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THE Canadian MINING REVIEW

Established 1882

Vol. XVI.—No. 3 MONTREAL—OTTAWA—HALIFAX. MARCH, 1897.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

The following Courses are Offered

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

   Doctor of Science (D. Sc.)
   For further information see the calendar of Queen's University for 1896-97, p. 128.
4. *Prospector's Course.*

   The School offers to Mine Foremen, Assayers, Prospectors and Mining Men generally, Special Courses of Instruction beginning January 6th, 1897, and continuing eight weeks.
5. *Extramural Classes for Prospectors and Mining Men.*

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

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

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

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,

SCHOOL OF MINING, - KINGSTON, ONTARIO.

PROVINCE OF NOVA SCOTIA.

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

—AND—

PRECIOUS STONES.

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

GOLD AND SILVER.

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

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

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

MINES OTHER THAN GOLD AND SILVER.

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

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

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

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

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

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

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

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

MINING LAWS OF ONTARIO.

ANY person may explore Crown Lands for minerals.

Mining lands may be taken up as surveyed locations or staked claims.

Locations range from 40 to 320 acres.

Claims range from 10 to 20 acres on vein or lode.

Locations may be acquired in fee or under leasehold.

Price of locations north of French River, $2 to $3 per acre, and south of it, $2 to $1.50, according to distance from railway.

Rent of locations first year 60c. to $1 per acre, and subsequent years 15c. to 25c. per acre.

Rent of claims, $1 per acre each year.

Claims must be worked continuously.

Royalty on ores specified in the Act, 2 per cent. of value at pit's mouth less cost of labor and explosives.

Royalty not charged until seven years from date of patent or lease, nor (as provided in s. 4 (3) of the Mines' Act, 1892), until fifteen years in the case of an original discovery of ore or mineral.

Original discoverer of ore or mineral on claim entitled to stake out a second claim.

Crown Lands sold under provisions of mining laws in force prior to 4th May, 1891, exempt from royalty.

Copies of the Mines Act, 1892, Amendment Act, 1894, may be had on application to

ARCHIBALD BLUE,
Director Bureau of Mines

TORONTO, May 25th, 1894.

15th YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

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

B. T. A. BELL, Editor and Proprietor. Published Monthly. OFFICES: SLATER BUILDING, OTTAWA; METROPOLE BUILDING, HALIFAX; WINDSOR HOTEL, MONTREAL.

VOL. XVI., No. 3. MARCH, 1897. VOL. XVI., No. 3.

Joint Stock Companies.

The subject of Joint Stock Companies seem, very properly, to be engaging the attention of a large portion of the public at the present time.

To those of our readers who were interested in the very able paper on the subject read by Mr. J. Bawden at the February meeting of the Federated Canadian Mining Institute, we can commend a trenchent article by Mr. H. V. Lockwood in the March number of the *North American Review* on "How to Reform Business Corporations." Mr. Lockwood discusses corporation laws as leading up to the difficult problem of handling trusts and combines, but his views are so clear and forcible that it is well worth while reproducing some of his facts and suggestions, especially since it is evident that Canadians are on the eve of (if not fully launched upon) an era of incorporations concerning mining, which, if not safeguarded by a more stringent law and one having Dominion jurisdiction, may shortly bring about economic conditions greatly to be avoided. We allude to what Mr. Lockwood states in these words—"that the selfish and dishonest management of business corporations has been the chief cause of the great inequality in the distribution of wealth during the past forty years; whereas, if they were honestly and safely conducted, they would afford a safe and satisfactory investment for small sums and tend thus to equalise the wealth of the people."

It is a well-recognized fact that corporations, as such, have been of immense service to civilization, adding to the wealth and extent of both commerce and industry, and enabling many enterprises of far-reaching and great public importance to be carried out that private firms or funds could never have accomplished. Corporations, therefore, have come to stay, and the question now for the people is so to legislate as to continue their usefulness, and at the same time to enact laws which shall ensure, so far as possible, honest management, and the removal of the opportunities for officials and promoters to use their powers for their own selfish interests, too often to the detriment of the shareholder.

"The *raison d'etre* of corporations aggregate at common law was to avoid the inconvenience of partnerships comprising a large number of members," thus enabling the management to be vested in a few, and relegating at its will, the "unofficial" shareholder to the position of silent partner. But too often these silent partners are entirely unable to judge of what is going on, in many cases are incapable of so doing, and though they may be certain that inspection and examination by a competent person would show dishonest or incompetent handling of the company's affairs, they are powerless if, as is usually the case, they are a minority. The annual meeting occurs, complaints are uttered, but to no avail, the majority of the stock is held by the officials and a board of directors to suit these officials is re-elected.

It is therefore a need for our own country that a provision in the Act and in private charters should be made permitting what is called in the United States the "cumulative" system of voting, which gives the smaller shareholders the power by bunching their votes, of electing at least one (perhaps more) director who will sit in the board as guardian of their interests, and can keep them informed of transactions to which, as a rule, information and access is denied.

Mr. Lockwood alludes to this measure among others, but we do not think enough stress is laid upon it; two noteworthy examples of its value in mining corporations have been shown in recent years in the cases of the Horn Silver Mining Co., of Utah, and the Tamarack Mining Co. of Michigan.

Mr. Lockwood suggests the following as points to be well considered:—

Require at least seven persons as the minimum number who may incorporate. Require all the capital stock to be subscribed and paid up in full at par before commencing business—this secures creditors and protects shareholders. In considering property or labor performed as the equivalent of cash in fully paid up stock issued therefor, let the value of such property or labor be stated by the president, treasurer and a majority of directors under oath, and make the penalty for violation imprisonment and not fines.

As an alternative, if the capital stock is not all subscribed, make it obligatory to print on the stationery, share certificates and other company documents the amount actually subscribed and the amount of cash paid in such subscriptions.

Require security from directors and officials for faithful discharge of duties, *or* require examination at least once a year into all details of the bnsiness by a person or persons who are not in the management preferably by a suitable public officer, such as a "commissioner of corporations" or a "registrar of stock companies;" an annual report in a schedule form to be prescribed by the above public official, is also advised.

Directors and officers should also have more personal liability to guard against wrecking a business for their personal profit; "they should always lose and never profit from a wreckage."

"A director or officer should not be permitted, directly or indirectly, to buy or sell the stock of the corporation during his term of office;" cumulative voting, as before mentioned is also suggested.

Reservation by the legislature to modify or repeal charters is considered very important by Mr. Lockwood, and it undoubtedly is in the the case of manufactures, but we think this suggestion hardly applicable to mining.

We commend this article to our readers unreservedly, and close with a quotation which is an argument for the whole:—

"Since corporations can be created only by the State, there is no reason why the latter cannot and should not dictate such terms and conditions for the privilege as are best fitted to make corporations more useful and less harmful."

The Asbestos and Asbestic Company, Lt'd.

At the moment when the attention of the whole country seems to be absorbed in the promotion of gold and silver mining ventures, the formation of a powerful company in London to work the old Jeffrey mine at Danville directs attention again to our richly productive areas of asbestos in Quebec, an industry that has now a world wide reputation.

The capital of the new company is £500,000 in shares of £10, of which the vendors receive 16,000 fully paid shares and £283,340 in cash. The asbestos mining property contains some 75 acres and has been successfully worked for a number of years, first by the late Mr. W. H. Jeffrey, and latterly by the Danville Asbestos & Slate Co., Ltd.

The following statements from the Prospectus will doubtless be of interest to our readers:

1. That treated in bulk the rock yields from 15 to 25 per cent. of asbestos, and from 50 to 70 per cent. of asbestic.

2. That the present capacity of the works is about 200 tons of asbestos and 1,000 tons of asbestic per week, and that the present average output is at least equal to three quarters of that quantity.

3. That under an existing contract nearly the whole of the product of the works is now going to the H. W. John's M'n'fg. Co. of New York, the price realized from asbestos at the works averaging $30 per ton.

4. That the total cost of production with the present plant and machinery and the present facilities of about 200 tons of asbestos and 1,000 tons per week of asbestic will not exceed $2,500 per week.

