. I. of M. E. They indicate ores even lower in phosphorus. The amount of pyrites in these ores seem to be well within the limit of Swedish practices, where owing to the methods of firing in charcoal hearths, the percentage of S. must nevertheless be small. This is attained by roasting. The gas calcining furnace of Westman is largely used.

The Canadian ores represented by above analysis come nearly up to the standard of Swedish ores from the Norbergs District Vestmanlands, Can, and are purer than much which is sold as Bessemer ore from Lake Superior, taking the following as examples :—

	Fe.	Ph.
Mountain iron	64	.045
Holmer	64	.053
Tubal	62	.065

It is estimated that 700 to 800 tons of vegetable matter goes to waste daily at the mills on the Ottawa, or say 450 tons of dry wood. If half of this, or say 200 tons could be converted into charcoal in the Ljungberg kiln it would yield 55 tons of charcoal and make over 60 tons of pig, while the saw-dust would make gas enough to convert the pig into steel and to manufacture the steel into specialized forms. This amount of iron may seem insignificant, yet it is more than one-tenth of Sweden's output.

At present it is costly disposing of this valuable vegetable matter as waste, yet in Sweden every grain of saw-dust, all the bark, and whatever will smoulder is carefully collected and turned into gas. Fish are abundant in rivers which turn half a hundred saw-mills. Even if the law permitted of the pollution of the rivers, self-interest would forbid. Attempts have already been made in the United States to utilize saw-mill waste in iron making. The Plattsburg or Norton Furnace was built in 1877 as an auxiliary to Norton's saw-mills for the treatment of Chateaugay ore, (T. of A. I. of M. E., IX, 77), but without much success. The appliances and metallurgical experience were however, at tnat date vastly inferior to those now accessible. The Kopparberg Company for instance, now uses the Ljungberg continuous kiln, in which refuse wood is burnt into charcoal, at 33 per cent. less cost than in heaps, and with 22 per cent. higher yield. The company reports that the yearly output per kiln is 200,000 hectoliters (=550,000 bushels) of charcoal. The kiln is charged by means of hoisting and conveying machinery. The work is mechanically discharged into pockets, whence it is conveyed by rope transportation to the top of the blast furnace. The company exhibited at Stockholm, tar, acetate of lime, methelated alcohol, and other bye products of charcoal kiln.

Waste such as saw-dust, shavings, bark, etc., too small or unfit for conversion into charcoal, is grasified in producers of peculiar construction. If the charge be sufficiently open to allow the free passage of air, the charge in the producer is 12 feet deep, if compact, as for instance, when saw-dust is being burnt, 6 feet in depth. In the latter case, forced blast is introduced, on a level with the solid hearth, for no grates are necessary, there being clinkers and very little ash. Formerly it was considered necessary to condense the moisture and the tar, before the gas was burnt; but now the ligneous fuel is dried before being thrown into the producer, and the gas, if the producer be no further than 50 feet from the furnace, is burnt as it is made. The introduction of the wood gas producer enables charcoal iron to be made into open hearth steel, aud this to be manufactured into articles which require high or accurately controlled heat, and the gas is made out of material whose disposal elsewhere entails cost and serious inconvenience to the lumberers.

If the circumstances in Canada be as supposed the methods pursued in Sweden are certainly well worthy of study by Canadian lumber men and iron miners. To the combination of the two great industries of lumbering and iron smelting is largely due the prosperous condition of both in Scandinavia. To practice conservative forestry is what every enlightened economist and lumbermen on both sides the line preaches, and what no one practices on a large scale, nor I fear will any one practice it, until obliged by law to do so. It requires no argument to prove, that a perennial blessing is better than an annual one; but before the full benefit of scientific forestry can be achieved a large immediate sacrifice must be made, and afterwards the lumberman would I suppose have to be satisfied with a lower average scale of profits. To associate pulp making with saw-milling is doing no violence to either industry, but it would certainly strain the versitility of our most enterprising lumber merchants, were they to undertake as an adjunct the delicate task of iron smelting, steel making and tool manufacturing. Such complex industries must be the product of growth. But the first step towards the realisation of such a system of exhaustive and economical utilization of nature's resources might be the establishment, if necessary under independent management, of iron and steel works, conveniently situated to the saw-mills of the Ottawa, and under contract with the saw-mill owners to supply mill waste.

NOTE.—According to Mathews (T. of A. I. of M. E. XI, 84) one cord of wood charred in a retort yields 70 bushels charcoal of 2,561 cubic inches; 225 gallons of pyroligneous acid, ½ gallon of wood alcohol, 25-30 gallons of tar. But for furnace use retorted charcoal is not considered economical, and the Kopparberg kilns do not show so high a yield of bye products.

The failure of such old enterprises as the Hull furnace, need not deter the promoter of such an enterprise, if they are satisfied of an abundant supply of pure ore; for a revolution in iron and steel making has taken place within the last 25 years. Moreover charcoal, iron and steel are even rarer products than they were then; for in 1875 the U.S. produced 515,700 tons of charcoal pig, whereas the output fell to 255,211 tons in 1897.

The production is never likely to be in excess of the demand. Such iron furnaces and mills need not be on the immense scale of the great coke and coal iron and steel plants. The famous Sandvik works of Sweden which supply the United States with the finer bicycle steel for tubing, turn out only 20,000 tons of finished product annually. Another company which exhibited its products in a separate pavilion at Stockholm, the Finspong, makes only 6,000 tons of open hearth steel ingots, 6,000 tons of open hearth steel castings, 600 tons of wrought iron blooms, and 2,500 tons of manufactured articles.

Compared with the enormous production of the United States for example, whose blast furnaces made in 1898 11,900,000 tons of pig the largest stacks touching 700 tons per day, Sweden's output if measured by quantity is almost inappreciable. Nevertheless by adhering to the principle of never sacrificing quality to quantity, her comparatively small contribution of iron and steel to the world's total, owing to its unique excellence, and its wonderful properties maintains Sweden in a prominent position among the metallurgical powers. Her enviable position and bright example are therefore worthy of being taken to heart by Canadian miners, metallurgists and lumbermen.

NOTE.—There have been great oscillations in production between these dates. The production rose to 628,140 tons in 1890, but for years past the production has not notably exceeded that of 1897.

COMPANY NOTES.

Hurricane Point Mining Co., 15½ per cent. Dividend.—The first annual meeting of the "Hurricane Point Gold Mining Co." was held in their office in Halifax, on January 11th last, and a very satisfactory meeting it was. This property is situated at Isaacs Harbor, Nova Scotia, and was formerly known as the "Palgrave Mine" and worked for some time by Mr. H. K. Fisher and others and paid well; but unfortunately they got involved in law suits and for a long time the mine was closed up and no work done.

On the death of Mr. Palgrave, in England, his heirs decided to discontinue law proceedings and the property fell into the hands of the contestants, Messrs. McMillan and others of Isaacs Harbor, who sold it to Mr. George A. Pyke, Hon. David McKeen, Patrick O'Mullin, Esq., and others in Halifax, and Messrs. Burchall and others of Sydney, C.B. The new company took it over in November, 1897, and pumped out the mine, made repairs to the mill and machinery and by January of last year had it in good working order. In 11 months they took out 2785 tons quartz, yielding 1766½ ounces of gold, worth $34,097.55, leaving a profit of $15,500. The gold from the "Hurricane Point Mine" is of very fine grade going over $19.50 per ounce. It is situated on a point of land near the entrance to Isaacs Harbor on the east coast of Nova Scotia, and part of the areas that are being worked are under the sea. This promises to be one of the good dividend paying gold mining properties in the Province of Nova Scotia, and as it is well and carefully managed the owners will no doubt do well on their investment.

The directors of the company who were re-elected are:—Mr. George A. Pyke, Merchant, President; Hon. Sen. McKeen, Vice-President; P. O'Mullin, Esq., President of Peoples' Bank of Halifax, J. E. Burchall, Esq., Sydney, John McMillan, Esq., Isaacs Harbor, Directors.