Messrs. Turquand Youngs Bishop & Clarke, Chartered Accountants, London, were authorized to examine the books of the company and reported: "As the result of the fortnight's working, we are enabled to report that for the first week the production from about 1,492 tons of rock and waste put through the factory was 275 tons of asbestos (of which 97 tons were of Grade "E") and 1,088 tons of asbestic; and that during the second ended 21st November, production from about 1,500 tons was 269 tons asbestos (of which 71 tons were of Grade "E") and 1,055 tons asbestic.

It appears that in consequence of the necessity of getting the pits into shape to raise enough of rock to supply the larger factory intended to be built, the quantity of rock raised is in excess of what can be dealt with by the present crushers, and that a quantity of the larger stuff has to be dumped down to be used when there is no more power.

With regard to the third statement, we can certify that, according to the books of the company, during the 16 months ending the 21st November, the mines produced and sold upwards of 10,000 tons of asbestos. Of this amount 5,147 tons were produced between 27th April and 21st November, 1896.

From the 1st May to 14 November the sales were 6,183 tons, and of this quantity 5,087 tons were sold to the H. W. John's Manufacturing Company. The average price realized on the sales to the John's Company, amounted to $27.60 per ton, but we should mention that the John's Company, under an arrangement, were taking a quantity of low grade asbestos (viz. "E" grade, at the price of $10 per ton) not included in their contract, but included in our figures as above. If this were eliminated, it would bring the average price payable by the John's Company of the asbestos sold to them for the above mentioned period under the existing contract to $30.17 per ton.

With regard to the fourth statement, we certify that the cost of producing the quantities mentioned above from the mines and works for the fortnight under review amounted to about $2,890.12 for the first week and $2,673.63 for the second week.

Deducting a very moderate estimate of the cost of raising the excess of rock which could not be worked through the crushers, the cost of production of 200 tons of asbestos and 1,000 tons of asbestic, would certainly not exceed $2,500 per week."

The value of the property is reported upon by Mr. R. H. Jones, the author of a well known work on asbestos and by Mr Earle C. Bacon, a New York Mechanical Engineer, with some experience in Canadian mines. Mr. Jones, while admitting that the product of the King, Johnson's and other Quebec mines is of better quality than the ordinary product at Danville—a fact that will not be controverted by anyone conversant with the industry—states that "though the staple may not be regarded as of extreme length, it is certainly long enough for every asbestos requirement and can well compete with any that can be produced elsewhere in regard to purity, silkiness, finess, elasticity, tensile strength or color." Mr. Bacon's is mainly of value from the description it gives of the mechanical equipment of the works. "The material," he says, "is raised from the pits (three in number) and carried by a cableway and derricks which are worked by large winding engines, direct to a large and well appointed mill thoroughly equipped with a plant of modern construction throughout, consisting of crushing, sorting, drying, pulverizing and separating machinery with power plant to drive them nothing like it in the slightest degree to be found in any other asbestos mine in the world, and when the capacity is increased as it should be and is proposed to 600 tons per day, the cost of producing and handling would be less than $1.50 per day." He also estimates on an output of 600 tons per day:

120 tons pure fibre @ $20	$2,400
210 tons short "milled" fibre (paper stock) @ $5	1,050
210 tons of asbestic "fibrous" sand for wall plaster at $2	420
Making a total selling price	$3,870
At a total cost to produce of $150 per ton	900
Leaving a net profit per day of	$2,970

This profit, he estimates could be produced for ten months per year of 260 days, or $772,200,

These estimates, it may be frankly stated, appear to us rather *couleur de rose*, and will, doubtless, be received with skepticism by most, if not all, of the other producers of the mineral in Canada. Nevertheless, the company has undoubtedly acquired a productive and well equipped property, and with ample working capital, energetically directed towards creating a larger market for the lower grade material there seems no reason why the enterprise should not be a success.

The Ontario Mining Deal.

Perhaps the present Government of Ontario has the impression that the recent agreement entered into between itself on the one part and "James Reid, William T. Engledue and James K. Kerr of the other part, is an agreement inuring to the benefit of the Province.

We very sincerely hope it may do so, but we very frankly state our belief that it will not.

Not a little of the slow growth of mining as an industry in Ontario has been due to what has been called "blanketing" large areas of the Crown domain by speculators who have been dominated by the hope that they could sell for $5.00 what cost them $1.00.

In what way this agreement differs from such blanketing is not apparent to our mind.

46,000 acres are locked up for three years on condition that $70,000 shall be expended by the licensees "in actual explorations." For let it be clearly understood that the $20,000 deposit is only forfeited through lack of expenditure during the first *two* years, and there is no forfeit nor obligation for the licensees to spend the $50,000 during the third year, the deposit of $20,000 being withdrawable at the end of the second year. Furthermore, the licensees may withdraw $10,000 of the $20,000 at any time by surrendering the license on the smaller block of ground.

What the Province, therefore, really can get out of this deal is the sum of $10,000.

It goes without saying that the specified expenditures each year are matters of book-keeping, and that the development of any such area as 46,000 acres with the sum of $120,000 (less than $3.00 per acre) depends greatly upon the whim of the management. There is no guarantee in the arrangement that the Province as a whole, nor its mining industry, will benefit, that the licensees, as a development company, will benefit there is little doubt. Under the agreement the company can acquire such lands as it may see fit, "upon the usual terms of purchase," for the period of three years, which is probably as long as the "boom" will last, and at the same time can dispose of such lands so acquired at such prices as usually obtain during boom times, with a very satisfactory margin of profit to itself.

At the same time that we admit a possibility of the agreement turning out to the advantage of the Government, we deplore the practice of giving options on large tracts of public land to syndicates or individuals for speculative purposes, or for any purposes.

The Department of Mines is already the subject of very unfavorable comment from the men who are engaged in opening up the mining industry. Surveys are far behind hand, applications are held indefinitely for surveys, frequent occasions for scandal and favoritism are engendered thereby, and lastly, but by no means the least, much adverse comment on the character and diction of the Annual Reports is heard whenever the subject is mentioned.

The department needs remodelling; what the miner and investor both want in the reports is the opinion of some competent practical man, of whom the public knows, upon the character of the mineral formation from a commercial standpoint. The report of a competent mining man as Mining Inspector would add immensely to the value of the publication, as would also an intelligent table of contents and good index.

Now that Ontario has undoubtedly proved that her western lands are rich in minerals it behooves her to revise her old laws and her old methods.

A rapid and sure method of acquiring a unit of land, peremptory forfeiture of the same for failure to develop within one year, obligatory annual returns, provincial regulation of mining partnerships, close scrutiny of incorporations for mining purposes, and a practical mining man at or very near the head of the department, are some of the suggestions offered for consideration in this line.

Ontario may take several leaves from British Columbia's statute book with advantage, and portions of the Nova Scotia law would fit in admirably.

EN PASSANT.

The adjourned annual general meeting of the members of the Ontario Mining Institute will be held in the Railway Committee Rooms, Parliament Buildings, Toronto, on Wednesday and Thursday, 31st March and 1st April, commencing at eight sharp. On Wednesday evening the programme will be entirely devoted to routine business, while on Thursday the following excellent syleabus of papers will be discussed: "Some notes on the Milling of Gold Ores," by Mr. John E. Hardman, S. B., M. E., Montreal; "Notes on Material used in Mining Machinery," by H.W. DeCourteney, Montreal; "The Western Ontario Gold Fields and their Genesis," by Mr. F. Hille, M. E., Port Arthur; "Some Metalliferous Rocks of the Kingston District," by Dr. W. L. Goodwin, School of Mining, Kingston; "A New Use for Scrap Mica," by H. C. Mitchell, Toronto; "Notes on Moss Litter," by Mr. T. W. Gibson, Bureau of Mines, Toronto. By special arrangement with the railways, members and their friends attending these meetings will be privileged to travel at reduced rates on the certificate plan. Members in arrears with their subscriptions will kindly remit the amount to the Treasurer, Mr. T. W. Gibson, Bureau of Mines, on or before the meetings.

A correspondent in London, Eng., writes: "There is no doubt there would be a big boom at British Columbia and Ontario gold mining ventures here, if only the position of the mining market was not in such a terrible slough of despondency. Most people on this side, who take an interest in mines, are overloaded with South African stock, in which they stand to lose heavily and are thus quite discouraged from further ventures."