Payne Mining Co's Dividends.—The following report of the operations of this company under date of 1st July will be of interest:

We have the pleasure of submitting to you the following brief report of operations of the Payne Mining Co., from the commencement to April 30th, 1898, and including returns received on all ore shipped to that date. It is in no sense a report of the operations of the Payne Mining Co., alone, but covers also the period from October, 1896, to April 1st, 1897, during which time the mine was operated by Messrs. A. W. McCune, Scott McDonald and W. L. Hoge, the owners, who, however, turned over to this company all the profits realized during that period, after deducting the cost of operating, and the amount paid for the property, said profits amounting to $85,000. The shut down of the mine in April, caused by the fire, enabled us to clean up, and furnished us with the opportunity to make a complete statement, and we have made it to cover the entire out put of the mine from the beginning, thinking such a statement would be more satisfactory to the present stockholders of the company than a statement from April, 1897, when the company took possession of the property.

There were mined and shipped to smelters during that period 17,468 tons of dry ore, which yielded 1,831,600 ounces of fine silver, and 17,786,000 pounds of lead, and netted the company $973,932.45.

The profit and loss account shows a credit balance of $627,089.42, of which amount $550,000.00 in dividends have been paid, leaving a balance on hand of $77,089.43 in cash and book accounts.

The company has thus paid in dividends more than 60 per cent. of its receipts, over and above the purchase price of the mines, all the improvements and the costs of operations.

It is a most remarkable showing and speaks volumes for the great value of the property.

A fire broke out in April, 1898, at the mine, near the mouth of tunnel No. 3, which consumed the ore house, blacksmith shop, rock breaker, and the upper end of the tramway. The head of the tramway has been re-built lower down the hill, at tunnel No. 5, thus avoiding the steepest part of the grade and shortening the line, and the rock breaker has been set up at the shipping point on the K. & S. Ry. and will be run by water power.

As a result of these changes the cost per ton of extracting ore and the total cost of operation should be less in the future than in the past.

The mines were owned and worked by the Payne Mine, from October, 1896, to April, 1897; and by the Payne Mining Co., from April, 1897, to April, 1898.

The financial statements herewith show the combined receipts and expenses of both companies.

Yours, very truly,
(Signed) W. L. HOGE.
President.

F. E. SARJENT,
Secretary,

Details of expenditure—Payne Mine and Payne Mining Company, April 30th, 1898:—

Tramway	$ 40,891 34
Waggon road	9,457 29
Buildings	6,394 80
Labor	132,715 26
Supply and equipment	15,627 54
Explosives	3,772 89
Assaying	2,864 80
Candles	2,403 00
Stable	1,006 22
Interest and exchange	488 75
Customs	11 00
Ben Hill	52 50
J. R. Way	211 31
Peter Nelson	50 00
Ore sacking	15,790 33
Ore hauling	19,530 62
General expense	28,616 49
Salaries	5,084 00
Investments	75,321 40
	$360,289 54

BALANCE SHEET.

Payne Mine and Payne Mining Company, April 30th, 1898:

Liabilities.

Capital stock, 1,000,000 shares at $2.50		$2,500,000 00
Profit and loss account	$627,089 42	
Less dividends paid	550,000 00	
		77,089 42
		$2,577,089 42

Assets.

Mineral claims	$2,499,982 50
Subscriptions	17 50
Cash and book accounts	77,089 42

PROFT AND LOSS ACCOUNT.

Payne Mine and Payne Mining Company, April 30th, 1898.

Dr.

Investments	$ 75,321 40
Improvements	50,743 43
Labor	132,715 26
Ore sacking	15,790 33
Ore hauling	19,530 62
Mine supply	26,488 01
General expenses	28,616 49
Salaries	5,084 00
	$360,289 54
Balance profit to balance sheet	627,089 42
	$987,378 96

Cr.

Ore sales	$975,932 45
Boarding house	11,343 66
Charity	82 00
Hospital	20 85
	$987,378 96
Dividends paid up to April 30th, 1898	$550,000

Dividends since April 30th, 1898:—

April, 1898	$ 50,000	
May, 1898	25,000	
June, 1898	25,000	
July, 1898	25,000	
August, 1898	25,000	
September, 1898	50,000	
October, 1898	50,000	
November, 1898	100,000	
December, 1898	50,000	
January, 1899	25,000	
February, 1899	25,000	
		450,000
		$1,000,000

Up to April 30, 1898, the company paid $230,786 duty on lead contents of ore, all of which was shipped to the smelters in the United States. The freight and smelter charges for the same period amounted to $362,686. As soon as the Canadian Pacific Railway erects smelters for the treatment of silver, lead ores and the new silver-lead smelter of the Hall Mines Company is completed, it will be seen that a great saving can be effected in duty and freight.

The earnings of the mine at present are said to be about $70,000 net per month.

The Consolidated Cariboo Hydraulic Mining Co.—The following is the report presented at the annual meeting held in Toronto, February 17th, 1889. Your directors beg to submit their report at the first annual meeting of the shareholders, together with the manager's report, balance sheet and auditors' report for the year ending December 31st, 1898.

During the period under review the Morehead Dam and Ditch were completed at a cost of $118,458.68, which amount is $6,541.32 less than the estimated cost thereof.

The company has acquired the mining leases and additional water rights as outlined in the report presented at the meeting held in January, 1898, at a cost of $20,000.

Your directors have decided to appropriate the sum of $17,000 recommended by the manager as necessary to complete the equipment of the mines and place the property on a basis for profitable production.

W. D. MATTHEWS,
President.

Assets.

Mines, Mining Leases, Water Rights, Canals, Reservoirs, Hydraulic Plant & Appliances, Buildings, Machinery	$3,894,558 38	
Mining Leases acquired during season	20,000 00	
		$3,914,558 38
INVENTORY. (See Manager's Report).		
Provisions, Mining Supplies, Explosives	37,754 31	
Lumber, Saw-logs and Sluice Blocks	9,959 67	
Tools and Implements	6,646 72	
Blacksmith's stores	1,614 12	
Horses and Mules	1,675 00	
Wagons and Harness	1,781 25	
Quicksilver	2,685 80	
		$62,216 87
Cash on hand, Mine Office		1,000 00
Personal Accounts receivable		5,176 10
Balance brought forward from Operating Account		2,527 17
PERMANENT IMPROVEMENTS—		
Morehead Ditch and Dam	118,458 68	
Drain Tunnel	3,533 42	
Installation of Steel Riffles	11,600 01	
Lands and Leases	1,322 00	
Equipment of Lower Bench	7,424 01	
		$142.338 12
		$4,126,816 64

Liabilities.

Capital Authorized	$5,000,000	
" Issued		$4,000,000 00
Accounts payable		24,917 07
Bills payable		50,000 00
Bank of Montreal		51,899 57
		$4,126,816 64

Examined and found correct,

TORONTO, 1st February, 1899. W. S. ANDREWS, Auditor.

OPERATING ACCOUNT, SEASON 1898.

To operating expenses as per Mines Account	$96,506 68	
" Incorporation license	1,687 50	
" Expenses reorganization	6,421 31	
" Interest account	2,143 86	
" Head Office expenses	909 18	
		$107,668 53
By Bullion recovered	105,141 36	
" Balance	2,527 17	
		$107,668 53

MANAGER'S REPORT.

QUESNELLE FORKS, B.C., December 31st, 1898.

GENTLEMEN,—As the Manager of the Consolidated Cariboo Hydraulic Mining Company, Limited, I hand you this, my annual report for the season of 1898, which reviews briefly the work performed in connection with the equipment, opening and operation of the Company's mine.

The work of cleaning the canals of accumulations of ice was commenced in the latter part of March and completed on April 10th.

The catchment water was pooled in the South Fork reservoir and washing gravel commenced on the 14th of April, in pit No. 1. Washing was also commenced in Pit No. 2, to remove the vast accumulations of bowlders and tailings deposited by the early Chinese miners in Dancing Bill Gulch and on the work out ground fronting the lower or bedrock bench, also the slide and other waste material from the northwest rim, the complete removal of which was necessary to make possible the installation of the permanent sluices and gold saving appliances.

A run of 70 days 19 hours was made in Pit No. 1, during which time 143,475 miner's inches of water was used to wash out 350,000 cubic yards of top gravel and clay, which produced 4,403½ ounces of gold, valued at $75,166.16, an average yield of 21 cents per cubic yard, an improvement of about $31\frac{8}{10}$ cents on the average for 1897.

A run of 40 days 15 hours was made in Pit No. 2, during which time 89,989 2 miner's inches of water was used in the removal of 436,200 cubic yards of tailings, bowlders and other waste material, which produced 351½ ounces of gold, valued at $6,021.70.