A good deal of interest has been centered in the formation of the Mica Manufacturing Company, Ltd., in London, with an authorized capital of £80,000 stg. to acquire and work the properties of the Lake Girard system in Ontario and Quebec. While it is true that a very large quantity of mica has been won and shipped by the Lake Girard people the management was notoriously bad, and a very large sum of money was squandered in foolish methods of conducting the business. Mica mining at best is a precarious enterprise, and the closest economies must be exercised in the management if the new company is to succeed.

The imports of free mining and smelting machinery into Canada show a steady increase over previous years, the returns for the fiscal year, 1896, showing a value of $193,098, as against $169,749 brought in during 1895. Since the present law was enacted the importations have been: 1890, $3,768; 1891, $78,432; 1892, $61,848; 1893, $87,208; 1894, $87,035; 1895, $169,749. The importations last year show the receipts by provinces to have been:—

Ontario	$118,772
Quebec	24,805
Nova Scotia	9,453
New Brunswick	730
Manitoba	3,060
British Columbia	36,254
N. W. Territories	24
or a total of	$193,098

Of the above, machinery to the value of $189,210 was imported from the United States, $2,945 from Great Britain, and $943 from Germany. It should also be mentioned that twenty-three diamond drills of a value of $6,793 were also imported for prospecting purposes last year.

A revision of the returns of chromite shipped from Quebec mines last year makes a slight alteration in the figures published in the last issue. By the Quebec Central Railway there were shipped 2,037½ tons, and from other points 55½ tons, making the total for the year 2,037½ tons, or, since the mines were opened in 1895, 5,839 tons. The total output to date is about 7,000 tons. Dr. Glenn, of Baltimore, an eminent authority, who furnishes an interesting description of our ores in the last volume of "The Mineral Industries of the United States," advises the following as typical of the shipments desired by the trade:—

	No. 1. p.c.	No. 2. p.c.	No. 3. p.c.
Silica	7·00	5·22	6·44
Chromic oxide	39·15	51·03	53·07
Ferrous oxide	27·12	13.06	15·27
Magnesium oxide	16·11	16 32	16·08
Calcium oxide	3·41	2·61	1·20
Aluminum oxide	7·00	12·16	8·01
Total	99·79	100·40	100·07

Work your mine on the same principle as a man would build a building for business he had in view, being sure of his business before he built. Make mining a *legitimate* business and not a speculative one, and the reward will come in increased work, good living and a time of prosperity. Those who make a business of mining intelligently succeed, while failures *as a rule* come from want of knowledge and bad management. Develop the mine first; find out how to work your ore, if good enough, then put in your machinery.

Pyrites, which are so plentiful in many parts of Canada, are likely to be more extensively used in the future than they have been in the past in the manufacture of sulphuric acid. A combination of mine-owners in Sicily has raised the price of sulphur some 50 or 60 per cent., so that its use is no longer economical. Deposits of sulphur, also as well as of pyrites, are likely to assume greater value, and will demand more attention.

The output of pyrites in the United States last year was 126,384 tons, valued at the mines at $320,163. The pyrites imported by that country for the manufacture of sulphuric acid amounted to 199,678 long tons of the value of $1,140,571.

Our illustrated supplement this month is largely taken up with a series of views of the fine new milling and chlorination plant erected at North Brookfield, Queen's County, Nova Scotia, by Mr. W. L. Libbey and his associates in the Brookfield Mining Company. In our next issue we propose to devote some space to a detailed description of this important installation, the whole cost of which has been, we understand, defrayed from the profits of the mine, which in 1895 produced with a small mill 2,975 oz. 11 dwt. 15 grs. gold from 4242 tons of rock crushed, and last year 4,667 ozs. 10 cwt. 15 grs. from 5,351 tons of mill material. The mill has been built and equipped by the Truro Foundry and Machine Co. of Truro, N. S.—an establishment with a great reputation in the east for first-class work in gold mill construction—while the chlorination plant has been put up on the specifications and under the personal supervision of Dr. Thies, the eminent American expert and patentee of the Thies process of chlorination.

The Gold Bearing Tailings of Nova Scotia.

By Mr. F. H. Mason, F.C.S., Halifax.

Probably in no country in the world where gold has been mined and milled for the length of time that it has been in Nova Scotia, have the tailings been so completely neglected. This is due to several causes, first among which is the fact that, although the mines of Nova Scotia have been known and worked for upwards of thirty years, no one has ever attempted to work them on a large scale. Although many of the companies operating in Nova Scotia have comparatively large tracts of land under lease, in no instance have they been opened up with a view to working them to anything like their full capacity. The largest mill in the province to-day is the 40-stamp mill at the Richardson mine in Guysborough county, while the next is the 30-stamp mill at the New Egerton mine. With regard to the latter it has not up to date been worked to anything like its full capacity, half the stamps often being idle. Besides these there are several 20, 15, 10 and 5-stamp mills in operation in the province, and in one case that of the Blue Rose Co., operating in Goldenville, there are a 20 and a 12-stamp mill on the same property. From this it will be seen that no single mine is turning out sufficient ore to keep a chlorination plant of its own in operation. No one has shown sufficient enterprise to put up a customs plant, nor have the mine owners themselves been sufficiently energetic to combine together and put up a plant, for a group of mines in one district. The Brookfield Mining Company, which owns an extensive and rich tailing dump, has recently put up a chlorination plant, but it is unfortunately situated at a considerable distance from the majority of the other mines, and consequently the cost of hauling concetrates to their works will in most cases be a matter of no small consideration, and will go a long way towards taking the gilt off the gingerbread, or in other words absorbing the profits. I wish it to be distinctly understood that by the foreginng I do not desire to belittle the value of Nova Scotia as a gold field, because work in the past has been done on a very limited scale there is no reason why such should be the case in the future. There are several places in Nova Scotia where with proper development I have little doubt that 100 stamp mills could be kept pounding day and night on low grade ore and show a profit on every ton of ore crushed, but up to now no one has attempted to work on such a scale. Another cause for the general neglect in the matter of tailings, is the very small capital of many of the companies operating the Nova Scotian mines and the shareholders who for the most part being cent wise and dollar foolish prefer gathering in the small dividends to allowing some of them to accumulate with a view to saving sufficient capital to put in the necessary concentrators and thus reap a richer harvest in the end. Another reason for the neglect of tailings is the very erroneous idea which has been, and to a large extent, still is prevalent in Nova Scotia, viz. that the gold in the ore in that province is all free and that what is not saved in the battery and on the plates of a stamp mill is not worth saving. This theory has been backed by gentlemen who I venture to think should have taken the trouble to have investigated the matter a little more fully before so positively uttering such damning statements. Why Nova Scotia should stand out alone to be the one blest spot of all the gold producing countries in the world, where all the gold in the ore is free and nothing but the stamp mill is needed to reduce it to marketable bullion is a little difficult to see, and I should have thought that men would have investigated such a phenomina very thoroughly before declaring such to be the case. In the persuance of my profession I have probably had greater opportunities of investigating the value of the tailings from the stamp mills of Nova Scotia than anyone has ever had before. The one great difficulty in arriving at the value of such tailings is that in many cases the samples have been taken by people unused to taking samples, and on more than one occasion after rich returns have had to be given, I have discovered that the samples have been dug out from the dump by the end of the sluice where a natural concentration has taken place and a result very much higher than the truth naturally obtained. The obtaining of a true sample is probably one of the most difficult things imaginable, and cannot possibly be done by a single assay unless it is a fluke, yet how many of our millmen imagine that they are keeping a run of gold they are losing by placing a bucket under the end of the sluice, drying the result and dispatching it to the nearest assay office to obtain a result which is in many cases of no value to them at all.

I propose first of all taking the last 50 assays of tailings I have made, the maximum of which is 16 dwt. 8 grains, the minimum a trace. The average is 4 dwt. 19 grains. The methods of taking these tailings is in some cases known and in others unknown.