The removal of this waste consumed about one-third of the season's water supply, added materially to the cost of the season's operations, and caused a proportionate reduction of the season's product.

The installation of the permanent sluice plant and gold saving appliances in the bed of Dancing Bill Gulch was commenced on July 1st and completed August 1st. This plant consists of two lines of sluices 7 feet wide by three feet deep, each line 240 feet long, both paved with improved steel riffles, which are the best in use for the recovery of fine gold.

After the installation of the plant, the work of opening the lower bench was commenced. A run of 16 days and 3½ hours was made, during which time 31,416.4 miner's inches of water was used in the removal of 35,670 cubic yards of gravel and slide rock from the bottom bench, which produced 1,389 ounces of gold, valued at $23,953.50, an average yield of 67.15 cents per cubic yard, which is 18.15 better than the average produced from the test pits sunk and prospected during the season of 1896 and 1897.

The opening work was attended with many delays and difficulties, on account of the immense slide of bedrock found underlying the old workings near Prospect Shaft No. 1, the immense deposits of bowlders found in the old workings on the east side of the channel under the main sluice from Pit No. 1, and the hardness of the underlying bedrock in which the working sluice cuts had to be sunk and advanced to facilitate the removal of the gravel to the sluices. During the progress of the run two bedrock cuts were excavated for a distance of 300 feet each and lowered in the rock from 2 to 60 feet in depth.

Then the workings were carried to a point under the old main sluice from Pit No. 2, and the bedrock uncovered under the deposit of slide rock, a rich stratum of gravel containing coarse gold was encountered and appears to continue up the channel on the flat rock on the east side. The gold recovered is heavier than any found in the upper workings, one nugget weighing 6¾ ounces and valued at $115.00.

WATER SUPPLY.

The water supply during the season was somewhat in excess of that in 1897. This was to be expected, as the record of rain and snow fall exceeds that of 1897.

	Inches.
Rain and snow fall from Nov. 1st, 1896 to Nov. 1st, 1897	25.56
" " " Nov. 1st, 1897 to Nov. 1st, 1898	28.57
Making the precipitation for 1898, in excesr of that of 1897	3.01

Two inches of the extra precipitation occurred during the winter, and should have caused the water in the storage reservoirs at Polleys and Bootjack Lakes to rise higher than it did in 1897.

The winter snow passed off under influence of warm days and nights of low temperature, at times considerably below freezing point, conditions most unfavorable for making water, and explains the cause of the failure of the water to rise in the reservoirs as high as expected.

On the other hand, the summer rains were in excess of the previous season. They came in protracted storms of several days' duration, which are favorable for increasing the flow, and much more water finds its way into the reservoirs and canals.

	Miner's inches.
Quantity of water used in 1897	223,416
Theoretical quantity expected for 1898	250,212
Actual water used in 1898, per Mine Report	264,880.9
Exeess of actual over theoretical	14,668.9

About $7\frac{1}{8}$ days' water for 2,000 miner's inches.

The Morehead Dam and Canal are now completed, at a cost of $118,458.68, this amount being $6,541.32 under the estimates.

The mine may, in future, depend upon double the supply of water afforded by the South Fork and Dancing Bill water system, and will ensure a steady supply throughout the season even under more unfavorable conditions than have occurred since the commencement of the equipment of the property.

The Morehead system is not complete, however, without a small pooling reservoir to collect and conserve the early spring and late water when not delivered in the quantity required to operate the mine, and to conserve the water flowing down the canals at times when the head gates are ordered closed down.

The necessary pooling reservoir can be made in the valley above the main South Fork canal, a short distance above the South Fork reservoir, which will hereafter be used for pooling water for use in the South Fork Pit No. 3.

Such a reservoir can be made by the construction of an earth dam containing about 4,500 cubic yards of earth, and can be constructed, together with the necessary gates, at a cost of $5,000.

This pooling reservoir will materially simplify the problem of the economical use of water in the mine.

LANDS AND LEASES.

The twenty-five Placer Mining Leases purchased during the season are situated on Long Lake Creek, Little Lake Creek and Morehead Creek.

The area of the leases is $2,112.\frac{8}{10}$ acres, These leases cover the auriferous deposits of an ancient river channel of stupendous proportions, for a distance of 42,530 feet, about eight miles, commencing at the old Cariboo Company's line west of the South Fork reservoir, and extending down to the confluence of Morehead Creek with the Quesnelle River.

Appurtenant to the above described property, are valuable water and reservoir rights, one for 1,000 inches of water from Morehead Creek and 1,000 inches of water from Little Lake Creek, together with the right to use said Little Lake for a storage reservoir. These additional water rights increase the company's water supply to 7,000 miner's inches.

The acquirement of this most valuable property adds at least four hundred millions of cubic yards of auriferous gravel to the Company's holding, making the total quantity of auriferous gravel available for future washing, amount to about four hundred and sixty-three millions of cubic yards.

MINE EQUIPMENT

COMPLETE PLANTS FOR THE EXCAVATION AND TREATMENT OF

ROCK, COAL and ORE

WE MAKE A SPECIALTY OF

Rotary and Side Dumping Ore Cars with McCaskill Wheels and Boxes

Cages and all Hoisting Appliances . . . . . .

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INGERSOLL-SERGEANT . . .
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STAMP MILL MACHINERY. **ORE AND ROCK CRUSHING PLANTS.**

Complete Estimates furnished on application to Main Office or Branch Offices.

JAMES COOPER MAN'F'G CO. Limited

MONTREAL.

BRANCH OFFICES: 116 Hollis St., Halifax, N.S. Hilliard Opera House Block, Rat Portage, Ont. P.O. Building, Rossland, B.C.

OPERATING THE MINE AND OPENING THE LOWER BENCH PIT No. 1.

COMMENCING APRIL 19TH AND ENDING NOVEMBER 1ST, 1898.

Water Used.			How Used.
Days.	Hours.	Qty. Miner's Inches.	
8	21½	19,717.6	Cleaning out ice and frozen clay.
40	3	80,257.8	Washing top gravel and clay.
17	9	34,749.9	" " " "
4	9	8,750.0	" " " "
70	19	143,475.3	

SUMMARY OF RUN IN PIT NO. 1.

Time occupied in washing	70 days 19 hours.	
Quantity of water used	143,475	miner's inches.
Quantity of material removed—		
Ice and frozen clay	42,300	cubic yards.
Clay from top, west side of Pit	106,000	" "
Top gravel and clay, east side	201,700	" "
Total quantity material washed	350,000	" "
Duty of water per miner's inch	2 44	" "
Gold recovered	4,403½	ounces.
Value	$75,166.16	
Average yield per cubic yard	21	cents.
Product per day of 24 hours	$1,058.67	

PIT No. 2.

COMMENCING APRIL 14TH AND ENDING NOVEMBER 1ST, 1898.

Removal of accumulations of Chinese bowlders and tailings and other waste material, preparatory to installation of gold saving appliances and opening of lower or bedrock bench.

Water Used.			How Used.
Days.	Hours.	Qty. Miner's Inches.	
4	11½	8,958.5	Clearing out ice and frozen clay.
23	4	55,072.5	" " earth, top waste and slide rock from N.W. rim, and accumulations of bowlders front of Lower Bench.
2	20	5,708.2	Clearing out accumulations of bowlders and tailings from bed of Dancing Bill Gulch.
6	9½	12,750.0	Clearing Chinese bowlders from front of Lower Bench.
3	18	7,500.0	Clearing Chinese bowlders from Lower Bench.
40	15	89,989.2	

SUMMARY OF CLEARING OUT WORK DONE IN PIT NO. 2.

Time occupied in washing	40 days, 15 hours.	
Quantity of water used	89,989.2	miner's inches.
Quantity of material removed:		
Ice and frozen clay and gravel	31,200	cubic yards.
Accumulations of tailings and bowlders	72,000	" "
Top waste earth and slide rock from N.W. rim	333,000	" "
Total waste removed	436,200	" "
Duty of water per miner's inch	4.84	" "
Gold recovered	351½	ounces.
Value	$6,021.70	
Yield per cubic yard	.01 37-100	cents.
Product per day of 24 hours	$146.87	

PIT No. 2 LOWER OR BEDROCK BENCH.

COMMENCING AUGUST 1ST AND ENDING NOVEMBER 1ST, 1898.

Water Used.			How Used.
Days.	Hours.	Qty. Miner's Inches.	
11	14½	23,166.6	Washing bottom gravel and lowering cuts.
4	13	8,249.8	Washing bottom gravel and lowering cuts.
6	3½	31,416.4	

SUMMARY OF OPENING RUN ON LOWER BENCH.

Time occupied in washing	16 days 3½ hours.
Quantity of water used	31,416.4 miner's inches.
Quantity of gravel washed	35,670 cubic yards.
Duty of water per miner's inch	1-1⅛ cubic yards.
Gold recovered	1,389 ounces.
Value	$23,953.50.
Yield per cubic yard	0.67-1⅛ cents.
Product per day of 24 hours	$1,483.58.

An immense bedrock slide encountered near Prospect Shaft No. 1 interfered materially with the progress of washing gravel, and reduced the duty of the water for the washing done on the lower bench.

SUMMARY OF THE SEASON'S WORK.

Total time occupied in washing	128 days 16½ hours.
Total quantity of water used	264,880.9 miner's inches
Total quantity of pay gravel washed	385,670 cubic yards.
Total quantity of Chinese tailings and other waste material removed	436,200 cubic yards.
Gold product for season	6,144 ounces.
Value of gold recovered	$105,141.36.

The receipts and expenditures attending the equipment, opening and operation of the Company's Mine for the season, will be found distributed in detail in the following statement:—

EXPENDITURES FOR SEASON OF 1898.

Permanent Improvements—			
Drain Tunnel		$ 3,533 42	
Lands and Leases		1,322 00	
Installation of Steel Riffles		11,600 01	
Equipment of Lower Bench		7,424 01	
			$ 23,879 44
MOREHEAD DAM AND DITCH.			
Dam—			
Cleaning Dam Foundation	$ 327 36		
Excavating Dam Foundation	2,852 51		
Making Dam Embankment	14,866 71		
Facing Inner Slope with Rock	3,918 44		
Trunk Conduit and Gate Tower	15,608 12		
		$37,573 14	
Ditch—			
Right of way Clearing	$ 1,471 23		
Excavation of Ditch	46,571 29		
Jaw-Bone Pipe Line	2,954 42		
Flumes	12,378 34		
Waste Gates	1,002 70		
Engineering, Walling and Incidentals	5,448 28		
		$69,826 26	
Special—			
Clearing Reservoir Site	$ 7,321 14		
Changing Government Roads	1,133 60		
Telephone	1,174 55		
Camp Buildings	1,429 99		
		$11,059 28	
Total Cost Dam and Ditch			$118,458 68
Total Cost of Permanent Improvements			$142,338 12
Operating Expenses—			
Lands and Leases		$ 432 14	
Mining—Explosives	$20,089 90		
Labor, etc.	31,766 33		
		51,856 23	
South Fork Ditch Maintenance		5,963 65	
Sluice Maintenance		7,047 57	
Portable Hydraulic Plant Maintenance		2,402 15	
Mine Light Maintenance		230 90	
Camp Maintenance		1,244 35	
Buildings Maintenance		1,088 15	
Melting Plant Maintenance		75	
Wagons and Harness Maintenance		187 95	
Telephone Maintenance		49 50	
Roads and Trails Maintenance		364 85	
Insurance Account		663 35	
Transportation of Miners, etc		4,983 56	
Stable expense		3,199 92	
Bullion Expense, *Government Tax and Transportation*		3,382 81	
Postage and Telegraph		328 86	
Mine Office expenses		2,504 74	
Incidental expenses		456 15	
Stationery and Printing		190 52	
Management		5,161 50	
Wagons and Harness Account, *Loss on Pack Train Rigging, sold*		1,026 75	
Horses and Mules Account, *Loss on Pack Train, sold*		1,443 80	
Tools and Implements, *Depreciation for Season*		668 93	
Quicksilver Account, *Loss for Season*		927 60	
Total Operating Expenses for Season.			$ 96,506 68
Summary—			
Total Permanent Improvements for Season		$142,338 12	
Total Operating Expenses for Season		96,506 68	
Total Expenditure for the Season			$238,844 80

Receipts for the Season—

Gold Recovered		$105,141 36

Inventory—

There is on hand at the Mine, as per Inventory taken October 31st, 1898, as follows:

Miscellaneous Provisions and Mining Stores	$ 32,795 43	
Explosives	4,958 88	
Total Stores		$ 37,754 31
Quicksilver, 56 Flasks	$ 2,685 80	
Blacksmiths' Stores	1,614 12	
Lumber, Logs and Sluice Blocks	9,059 67	
Live Stock	1,675 00	
Wagons and Harness	1,781 25	
Tools and Implements	6,646 72	
		$ 23,462 56
Total		$ 61,216 87

WATER SUPPLY SYSTEM.

The Water Supply System, as now completed, consists of the

	Length miles.	Capacity, miner's inches.
Main South Fork Canal from Polleys Lake reservoir to the mine	19	3,000
Canal from Drop Gulch to South Fork reservoir	1	3,000
Canal from South Fork reservoir to Dancing Bill Gulch	1	3,500
Ditch from Dancing Bill Gulch to South Fork reservoir	1	1,000
Old South Fork Ditch from South Fork reservoir to French Barr Bluff	1	1,000
Morehead Canal, from Morehead Lake reservoir to its junction with South Fork Canal	10	2,500
Total length of Canals and Ditches completed	33 miles.	

All the above named canals and ditches are in good condition, excepting the old South Fork Ditch from South Fork reservoir to French Bar Bluff. This ditch will be improved, and used hereafter for the delivery of surplus water for use in the South Fork Pit.

CONDITION OF THE MINE.

Since the opening of the lower bench in Pit No. 2 at Dancing Bill Gulch, the Mine may be considered in good condition for the use of the increased water supply from Morehead Lake.

The installation of the hydraulic plant in the South Fork Pit, which will be called Pit No. 3, is now under way, and will be completed early next spring ready for the use of the spring freshet and any surplus water that cannot be profitably used in Pits Nos. 1 and 2.

The heavy body of indurated clay overlying the gravels on the west side of Pit No. 1 is rapidly decreasing as the workings are advanced easterly up the channel.

There is a marked improvement in the average yield of the top gravel in Pit No. 1 as the workings are advanced up the channel.

The character and grade of the gravel in the lower bench is as good as expected and is likely to improve as the workings are carried up the channel above the old Chinese workings.

When the improved condition of the working pits, the high grade of the gravel and the increased water supply is considered, it is reasonable to expect that the product should double that of any season since the opening of the hydraulic excavations.

The sum of $17,000 should be appropriated to purchase hydraulic plant and appliances required in addition to that now in stores, to complete the equipment of the South Fork Pit, construct a pooling reservoir for the Morehead System and to complete the Bullion Retorting and Melting Plant. When this work is completed, the property will be fully equipped for the economical use of the increased water supply and the successful and profitable operation of the Company's mines at Dancing Bill Gulch and Black Jack Gulch.

With the additional force required to handle and utilize the increased water supply and perform the extra work attending the opening of South Fork Pit, it is expected that the operating expenses for the ensuing season will be increased, but will probably not exceed $108,000.00.

This report deals with the revenue and expenditures attending the equipment, opening and physical operation of the mine, and does not include Head Office expenses.

Very respectfully yours,

J. B. HOBSON,
Manager.

North-West Ontario Mining and Development Co., Limited.—This company was recently registered in London with a capital of £50,000 in shares of £1, to acquire a mining property comprising 39 acres on Shoal Lake, Lake of the Woods, Ont.

The Directors are: C. J. Ponsonby, Dashwood House, E.C., Chairman; George Deas, 35 Queen Victoria Street, E.C.; T. Wentner Smith, 23 Finsbury Circus, E.C.; W. H Moresby, 2 Hare Court Temple, E.C.; James Hill, Wellington, Surrey. Advisory Board in Canada: The Hon. J. N. Kirchhoffer, Barrister-at-Law, Brandon, Manitoba, (Senator of the Dominion of Canada); J. M. Savage, Rat Portage, Ontario, (Manager of the Western Lumber Co., Limited, Ontario); C. W. Chadwick, Rat Portage, ex-President of the Board of Trade, Rat Portage, Ontario, (Director of the Bullion Mining Co. of Ontario, Limited.) Consulting engineer; John F. Talbutt, Mining Engineer, Rat Portage, Ontario.