I will next give the last 25 assays of concentrates I have made. I have excluded from this list three samples which I consider to be altogether abnormal, and which contained appreciable quantities of amalgan. The maximum of these is 12 oz. 8 dwt. 6 grains and the minimum is 2 dwt. 22 grains, the average is 3 oz. 11 dwt. Methods of taking samples mostly unknown. I now propose to select three mines as examples, namely the Brookfield Mine in the west of the province, the Northup, Central Rawdon, which is fairly central, and the Richardson, which is in the east of the province, and I may here say that I wish to thank the owners of these properties for their kindness in allowing me to use the assays I have made for them.

I will first take the Richardson Mine, as in this case I took all samples myself. At the time of my visit, they were in exceptionally poor ore, the return of free milling gold while I was there being 2 dwt. of gold per ton of rock crushed. The tailings from upwards of 40 assays gave an average 1 dwt. 18 grains from one battery, and 1 dwt. 19 grains from the other, which amounts to a loss of 46.66 per cent. of the total gold in the ore. Owing to the fine state to which the ore was being crushed it was impossible to make a true estimate of the percentage of concentrates by panning, the only method at hand, but it approximated 4 per cent. Nearly the whole of the ore crushed could pass a 60 mesh screen, while at least 80 per cent. would pass a 100 mesh screen. A clean concentrate, panned as it came from the sluice, gave 2 oz. 14 dwt. 21 grains, and an analysis showed the mineral to be a true mispickle.

The samples from the Northup mine vary considerably, at one time running very high in concentrates. Sometimes these concentrates are rich in gold, at other times they contain comparatively small amounts. The first sample I propose giving was taken from the dump, it assayed 13 dwt 7 grains per ton, gave 23·7 per cent. of concentrates, which had an assay value of 2 oz. 17 dwt. 4 grains. These tailings contained amalgamable gold to the value of 6 dwt. 10 grains per ton. The gangue of these tailings contains a large proportion of slate and make a very slimy tailing; at the same time by the use of plenty of water they are easily concentrated. The concentrates are a mixture of iron pyrites and arsenical iron pyrites. It will be noticed in this case that the concentrates come out a little higher than theory, which must be accounted for by the very much larger bulk taken for the concentration test, and that there is some free gold in the tailings and probably a little amalgam. In making the concentration test the utmost care was taken, the tailings being first sized into four lots and each lot concentrated separately.

The next assay I propose giving from this mine gave 2 dwt. 5 grains per ton; it yielded 2·03 per cent. concentrates, having an assay value of 5 oz. 5 dwt. per ton.

Another sample of tailings from this mine yielded only a trace of gold, while the concentrates ran in the neighborhood of 10 per cent.

At the North Brookfield mine I have only records of the concentrates which average 6 oz. 8 dwt., and had the following composition:

Insoluble	13·95
Sulphur	29·21
Arsenic	16·15
Iron	34·41
Not determined and loss	8·28

These concentrates as received were somewhat oxidized. I hoped to have given some results from the practical treatment of these concentrates, but I hear from Mr. Libbey that they have not cleaned up from the Chlorination Works yet, at Brookfield.

I think the above results are as near the truth as it is possible to get under ordinary circumstances. It would be much more satisfactory of course if some competent person were to go round and take all the samples himself, determine the total amount of gold, the amount of free gold and the percentage of concentrates, but no one is likely to do this of their own accord, and the local government who really in their own interest should look after this work, have either not sufficient foresight, or are more probably too busy collecting rentals and royalties, the latter being the only way they have ever attempted to encourage the gold mining industry of Nova Scotia!

A bone of contention in the past has been the condition of the gold lost in the tailings. Undoubtedly in some cases some of it should never have escaped the battery plates, but I think in the majority of cases at any rate the greater proportion of it may be looked upon as refractory gold, by which I mean in this case, gold which cannot be *economically* saved in the stamp battery.

Having, I think, clearly proved that we are losing gold in milling, the next point which naturally occurs to us is: How can we best recover this gold? One of the greatest banes to Nova Scotia in the past has been the patent process man, and I propose to throw him overboard without further comment. This brings us down to practically two processes or modifications of them, viz.: chlorination and cyanidation.

With regard to the latter I have tried a considerable number of Nova Scotia concentrates by this method on a laboratory scale under the most favorable circumstances, and I have never obtained anything better than a 78 per cent. extraction, unless the concentrates were previously roasted, in which case chlorination is the better method for subsequent treatment, and although I would not condemn cyanidation in every case on this account, I think we must look to chlorination for the most satisfactory means of recovering this gold

I have in the case of both the Brookfield concentrates and the Richardson concentrates succeeded in extracting on a laboratory scale between 94 and 95 per cent. of the gold contained by barrel chlorination, and I may here say that in the case of the North Brookfield concentrates, Mr. Adolphus Thies, of North Carolina, working in a commercial way, extracted exactly the same per centage that I did in the laboratory. By leaching these same concentrates with chlorine water containing 0.7 per cent. of chlorine, I obtained over 96 per cent. of the gold contained in them, and this latter method not only has the advantage of obtaining a higher per centage than barrel chlorination, but it is also cheaper, especially in Nova Scotia, where pyrolusite for generating chlorine occurs naturally. It is now necessary for us to get some idea as to the probable cost of treatment, and I propose to take some figures given by Mr. James Douglas in a paper he read before the Society of Arts of work Mr. Thies was doing at the Haile Mine in North Carolina in 1894, the following are his working expenses:

Labor	$2.31
Fuel	.55
Sulphuric acid	.24
Chloride of lime	.21
Power and administration	.12
Total	$3.43

For sulphuric acid Mr. Thies paid 1-5 cents per pound, and for chloride of lime 3 cents per pound. I have estimates for supplying those two reagents at 1-5 and 2-7 cents respectively per pound at any port on the south coast of N. S. For wood Mr. Thies gave $1.50 per cord, while at most of the mines in N. S. it would probably be worth $2. Mr. Thies unfortunately does not give the cost of labor, so we cannot compare with Nova Scotia, but I have little doubt were it possible it would come out in favor of the latter.

Taking these figures, there is no reason why the cost of chlorinating a ton of concentrates in Nova Scotia should be over $4, and if we take half of the average I obtained from concentrates, I have assayed as a basis, it would leave a net profit of $31.50 on every ton of concentrates treated. If leaching with chlorine water were adopted instead of barrel chlorination the cost of working could I estimate be cut by about 12·5 per cent. The gold in Nova Scotia has a value of between $17 and $20 per ounce, and it is on account of the ores containing such high grade bullion that leaching with chlorine water is able to replace barrel chlorination. One of the main objects of the barrel is the removal by abrasion of silver chloride formed on the particles of gold. Before concluding this paper there is one point more I want to touch upon, it has only recently occupied my attention, so I can say very little about it. While recently at a mine in Eastern Nova Scotia I brought away two samples of slate from the dump. These samples were not average samples, but were selected because they were particularly heavily mineralized. At the same time there were several tons of similar pieces on the dump and a much larger quantity stowed away on the scaffolds under ground.

The following were the results of the assays: (1.) Assay value, 11 dwt. 2 grains, yielded 12·5 per cent. of concentrates, having an assay value of 4 oz. 2 dwt. 3 grains. (2.) Assay value 17 dwt. 2 grains, yielded 15.6 per cent. of concentrates, having an assay value of 5 oz. 6 dwt. 12 grains. Considering that this mine was running on less than 5 dwt. ore at the time these pieces of slate were dumped, the subject is certainly worthy of further consideration.

Mines and Management.

By Robert Archibald, M. E. Joggins, N S.

I wish to say that I have with your kind permission, and which I have taken the liberty of assuming granted, preferred to confine the following few remarks to mine management, embracing amongst its various details, management of men, a subject I am afraid which is not too seriously taken into consideration by mining men and others directly and indirectly connected with mines.

Mine management has advanced by leaps and bounds during the past few years, and has now attained such a state of perfection as to be included, or classed, amongst the sciences.

It is well known that a mine manager of the present day to be successful has to have an almost perfect knowledge of several scientific subjects; in fact to put the whole matter in a nutshell he is expected to know everything and anything, so much so that he not only ought to be classed a scientist, but a multi-scientist, if I might be permitted to use the expression.

The future success of a managerdepends largely on his early training, and I cannot lay too much stress on the importance of having good mining schools which unfortunately are only too limited in Canada. In Great Britain where the new schools of mine managers are fairly well established, due to a large percentage of their being trained mining engineers and graduates from the various scientific colleges of which she has an ample and excellent supply all under the direct patronage and support more or less of the government. Most young men on making up their minds to adopt the profession of mining, enter a mining engineer's, or better still, a civil and mining engineer's office, where they serve as a pupil from one to five years' duration, getting no remuneration, and in a great many cases large premiums have to be paid for the privilege of gaining this training. During this probationery period they can attend college either during the day or at night according to their means or taste, and when this period is completed a situation is generally found for the student at one of the large collieries as assistant manager or surveyor where he can get the usual practical experience to enable him, if he wishes to become a permanent member of this profession, to go forward as a candidate for the necessary mine manager's certificate. It generally takes from the time of entering the mining engineer's office until this goal is gained a period of about seven years, but this is varied by many circumstances which it is unnecessary to mention here. I wish to say that mine managers are not all composed of men of this class, as there are a great many young pickmen endowed with ambition to rise in the world, and who take full advantage of the very cheap and efficient night schools provided in every village and generally end the race in a neck and neck encounter with their more fortunate—from a worldly point of view—brethren. I have known men to work hard for years in the mines to enable them to save sufficient money to keep them whilst serving as a pupil with a mining engineer's firm. One man in particular with whom I was acquainted was upwards of thirty years of age before he was in a position to undergo this training. He served for four years with a large firm of Civil and Mining Engineers in one of the largest cities in Great Britain,and during that time he enrolled in one of the Mining Science classes in the University of that city and at nights attended one of the Science and Art Colleges. He is now a successful mine manager in Scotland. I could quote innumerable cases of a like nature, but it is hardly necessary, as the one will suffice to show that the battle is not always to the m endowed with this world's gear. In the world's fight for position most men, not being born with the proverbial spoon, have to depend on themselves, and this decidedly applies to mining men.

I care not what collieries or mines you visit, you are certain to meet with a more than ordinary intelligent class of workmen, as a miner in nine cases out of ten is a thoughtful man. A thoughtful man as a rule is an intelligent man, and what is more brimful of thought than mining? And when I state that the officials are the very pick of the men, I am not far wrong when I say that mine officials are as a rule more intelligent men than officials of a similar degree in other trades and occupations. To govern and guide these men, a manager or head is essential, and as will be readily acknowledged such a man must be of ready resource, gifted with keen foresight, have a thorough knowledge of his profession, and be able and willing to display energy and tact (a very essential trait of character(at all times.

To the casual observer, perhaps, he might say that little or no thought is required in the initial stages of working a mining property, but Ihave to say that a good deal more thought is required to this particular case than in many of the most intricate problems of the day, and that the slightest mistake made during this stage of development might result in the ultimate loss of thousands of dollars, if not tens of thousands. When you take into consideration the fact in the case of a slope or shaft having to be sunk for a considerable distance to a seam, say of coal, that such considerations as nature of strata, likely quantity of water to be met with, best position for the shaft, connections with railway or water, transportation and efficient working of the seam; houses and water on surface, faults in strata, and the thousand and one possible drawbacks or otherwise, that have got to be taken into very serious consideration, you will at once admit that a great deal of thought must be brought into action. I know of one instance where two shafts 350 yards each deep were sunk. The seam dipped in a northerly direction at an angle of 15° towards a river, the boundary of the property, and the main line of railway ran close to this river and parallel to it. The shaft was sunk about a mile from the railway and on the face of a hill, and which, mark you, dipped in the same direction as the seam and at the same angle for half the distance, between the pits and the railway. It was a well-known fact that large faults lay to the south and close to the pits, and that it would be an utter impossibility to proceed further in that direction after striking them, although an unsuccessful effort was made. What was the consequence? In a very short time the entire seam to the rise of the pits was worked out and nothing was left but to work the seam to the dip, involving a large expendituae of money in providing additional pumping and hauling plant for this purpose, whereas had the shaft been sunk about half a mile further to the north they would have had all this extra to work to the rise with the same depth of shaft and same expenditure of money. Of course the portion to the dip would require to have been worked sooner or later, but I say the company would have been more able to bear the increased expenditure under the latter conditions, and with a much less area to the dip to work, instead of being plunged into it almost at the very outset. By sinking at this particular spot the colliery branch line would have been at least half the distance it was, and in itself a very serious item in a country where no government subsidies are given to private enterprise. I know of another case where a shaft was attempted to be sunk in a patch of running sand; very large expense was incurred in endeavoring to get through this, but ultimately it had to be abandoned and another one sunk about one hundred yards to westward, where no running sand was encountered. In the first of these two instances, the dip of the strata was well known by boring, consequently there was no excuse for the manager sinking his shaft where he did, and in the second the seam they were going to had been worked, and

was being worked in the surrounding properties, consequently the manager did not consider it necessary to prove the property by boring, with the above result; but what I would like to point out is that on reaching the sand it would have been as well to have suspended operations and put down a few surface bores, as it is well known that running sand does not extend over a great era, and a few hundred yards either one way or the other would have been immaterial, so far as the economical working of the seam was concerned, and thus saved a great deal of money. The above are, I am pleased to say, isolated cases borne out by my experience in the mining centres of both Scotland, England and Wales.

In preparing to develop a seam of coal we will assume that period of deep thoughtfulness has been got over and the site of the shaft determined on. The shape and size are according to the ideas of the manager and proposed quantity of output. I prefer a rectangular shaft, as every square inch can be utilised, whereas with circular or elliptical a great area of space is lost,—the shaft to be sunk as far to the dip as possible consistent with shipping communications and other essential matters. It is customary in sinking through the surface to do so by means of a windlass worked by hand, and when the shaft becomes too deep for this method of hoisting, generally a small second hand engine is got to hoist for the remainder of the distance, and as the sinking nears completion the permanent hoisting engines are put in position to be ready to hoist when the pillars supporting the shaft at the bottom are being formed and other development work carried out. It is a matter for reflection whether it would not be advisable to have the permanent hoisting engine in position and ready to hoist almost immediately after sinking operations have been started. As a matter of fact, I believe the work could be done much more expeditiously and safely by this means than any other, as pumping gear could be handled easier, the loads raised could be heavier and more quickly drawn to the surface. Exceeding care has to be exercised in keeping the shaft perfectly plumb, and strongly timbered where soft strata is met with. The timber should be of good fresh lasting wood, and the surface and soft measures below it bricked, although this portion of the shaft is often timbered, and in many instances I have seen the shaft timbered from top to bottom. It is customary for the sinkers to carry a midwall or partition dividing the shaft into two for ventilation purposes, the current being carried by either steam jet or water, but as the water has to be pumped up again the steam jet arrangement is the much better of the two. This is done by leading a small steam pipe down into one of the divisions and allowing a jet of steam to escape from it. I need not say very much about the pumping operations, although care must be taken in putting in this plant to make it large enough to cope with any amount of water got,—an approximate estimate of which can be easily obtained from the bore hole, if any, and neighboring works and other indications. When the shaft is wet the permanent line of pipes are generally put in by the sinkers as the work progresses, and lodgements for draining and storing the water made at suitable distance apart and according to depth of shaft and length of pumping lifts. Bucket pumps are very often used, but the plunger or force pumps are to be preferred, as they give mueh less trouble and are more easily repaired in a shaft. Good hydraulic pumps are very efficient but require close attention.

The shaft having now been sunk we will say and the task is before the manager of forming the supporting pillars for the shaft. The size of these pillars is determined by the superincumbent strata, and as it is best to be on the safe side, if he is a wise man, he will leave them a little larger than he actually requires. I have known where all the coal was taken out at the pit bottom aud wooden pillars substituted, but as this operation requires the utmost nicety and precision in performance, I would not recommend it particularly in deep shafts. After the pillars have been formed it now remains to develop the workings, and this can only be determined by the nature of roof and pavement, nature and thickness of coal and surface structures and natural features. There are two distinct methods of working, viz. longwall and pillar and bord. There are several modifications in the latter system under different names, but the fact remains that it is still pillar and bord. With the longwall system when adopted a much larger per centage of round coal is got than in pillar and bord, the amount of slack made is much less and altogether when the seam will admit of it it is a long way the better mode of working of the two. For the unitiated I may say that with the longwall system all the coal is removed at first working. The roadways are formed and kept up by wooden pillars and material got from the roof or pavement. This material, if got in large quantities, is also built behind the mines and parallel to the working face from either side of the roadway as far as it will extend. The timber by this method costs more as a rule, as a large quantity is used, but the coal is mined so much cheaper that the extra cost of timber is a long way more than counterbalanced by the cheaply got coal. The main thing, and which must be done in order to make this system a success, is to keep the building close up to the face and thereby throw the weight of the strata on to the face making it much easier and consequently cheaper to mine.