Knob Hill Mining Co.—This Company held its annual meeting in Montreal this month, Mr. S. H. C. Miner, Granby, presiding.

The superintendent's report and the financial statement were read to the meeting, and were favorably commented upon, after which the election of directors was proceeded with, resulting in the following board being chosen: S. H. C. Miner, W. H. Robinson, Jay P. Graves, H. E. McIntosh, A. L. Whise, D. A. McCaskill and C. J. Chisholm. At a subsequent meeting, the following executive were elected: President, S. H. C. Miner; Vice-President and Western Manager, Jay P. Graves; Secretary-Treasurer, A. L. White.

The Hammond Gold Reef Mining Co.—The following is the Directors' Report of the affairs of this company to the end of December, 1898:

A very considerable amount has been expended upon the property in the erection of the mill and in development work. At the outset, work was carried on simultaneously upon the reef proper and upon two very promising quartz veins leading from the reef. Upon sinking to a considerable depth upon these veins it was found that while pay values were disclosed, they were not sufficient to warrant further sinking until such time as the company might have cheap power available. A depth of 140 feet was obtained upon B vein, and a depth of 50 feet upon E vein, as well as several pits from 5 to 20 feet, and as it was found that the free milling values did not exceed the values from the main reef, and as the latter were workable at a much less expense, attention was directed entirely to it, and the season's work has been wholly upon the main reef. The work prosecuted upon the reef has been at three points, viz.: the most easterly point at what is known as the cross cut on 347 X. A shaft on 338 X, situate about midway between the above-mentioned cross cut and the westerly boundary of the property. This shaft has been sunk to a depth of 84 feet, and drifts run across the formation of the reef 45 feet at the 65 foot level, the ore at that depth appearing to be of the regular reef character for the whole depth and width opened up, and the gold values showing improvement with depth.

The third point where work has been prosecuted is immediately on the westerly line of the company's property, where an open quarry some 30 feet in width by 100 feet in length has been opened up diagonally across the reef to a depth of from 15 to 20 feet, the greater depth being on the westerly side, which is higher ground. All of the ore taken from this quarry has been put through the mill without selection, the last run of 396 tons yielding $3.85 per ton on the plates, the concentrates having been saved for future treatment, and running in value from $33 to $70 per ton. Complete tabulated records have been kept of assays, both of ore and tailings, and the work of the mill has shown very satisfactory results. The ore taken from this quarry showed a marked improvement as the work progressed, the best results obtained being from the ore taken from the bottom of the quarry; and your directors would recommend the concentration of all work, for the present at least, at this point, as surface development from the northerly end of the quarry to the northerly wall of the reef has disclosed milling ore for the whole distance about 200 feet. At this point the reef is 462 feet in width. From various points where work has been prosecuted on the reef, 2,283 tons of ore have been put through the mill, giving a result on the plates of $3.70 per ton, with the concentrates yet to be treated. Your directors are convinced from the work already done, that larger quantities of ore can be mined by open quarry work, sufficient to supply a very large stamp mill, and have decided upon the immediate erection of 30 additional stamps, additional ore crusher, air compressor and aerial wire rope tramway, with the necessary electric motors to drive them, arrangements having been made with the Folger-Hammond Mines Company, Limited, to develop their water power and generate electric power, which will be available for the use of this company upon reasonable terms by the time the additional stamps are ready for operation. Your directors are convinced that with 40 stamps, and with electric power generated by water available, that this ore can be mined and milled for at least $1.25 per ton and that even this figure can be much reduced with a large plant. With this plant the company should be on a dividend paying basis within the present year, and a much larger plant should be gone on with during the next winter, when, following the example of many other mines upon deposits of similar magnitude, the cost of mining and milling can be reduced below $1.00 per ton. Your directors have not deemed it advisable during the year to place additional treasury stock on the market preferring to arrange advances to the company instead, and have contributed from their own holdings sufficient to bring the treasury stock up to the original amount 200,000 shares, at which the treasury now stands.

The present plant and buildings consist of a well constructed and thoroughly equipped 10-stamp mill. A commodious and substantial assay office and laboratory, complete with every appliance, an office building, large boarding house and dining camp. A large store house, frame barn, 40 ft. by 60 ft., a blacksmith shop with wood working shop overhead, and pumping station at lake.

A good road has been constructed from the lake, and for a considerable distance along the reef, connecting the various workings with the mill, together with tramways where necessary.

The heaviest supplies for next season's work have been placed on the ground this winter.

Whitewater Mines.—During December about 3200 tons (subject to correction) of concentrating material were put through the mill, and the yield of concentrates may be approximately stated at 200 tons. This high ratio of concentrates is due to the fact that in order at all to realize on the material filled back into old stopes in the upper workings it had to be milled at once, otherwise it would have been lost owing to subsidence and caving of the hanging. This material having had all the clean ore sorted from it was, of course, extremely low grade in lead. Most of such material has now been disposed of, and better results may be expected from the operations of the current month. Shipments of concentrates from the mill have been interrupted during December for several days, because the wagon road was blocked by small but troublesome snow slides, produced by a week of very soft weather.

Canadian Pacific Exploration, Limited.—The second ordinary general meeting of the Canadian Pacific Exploration, Limited, was held this month in London. The Right Hon. Visconnt Powerscourt, K.P. (the chairman of the company), presided.

The Secretary (Mr. H. B. Cheslyn Callow) having read the notice convening the meeting.

The Chairman said: The circular which you received from the board informed you of the reason for the postponement of the annual general meeting, and I have no doubt that you will agree with us that it was to the advantage of the shareholders to hold over the meeting until our managing director could be present to give you all the information in his power, and to answer any inquiries you may wish to make. I think the balance-sheet is sufficiently explicit, and calls for no further explanation, but I will mention that the calls in arrear have been practically all paid up. The mining share investment which appears on the credit side of the account consists of shares in an Arizona mine. We believe we have an excellent property in the Porto Rico mine, and we have considerable hopes of much benefit arising from our acquisition of an interest in Arizona. The company has besides a few mining properties which are as yet unproven, but any one of which may at any time turn out to be of value. Turning now to our principal asset, the Porto Rico mine. You have all received the valuable report which our managing director made in October last. You will observe that in it he estimates the value of the ore at $16 per ton, less 6 per cent. loss; that is to say, $15.14. It is very satisfactory to find that the

results of our six weeks' working have not only been up to this estimate, but even in excess of it.

The result of the first crushing of clean ore for ten days was 142 tons, giving a return of 291 oz. of retorted gold. The cable's report for the month ending January 18th, shows that 540 tons were crushed for 561 oz. of gold. I may mention that in January, 1898, we also sent 40 tons of sorted ore to the smelter at Trail, which showed a return of 148 oz., or 3 oz. 14 dwt. per ton of 2000 lb. In referring to the general prospects of the mining industry in British Columbia, the Chairman said: Anyone who has watched the development of this Province must be convinced that it has a brilliant future before it. The Chairman then read the following cablegram just received from Mr. A. B. Irwin, and dated 8th February, 1899: "The weather here is now exceedingly cold. Has been 29 degrees below zero. Mill running steadily. Stopes looking exceeding well." He conclnded by moving the adoption of the report and accounts.

Dr. Trouncer seconded the motion.

Mr. W. H. Corbould (managing director) said: It affords me great pleasure to have the opportunity of being here to-day. At the commencement of the company I predicted that British Columbia was one of the coming mining districts, and I think you will agree with me that the returns which our chairman has just given us bear out the fact that I was not mistaken in my opinion regarding the mineral resources of that part of the Empire. Those of you who have seen a copy of "Rossland in 1898," issued by the Rossland Board of Trade, will doubtless have observed from the illustrations the rapid progress that has taken place in the Kootenay district, which only a few years ago supported a small number of trappers and hunters. Large works have been erected in diffierent localities for the treatment of ores, and mines have been developed to a considerable depth. The power from some of the rivers which for ages past has been of no value, has now been harnessed, and the electricity generated by this means transmitted to the mines. I may mention that on the Kootenay River the power plant there develops about 20,000 horse-power, which is transmitted thirty miles to Rossland, and the owners contemplate utilising two other falls, which will give them 60,000 available horse-power. All over the country there is an abundance of fuel and water. As to the value of the lodes in depth, the Le Roi has been proved to a depth of 700 ft., the War Eagle to a depth of 500 ft., and our mine, the Porto Rico, to about the same depth.