With the pillar and bord system pillars are formed and sized according to depth from surface, angle of seam, etc., and called the first workings and when the boundary is reached these pillars are extracted and the men gradually work their way back to the pit bottom. This is called the second working. The bords are the galleries, driven in forming the pillars. This system has to be adopted largely, but the percentage of slack got is very large, especially when removing the pillars. In forming the pillars care must be taken to make them large enough. By doing so the quantity of slack coal got is reduced considerably and any danger from crush averted. I cannot understand it, but it is the case, that a great many managers will make the pillars too small. Although probably this is not done to the same extent as it used to be, and the consequence is that when they come to take them out, if they have not lost them by their imprudence, the quantity of round coal is almost nil. Large sections of workings have been entirely lost in this manner, and I know of one colliery where several acres of magnificent splint coal were lost, and so rapidly did the creep or crush come on that the miners in their flight from the working face had to leave all their tools behind them, a rather serious loss to the men, as they were their own property. It does not matter what system of working has been adopted, the development process is much the same. Levels are generally driven at right angles to the rise of the seam, into which all the coal got from the mines gravitates. Other main roads are formed, but the levels are the principal roads from where the coal is hauled to the pit bottom, either by horse, steam haulage, or any other system adapted to the workings.

The foregoing description lightly touched upon of the development of a coal area is merely set down as a basis from which I intend to demonstrate the requirements of the mine manager. At the outset the area has been proved by boring, and from this and other sources of information a plan is made showing a cross section or sections in which the faults got in the strata are marked and it is from this plan that the position of the shafts are mainly determined on. As already stated, the position of the shafts should be as near railway communication as possible, and in such a position that they will drain nearly if not all the water got in working the area. The water got in mining is a serious drawback to cheap working, and it is of supreme importance that the method adopted in getting rid of this water should be such as to reduce this item of expenditure to as low a figure as possible, and it is only by considering the matter well at the start that the mine manager can at all hope to do it at anything like a reasonable cost. I of course refer not only to coal mines, but to all branches of mining, as the system of water drainage adopted is pretty much alike. When the manager has a good pumping outfit in his mine the worst and initial difficulty to cheap mining has been overcome.

The class of machinery and boilers have also to be carefully considered, and for good effective work a pair of coupled horizontal engines from 24 in. to 26 in. cylinder should be fit to cope with any output. The boilers should be Lancashire, as they are the best boiler extant for mining purposes, and it is always as well to have at least one more boiler than is actually required. This, combined with a good smoke stack, should make a very good outfit. For pumping when an engine is used, I believe the condensing engine to be a very good one for the purpose. When slopes are used as an outlet for the coal, I have found in a great many instance that the steam is conducted to pumps situated in the workings. I do not approve much of this system of pumping, as I would not, if it can at all be avoided, take steam into the workings. It causes serious deteroriation to the section of the workings the pipe may be placed in, and is always a source of danger, and I question very much if the effective power got when the slope has been sunk long distances is very much better than that given by compressed air. In defence of this system it is said that the assistance given to the ventilation more than compensates for its drawbacks, but what is the necessity for this if a good ventilating fan is in operation at the colliery? The steam pipe can be covered certainly, but even with this considerable loss occurs by condensation. Hydraulic pumps are much better suited for this class of work, and although a good pump would cost largely at first, still it would amply repay itself in the long run. Before going further or rather deeper we will complete the work on the bank. It is a very necessary matter to have a good steam winch when large pumping plant is in operation, the rope used being round galvanized iron. The pithead frame can be either wood or iron. I prefer iron as being less liable to distruction by fire. I have seen a very serviceable frame made from old railway rails bolted together. When haulage is employed below ground the engine should be situated on the bank and the ropes taken down the shaft in aprons to protect them from the action of the water as much as possible.

The hoisting ropes, when a heavy load has to be lifted, should be of the very best plough steel, and when only a medium lift is repeated crucible steel would do. The hoisting drum on engine or pulley in pithead frame should be of large diameter and same size, and the rope should not be at a greater angle than 30° to 35° coming from the drum to the pulley. The machinery and boilers should be built on a strong solid foundation, and as it is best to err on the right side, the whole of the plant or bankhead structure should be a shade stronger or larger than demanded by the theoretical rules usually employed in this kind of work. Workshops, engine house, storehouse, powder magazine, etc., have to be erected, but as they are mere matters of detail they need not be gone into here.

The ventilating fan has now to be chosen. Formerly mines had to depend greatly for their ventilating current on the state of the atmosphere or natural ventilation, but this at the best was rather an unsuitable state of affairs. Furnace ventilation was adopted, but the system only gave good results when a long motive column can be got as in deep shafts, and owing to the danger from fire accompanying it, it is not to be recommended. Fan ventilation is by far the best and safest method, and although a little costly at first, the accruing results more than compensate the manager for his outlay. There are various kinds of fans in operation, and I do not mean to occupy your time in detailing them, but as they can be inspected at the various colleries and their respective merits inquired into, it only remains for the manager to chose the one that is going to suit him best, but I would say let it be of such dimensions as to at least add to his ventilating current by at least twenty-five per cent at any time if required. As to exhaust and blow down fan I prefer the exhaust. On erecting the fan it ought to be placed well back from the upcast shaft as in the event of an explosion it would run less risk of damage.

In driving the main roads below ground care should be taken to drive them perfectly straight for haulage purposes. When the coal has only to be hauled a short distance horse traction is the cheapest method of hauling, but when long distances have to be overcome rope haulage is a much cheaper method.

There are two distinct systems of rope haulage in use, the endless rope and the tail rope and both, where the seam is adapted to them, work equally well. The endless rope does very well in a flat seam, and the tail rope in an undulating seam, and where the roof is frail and narrow roads can only be driven. I have had experience with both, and have a decided preference for the tail rope as it can be taken anywhere. The endless chain is occasionally used, but its weight is against it. It can, however, be used effectively when the distance to be travelled is not too long.

This system would give, I am certain, satisfaction on a long slope instead of the usual method of hoisting now employed.

The tubs used in hoisting the coal should be made from hard, tough wood, built to carry about one ton. I have had experience with steel tubs, but when they begin to wear out they become rather costly to keep in repairs, whereas the wooden tub is much more easily and cheaply repaired.

I knew of a very costly plant of this description having been taken out of a mine and wooden tubs substituted on this account. The great drawback to large tubs is the difficulty experienced in hauling them when they leave the track, but there is no reason why the track should not be maintained in good order and this difficulty reduced to a minimum.

So far the colliery is now in condition for putting out a large output, and to do this, and to do it at the least possible cost, a competent staff of officials is required. The selection of these men lies with the manager, and if he is looking to his own interests, he will chose none but good, steady, efficient workmen. It is of paramount importance to have a thoroughly good underground manager, as the carrying out of the day's work devolves on his shoulders. He it is who sees that the plans are worked in a workmanship-like condition. He can tell at a glance when a prop is awanting or if a bord is not driven level or straight. He overlooks personally the haulage, and sees that no unnecessary delay occurs, and that the track is kept in good repair. A good man of this stamp is invaluable, particularly if he has good tact in handling the men.