We, under the cricumstances, decided to throw up our options, and settled down to place the Porto Rico mine in a paying state. To have retained the options and have made several payments that were due would have crippled us and left us with a lot of properties, but with no money to run them. Crushings.—During January of last year the company shipped to the smelter at Trail about 40 tons of sorted ore from our Porto Rico mine, which yielded a return of 3 oz. 14 dwt. gold per ton of 2000 lb. The result of the first clean-up at the company's mill, which started on 8th December last, was as follows: We crushed 142 tons, which gave a return of 291 oz. of retorted gold, also 20 tons of concentrates, valued at about $500. On the 18th January the result of the first month's working of the mill at the mines was follows: We crushed 540 tons of ore and country for 561 oz. of gold, also concentrates, value $400. We hold an interest in a property in Arizona, which I inspected during my last visit to the States. If the shoots of gold prove long enough and the values carry down, as I have every reason to think they will, it will certainly become one of the big mines of the day. We are now trying to arrange to bring in some more capital and work the property in a systematic way. (Applause.)

Mr. Skinner called attention to the present high rate of expenditure of the company, and desired to know whether it would continue in the future. He further inquired the present cost of working and treating the ore at Porto Rico mine with ten head of stamps, and asked if the cost would be reduced with twenty or thirty head of stamps. He also asked what profit the company would derive from the use of the additional stamps.

Mr. W. H. Corbould (managing director) replied that the London expenses had been unusually high at the start, because it was expected that the company would develop into a large exploration company. For that purpose it was necessary to have a central office in London, a managing director, etc. The directors had now realised that in the present state of the British Columbian market it was out of the question to float subsidiary companies. The present cost of mining and milling at the Porto Rico mine was about eight or nine dwt. per ton, while the value of the ore, according to the crushings they had received, he estimated at $16; the returns, however, so far, had been over an ounce. Later on, if the development warranted with an extra twenty or thirty head, the cost of mining and milling should be reduced to $4 or $5 a ton.

The motion was unanimously adopted.

Messrs. T. Edwards and G. H. Haywood were re-elected directors of the company, and Mr. J. M. Henderson was reappointed auditor, after which votes of thanks were given to the chairman and directors, and the proceedings terminated.

Tangier Mine.—Extracts from Mine Manager's report, dated the 19th of December, 1898: "Shaft sinking was resumed on the 8th instant, and the first shots fired improved vein since last work thereon. Vein is between 6 ft. and 7 ft. in width, over 3 ft. being well mineralised, showing more galena and less animonial silver than ore previously exposed. When first encountered hanging-wall was dipping northerly at an angle of 75 deg., but on further development its position has changed to the vertical. About 12 tons of very good ore has been sorted and saved, assay value of which and other points will be forwarded. Owing to extreme hardness of formation, new machinery, and men, progress has been slow; but improvement is perceptible, and hope to report greater speed in future. In event of property fulfilling expectations would advise the installation of air drills, ground being too hard to be economically worked with hand steel."

The Ymir Gold Mines.—The following cablegram has been received from British Columbia, dated 9th February, 1899: "Have not been able to commence crushing ore owing to the severity of the weather, which rendered it necessary to drain water-pipe line. We are quite ready to begin. The weather is much better. Hope to start almost immediatcly."

Hall Mines, Limited.—The following are the official returns of four weeks smelting ended 27th January: 22 days, 6 hours smelting, 2,727 tons treated; yielding 69 tons copper, 39,250 ozs. silver.

43rd Mining and Milling Company of Cariboo, Limited.—The shareholders of this company held their annual meeting in Ottawa last month, when a satisfactory report of the construction work on the company's property in the Omenica District was presented. Mr. A. F. Cotton, the Engineer in charge reported: As soon as Mill Creek was clear of ice the logs which had been laid up on the bank were driven to the mill. These were all cut into lumber and used in the flume. On May 9th commenced work on the ditch, the snow being all gone; this work went on steadily for the remainder of the season. The ditch having been cleaned out and all connections made up to station station 115, the water was turned on on June 4th, and I am happy to say both ditch and flume worked admirably; no leaks of any consequence. A temporary waste gate was put in at station 115, and all material required was floated from the mill to this point. The time occupied for a piece of timber to run this distance was 42 minutes, being a little better than than three miles per hour. On your arrival with additional men and horses, work in the different sections was pushed as rapidly as possible. The waggon road was extended and is now completed to the back channel, a distance of over four miles, and is a first class one. From your arrival up to the time of our departure, October 1st, 8,650 feet of new ditch have been completed, 5,200 feet of flume built, and waste gates have been put in at stations 20, 90, 133, 146 and 170. The total length of tested ditch and flume is 18,000 feet. The trestle is completed to station 195, while the ditch is finished to station 248. In this distance there remain only three short stretches of flume to complete to station 248. At station 196 the ditch is to be tapped by a flume, so as to work to the mouth of Kildare Gulch. This flume will be 1,500 feet in length, and owing to the increased grade will only require to be four feet wide and two feet deep. The trestle for this portion is completed. The ditch to command the upper portion of Slate Creek being thus nearly completed completed. The ditch for working of the lower portion is completed for a distance of 2,400 feet, and it at a lower level than the other, but it is to be supplied by the higher one. The two ditches will be connected by a short piece of flume, down a small ravine, near station 223. By having the ditches at different elevations, a much shorter pipe line will be required, and still both have a good working head, the lowest being 180 feet. From stations 120 to 123, the ground through which the ditch was built, proved to be rather sandy, so it was deemed advisable to put in 300 feet of flume, which has been done, thus making it secure for all time. At station 163 a temporary waste gate was put in, and a ground sluice carried over to the head of Kildare Gulch, where we did a little prospecting, with the following result:

Taking 150 pans of gravel to equal a yard, we got an average of $12 per yard, On "Poverty Bar," Slate Creek, we cleared out an old open cut, and at five feet from the surface nice gold was found, which gave over $8 per yard. The company will clean up regularly during the coming season and profitable operations are confidently anticipated. Our illustrations show the progress of the company's works to the end of last year.

Mikado Gold Mining Co.—Official returns for December: Mill ran 26 days, crushed 1027 tons, producing 393 ounces of gold; cyanide treated, 370 tons, yielding 74 ounces of gold; total, 467 ounces.

Regina (Canada) Gold Mine, Limited.—Official returns show:—Yield for December to have been 214 ounces; cyanide not cleaned up.

Mikado.—Result for January. Mill ran 23 days, crushed 982 tons, producing 407 onnces of gold. Cyanide treated, 520 tons, yielding 143 ounces of bullion.

Regina (Canada).—For the month of January mill ran 242 hours, crushed 615 tons, yield of gold 255 ounces (225 from plates, 30 fron cyanide).

Grant-Govan's Commissions.

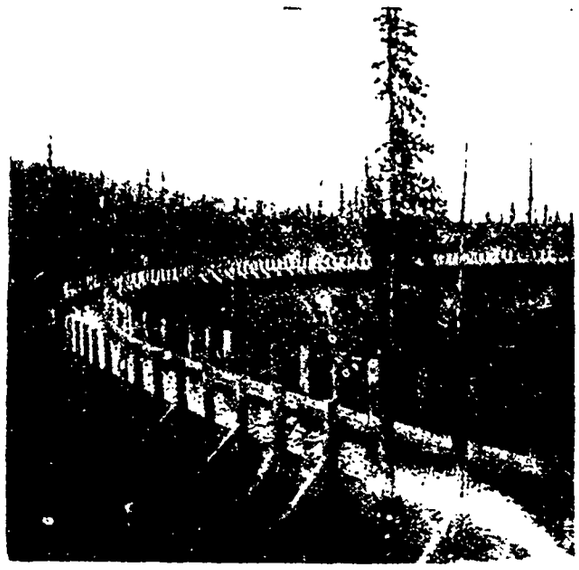
GRANT VS. THE GOLD EXPLORATION, &C., SYNDICATE OF BRITISH COLUMBIA.