The manager should not be long in discovering the good qualities of his subordinates, and if he has any tact at all he will be able to get more work out of the men by a little judicious kindness than by all the oaths and driving known to the slave driver. This system applies to pickmen as well as officials, and I must say I never knew it to fail. There are some men on whom kindness and forethought are thrown away, and the sooner these are got rid of the better, but in all my experience I never met above half a dozen of such men. A well known and influential mine owner in Scotland once told me that he would prefer giving the men a few pence on the ton rather than have any discontent, and I need hardly say that trouble with his men was an unknown factor. Certainly it is not every mine proprietor who could afford to give his manager such instructions, but at the same time it shows clearly that even small concessions costing little or nothing are not thrown away. There are many things a manager can do to please his men and not cost his employer one cent, and by strict attention to those little details he can soon command the respect of his men, and once that is gained it is comparatively speaking plain sailing for him after that. I would not advise any manager to swear at his men, as let miners swear ever so much themselves they do not like it from anyone placed over them, and in course of time simply detest such a man; you can keep your men at arms length and still treat them kindly. Miners soon come to recognise when a manager considers himself superior clay to his fellow being, and woe betide him then, for he will soon have his hands filled with trouble.

I knew of a case where a certain manager, quite a young man too, got along very well with his men. He took an interest in each individual, organized a reading room for them and an athletic club, and his influence was such that when an agitation sprung up in that district for an advance of wages, he was able to keep his men working steadily, whereas the men belonging to the surrounding works lost at least three weeks during a period of about six weeks' agitation. This man, by his masterful tact, probably saved more to his employers in those six weeks than his yearly salary amounted to. In making a promise to a miner, keep to it, even although you should discover to have made a mistake.

The official whose word can be depended upon, is a favorite with the men, let him treat them ever so harshly otherwise. The manager should know every man in his employment, and this can only be done by visiting them in their working places regularly. He can hear complaints, as miners as a rule never care about going to the manager with complaints, and he should see that his instructions to his subordinates are being carried out. The manager who does this will have less trouble with his men than the manager who visits them very seldom; and above all, the manager who is above reproach, whose word can be depended on, and who, when he says no, means it, that man will be a successful manager, and when the day of trouble comes, he will find he has more friends in this world than he wots of.

A few words about strikes and then I will finish. I say that all strikes and lockouts should be declared illegal by law, and whenever dispute occurs it ought to be referred to a board of arbitration whose finding should be final. Quite recently the steel workers in a large works in Great Britain considered that they were not being paid sufficient wages for the work done. They decided on striking, but somehow or another it was arranged that the matter should be decided by arbitration. This was done with the result that it was clearly proven that the firm was not in a condition to advance the wages, and the men are now working perfectly contented.

Great Britain and the United States of America are about to ratify an arbitration treaty, and in my opinion this is an object lesson not only to the nations of the world, but also to the laboring masses of the world and their employers, and I am certain that it only wants the passing of some such law by the government and strikes and workmen's association will be relegated to where they came from, and be things of the past.

E. J. Kelly, Superintendent Deer Park Mine, Rossland, B.C.

Chas. Robbins, F.M. War Eagle Gold Mine, Rossland, B.C.

T. W. Gibson, Bureau of Mines, Toronto

R. L. Campbell Johnston, M.E., Boadholder Silver Mine.

James Clark, Superintendent, War Eagle Mine, Rossland, B.C.

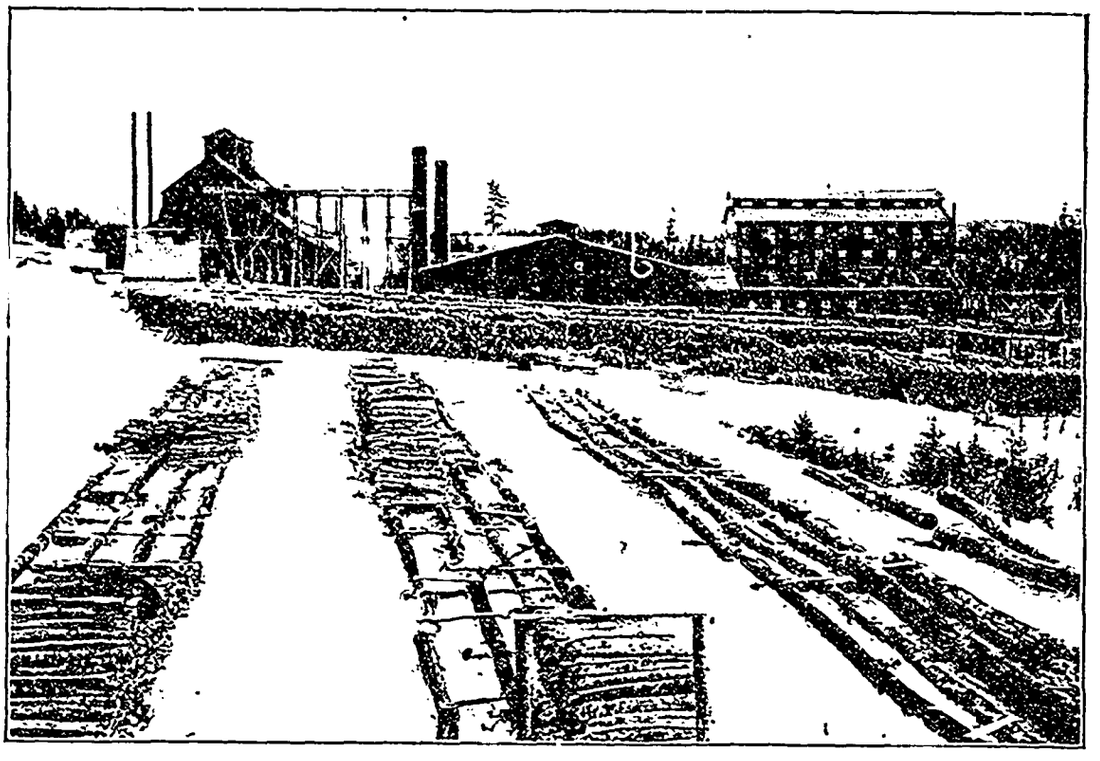
G. F. Moncton, F.G.S., Sec. B.C. Ass'n of Mining Engineers.

John Blue, C. & M.E., Eustis Pyrite Mine, Que.

S. L. Spafford, Nichol's Chemical Co., Capelton, Que.

Capt. Isaac Gragg, Coxheath, C.B. Eastern Development Co.

BROOKFIELD MINING Co.



New 30-Stamp Mill | Furnace House. | Chlorination House.

Installation of Chlorination Works at North Brookfield, Queen's Co., N. S.

Concentrating Room, North Brookfield.

Major Leckie, President, Mining Society of Nova Scotia.

A. Blue, Toronto, Director of Mines for Ontario.

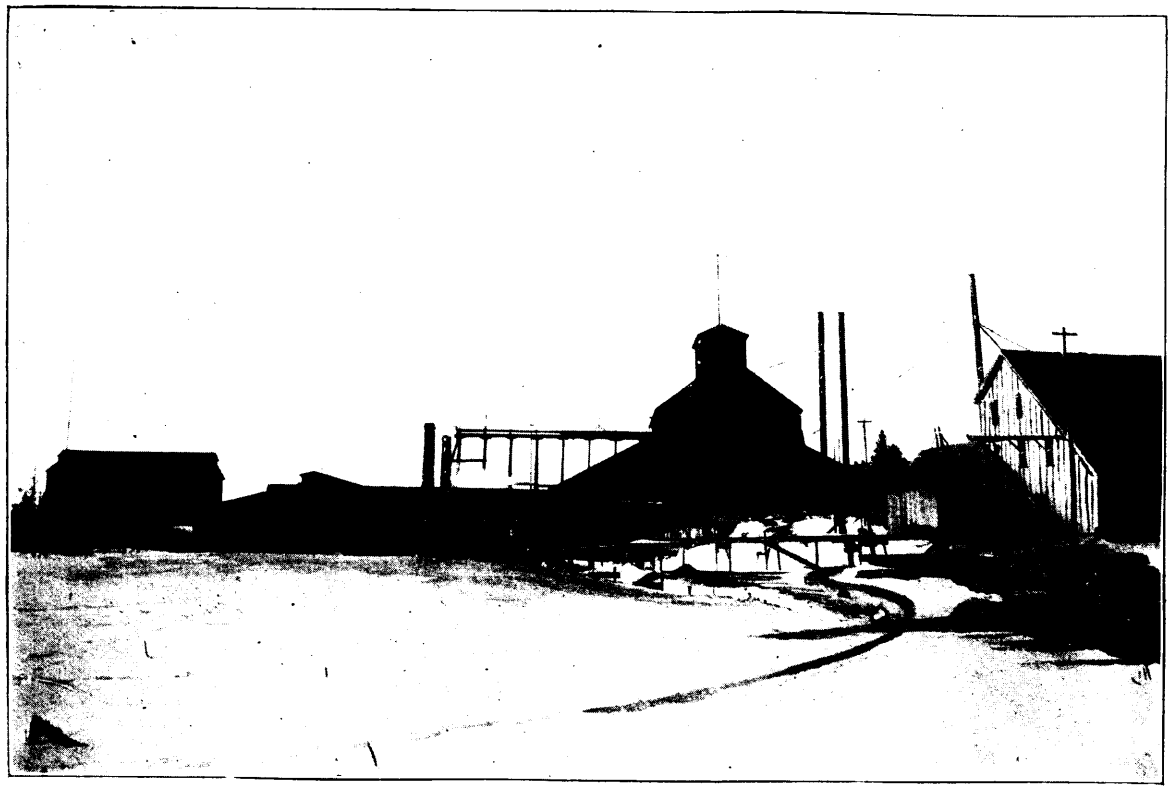
H. A. Guess, Greenwood, B. C.