This action was heard recently in London, Mr. Duke, Q.C., and Mr. Kelly appeared for the plaintiff, and Mr. Rufus Isaacs, Q.C., and Mr. Wills Chitty for the defendant company. Mr. Duke said the action was brought to recover a sum due on a promissory note and interest. The amount alleged to be due was £2,500 and interest, and the defendants said only £2,000 with interest was due, and they had paid £2,331 into court. The plaintiff was a timber merchant at Revelstoke, in British Columbia. At the end of 1896 he was the owner of some mining property in the Kootenay district of British Columbia, and in September of that year a Mr. Govan was introduced to him. He said he represented a Lordon firm, and was on the look-out for gold properties to be introduced to the London market. Ultimately terms were come to by which Mr. Govan was to introduce plaintiff's property to the London market, and was to be paid 10 per cent. on the property being disposed of. The agreement was put into writing, and under it Govan had an option for six months, and was to send an engineer to report on the properties with the object of forming one or more limited companies. On these companies being floated Govan was to receive 10 per cent. on all money and shares received by plaintiff. Plaintiff was wired for to come to London, and in January, 1897, he agreed to sell the property to the defendant company for £25,000 in cash and £11,500 in shares. In March, 1897, the company paid plaintiff £10,000 out of the £25,000, and plaintiff took a note for £10,000, and ultimately renewed another for £5,000; and the balance of the last note and interest was now sued for. The dispute arose in this way: In March of last year the chairman of the company met the plaintiff, and heard of the agreement between him and Govan, who was a managing director of the company, for the first time. In March, 1897, Govan had approached Grant and purposed to take £2,000 instead of £2,500 commission if the money was paid at once, and thus make an end of the matter. That was agreed to, and when the company asked Govan to explain the affair he denied the whole matter. Mr. Grant, however, satisfied the company that he had paid Govan the £2,000 by producing the numbers of the bank notes. Then Govan admitted it, and the company called upon him to refund the sum and pay it to the aompany, which he did, with some reluctance. The entry of the transaction in the minute-book of the company was as follows: "It was resolved that the repayment of the £2,000 offered by Mr. Govan be accepted with the assurance that he received the money in the full belief that he was justified in accepting the same, and without any dishonourable intention, and thereby unwittingly made a mistake." Things went on, and in June the other promissory note for £5,000 fell due and the company was not able to pay it. They resolved to make payment of £2,500 on account and said nothing to Mr. Grant.

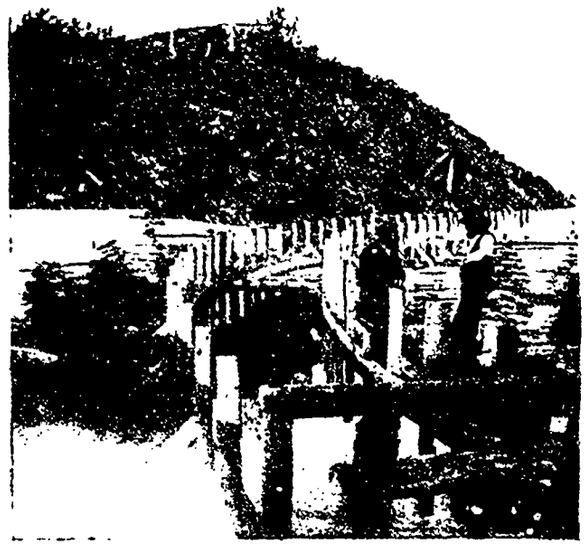
His Lordship asked why Mr. Grant should not save £500 by paying Govan his commission before it was due?

Mr. Chitty said the presumption was that the £2,500 which Govan was to get from Grant was added to the purchase money. There had, in fact, been a corrupt bargain, and what the company contended was that, having got the £2,000 which Grant had paid to Govan, they were entitled to the other £500, which Grant had not

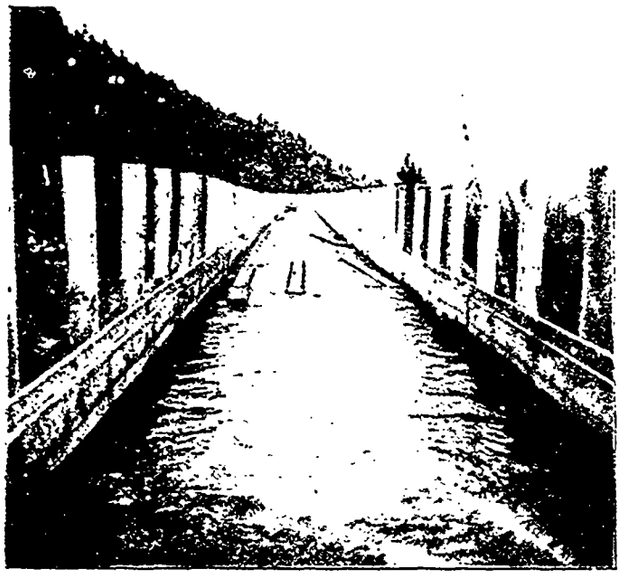
WORKS OF THE 43rd MINING AND MILLING CO. OF CARIBOO, LIMITED, OMENICA, B.C.



Flume crossing Kildare Gulch.



Flume, lower part of Kildare Gulch.



Flume Floating Timber.

Section of Ditch completed near Slate Creek.

paid, but which presumably had been added to the purchase price. Mr. Duke said that in November last £2,341 18s. 4d. was tendered to Mr. Grant in settlement of his claim with interest, but he refused to accept of it.

Mr. John Grant (the plaintiff) was called, and bore out his counsel's statement. He said when he made the arrangement with Govan he did not know that he was a managing director of the syndicate. He thought he was a rich man, and able to assist him in forming a company. He told him he was a director of the War Eagle Mine, and was going to Rossland to take it over. Mr. Rufus Isaacs argued that the assumption was that the syndicate had paid so much more for the mine by reason of the bribe paid by Grant to one of the directors. There was no doubt that Grant got Govan, in his position as a director of the syndicate, to use his influence without the the knowledge of the board, to pay Grant £5,000, out of which he himself was to get £2,000. He submitted that that was a corrupt bargain and a bribe. Mr. Grant, he submitted, was not entitled to keep in his pocket the extra £500 which he had got by that corrupt bargain. His Lordship said he would take time to consider his decision.

LAKE OF THE WOODS.

RAINY RIVER DISTRICT.

Mining matters have been about normal since last writing; work is going on steadily at all the camps that continued operations past the close of navigation. The long spell of extremely cold weather that has just been followed by higher temperatures caused a good deal of suffering to those who were obliged to travel on the lakes, yet very few serious cases of frost bites are reported.

Messrs. Rogers & Ahn have been touring in the east with an exhibit of rich specimens, collected no doubt from many mines and prospects, and the local press as well as some of the Toronto papers have contained glowing accounts of their doings in the exhibition line. Mr. Rogers is Manager of the Bullion Mining Company, and one of our local papers publishes a telegram from Montreal to the effect that a number of capitalists in that city have acquired a half interest in the properties held by that Company. This is good news if the said capitalists are going to go to work and develop some of the properties into paying mines. We want men who will go to work and get down into the ground; any other kind is no use. The mere selling of stock, especially if effected through the sophistries of the showman, may be a bad thing, since it pledges the properties concerned to a degree of success which in many cases cannot justly be expected of them. In the interests of the mining industry it is very greatly to be desired that those seeking an investment in it should put down their money only on some definite proposition, some property whose value or

The adjourned Annual General Meeting of the members of the General Mining Association of the Province of Quebec will be held in the Club Room, Windsor Hotel, Montreal, on

WEDNESDAY,
1st MARCH, 1899,
AT 10.30 A.M.

GEORGE E. DRUMMOND, President.

B. T. A. BELL, Secretary.

probable value has been attested by some well known, capable or reliable person or persons, and thus eliminate the element of speculation as far as practicable. Any one operating along other lines is no friend to mining.

REGINA.

General Wilkinson went out to the mine last week. It appears he received intelligence that the ore body on the lowest level had widened and was now over five feet, and that the value also had improved, being now ten dollars per ton. The main shaft is to be put down to the 500 foot point before stopping.

SULTANA.

The Rat Portage *Weekly News* of February 11th, says:—"The best recent clean-up for one week's work at the Sultana, is given at the sum of $10,373 about. This report is not given as being absolutely correct." There must be some mistake about this, for at this rate the ore must have been worth about $28.00 per ton. It seems a pity that the mine managers are obliged to observe such secrecy about the amount of the output of gold, and the value of the ore.

MIKADO.

Gold bricks of the value of almost $15,000.00 arrived from the Mikado last week. This amount was the result of the weekly clean up, and makes the ore to be very rich.

THE BURLEY.

Sinking is going on steadily.

THE SENTINEL.

When a depth of 135 feet has been reached in the shaft on the main vein, a cross-cut will be run to the foot wall; this will be completed about the end of February or a little sooner.

BAD MINE.

The vein has been cut in the adit run into the side of the hill to cross it. It appears the ore is not quite so rich as it is nearer the surface. A station will most likely be cut, and sinking on the vein begun.

THE TRIGGS.

The deal on this property which has been on hand so long was finally closed on the 11th inst., when Captain Triggs paid over the $5,000.00 to the owners and received the deeds. The Captain proposes to resume operations at the mine shortly.

Mr. Allan Sullivau, C.E., is expected to arrive in Rat Portage from England in a few days. It is said he has been successful in placing the Scovil-Moore property, north-east of the Virginia Mine, with capitalists who will begin development at once. A survey party leaves town to-morrow for that part of the district to survey a number of mining locations.

A. M. Hay, Esq., is going into silver mining in the Port Arthur country, and is re-opening the Rabbit Mountain Mine.

J. M.

Rat Portage, February 14th, 1899.

Advertising Pays

Montreal, 21st February, 1899.

The Canadian Mining Review,
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We have been advertising in the Canadian Mining Review for some thirteen years, and as extensive manufacturers of mining machinery in Canada we have great pleasure in stating that we consider that the money spent in reaching the public through your columns has paid us an hundredfold. We consider it, without exception, the best medium to reach the mining, engineering and investing public in the Dominion of Canada, not taking into consideration its foreign circulation. Our continued patronage will serve as substantiating the above assertions.

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ON 1st, 2nd, and 3rd MARCH, 1899.

Sessions Commencing
10.30 a.m., 3 and 8 p.m.

Lantern Projections
Thursday Evening.

THE FOLLOWING WILL CONTRIBUTE PAPERS FOR DISCUSSION AT THESE MEETINGS

DR. JAMES DOUGLAS, Copper Metallurgist, New York.
DR. GEORGE M. DAWSON, C.M.G., Director Geological Survey of Canada.
MR. A. R. LEDOUX, Metallurgist, New York.
MR. BERNARD MACDONALD, M.E., Salmon River, N.S.
MR. JOHN BIRKINBINE, M.E., Philadelphia, Pa.
DR. HENRY AMI, Geological Survey of Canada, Ottawa.
MR. A. McCALLUM, Peterborough, Ont.
MR. F. CIRKEL, M.E., Vancouver, B.C.
MR. F. T. SNYDER, Peterborough, Ont.
MR. A. H. HOLDICH, Nelson, B.C.
MR. J. T. DONALD, M.E., Montreal.
MR. A. HOLLAND, Ottawa.
MR. A. J. COLQUHOUN, Savonas, B.C.
MR. WM. BLAKEMORE, M.E., Fernie, B.C.
MR. F. HILLE, M.E., Port Arthur.
MR. JOHN E. HARDMAN, S.B., M.E., Montreal.
PROF. W. G. MILLAR, Kingston, Ont.
MR. C. A. MEISSNER, Londonderry, N.S.
MR. CHARLES FERGIE, M.E., Westville, N.S.
PROF. DEKALB, Kingston, Ont.
MR. JOHN B. HOBSON, Quesnelle, B.C.
MR. R. G. McCONNELL, Geological Survey of Canada, Ottawa.
MR. J. BURLEY SMITH, M.E., Winnipeg.
MR. JAS. D. SWORD, M.E., Rossland, B.C.
MR. R. C. CAMPBELL JOHNSTONE, M.E., Nelson, B.C.
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MR. GEORGE E. DRUMMOND, Montreal.
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MR. W. HAMILTON MERRITT, A.R.S.M., Toronto.
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REDUCED RAILWAY RATES

By special arrangements made with the Railway Companies mining men attending these meetings will be carried to and from Montreal at reduced fare as under.

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In order to obtain these reduced fares members and their friends and all who intend being present at the meetings must obtain from their Ticket Agent a Certificate which must be signed by the Secretary of the Institute at the meetings.

Everyone interested in Mining or Metallurgy and in the Development of the Mineral Resources of the Dominion is invited to be present and take part in the proceedings of these Meetings.

ANNUAL DINNER

Members and their friends will dine together in the Windsor Hotel, on Friday evening at eight o'clock.

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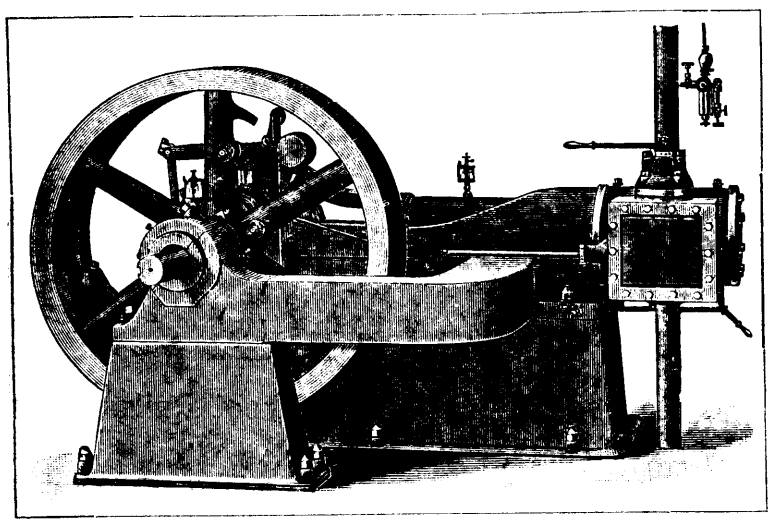

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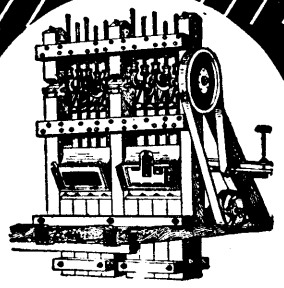

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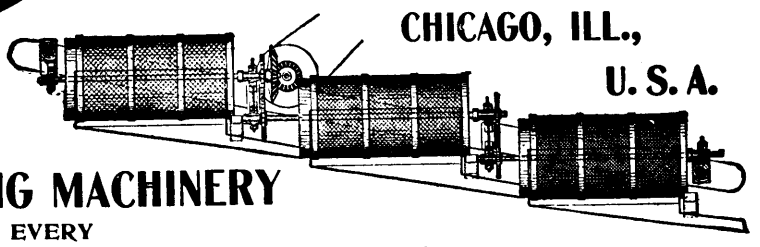

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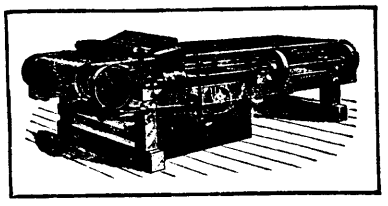

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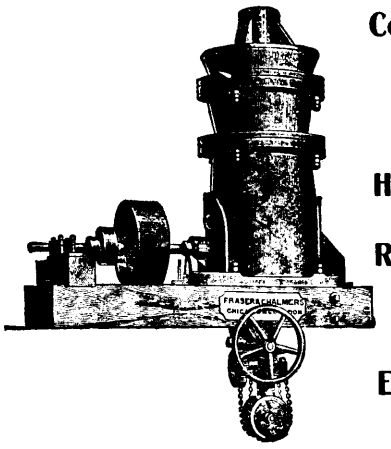

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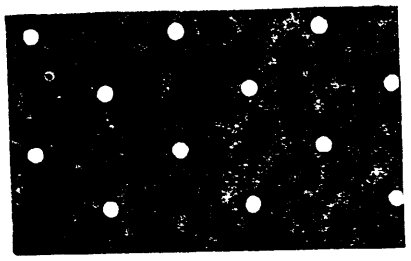

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