W. Hamilton Merritt, F.G.S., Toronto.

A. Dick, C. & M. E., Inspector of Mines for British Columbia.

J. B. Hastings, E.M., F.G.S.A., War Eagle Con. M. Co., Rossland, B.C.

BROOKFIELD MINING Co.



Chlorination House. Furnace. Shed for Chlorination. New 20-Stamp Mill. Old Mill.

Installation of New Milling and Chlorination Plant at North Brookfield, Queen's Co., N. S.

Mr. W. L. Libbey, Man. Director .
Brookfield Mining Co.

Mr. F. H. Mason, F.C.S.,
Con. Chemist, Brookfield Mining Co.

Dr. Coleman, Prov. Geologist, Province of Ontario.

J. D. Sword, M.E., Rossland, B.C.

C. A. Meissner, Gen. Manager Londonderry Iron Co., N.S.

J. M. Harris, Sandon, B.C. Reco Silver Mine.

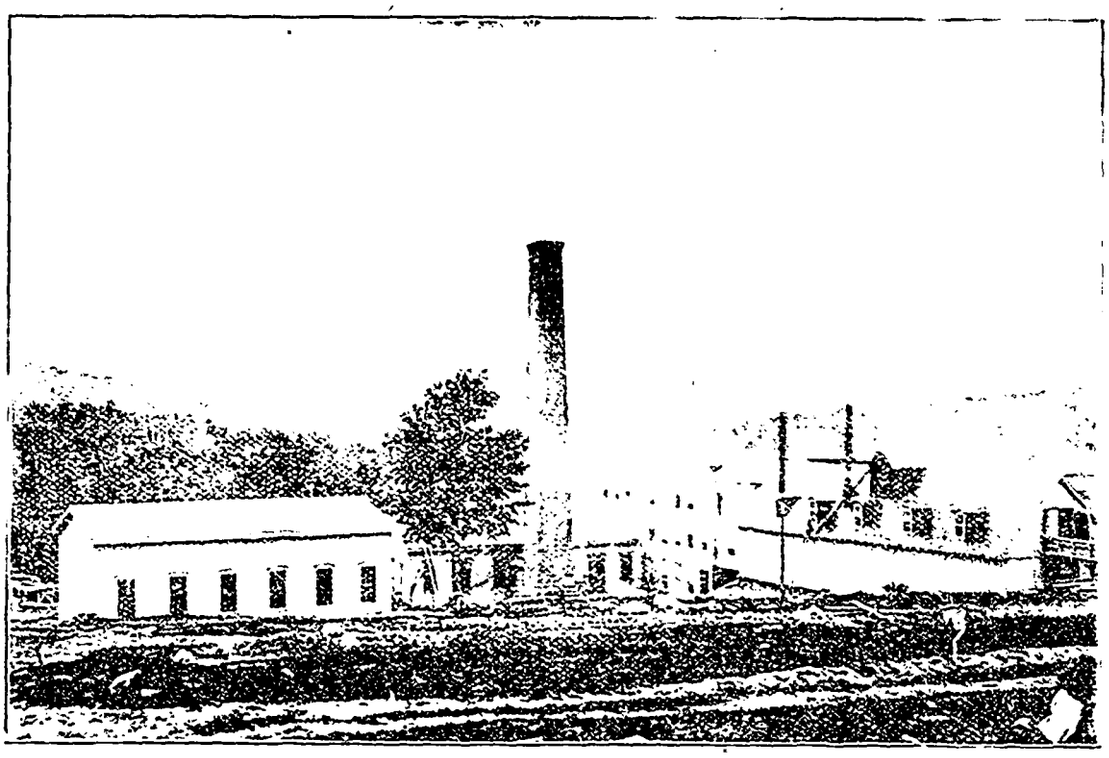
F. C. Loring, M.E, Rossland, B.C.

C. W. Callahan, M.E., Galena Farm, Lt'd.

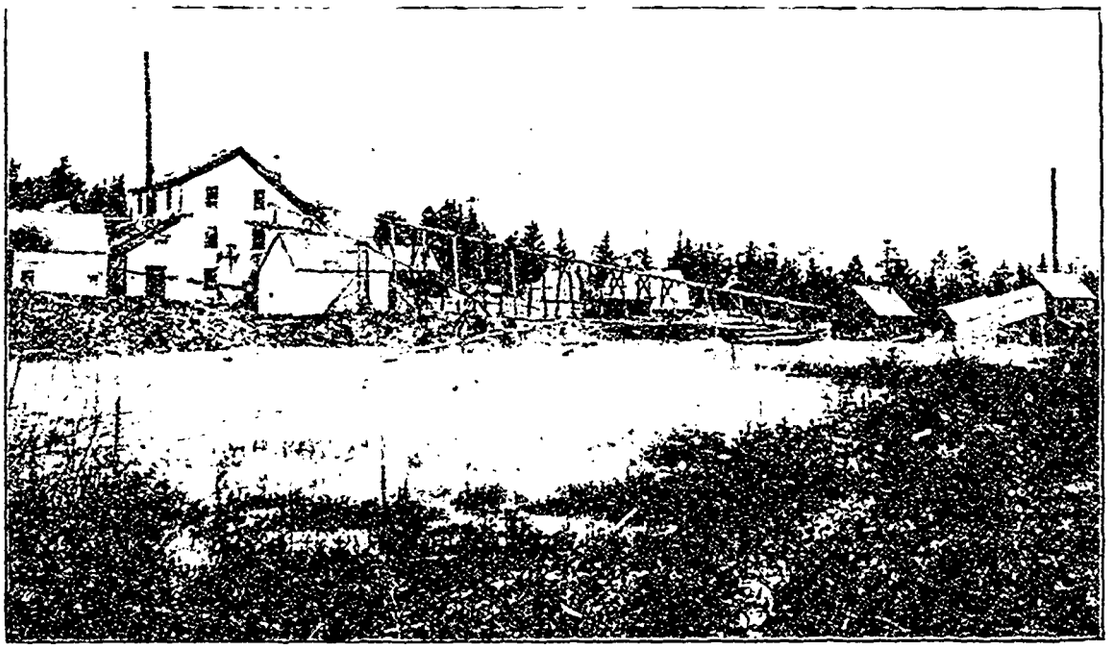
Jas. McArthur, Sudbury, Canadian Copper Co.

Graham Fraser, New Glasgow, Nova Scotia Steel Co.

J. Obalski, M.E., Inspector of Mines, Que.



Asbestos Factory at Danville, Que., acquired by the Asbestos and Asbestic Co., Ltd.



Old Mill and Surface Works of the Brookfield Mining Co. at North Brookfield, N. S.

H. E. Crossdale, Manager Hall Mines, Nelson, B. C.

Oliver Durant, Managing Owner Centre Star Mine, Rossland, B.C.

George Turner Gen. Manager, Le Roi Mine, Rossland, B.C.

Howard West, A.R.S.M., New Denver, B.C.

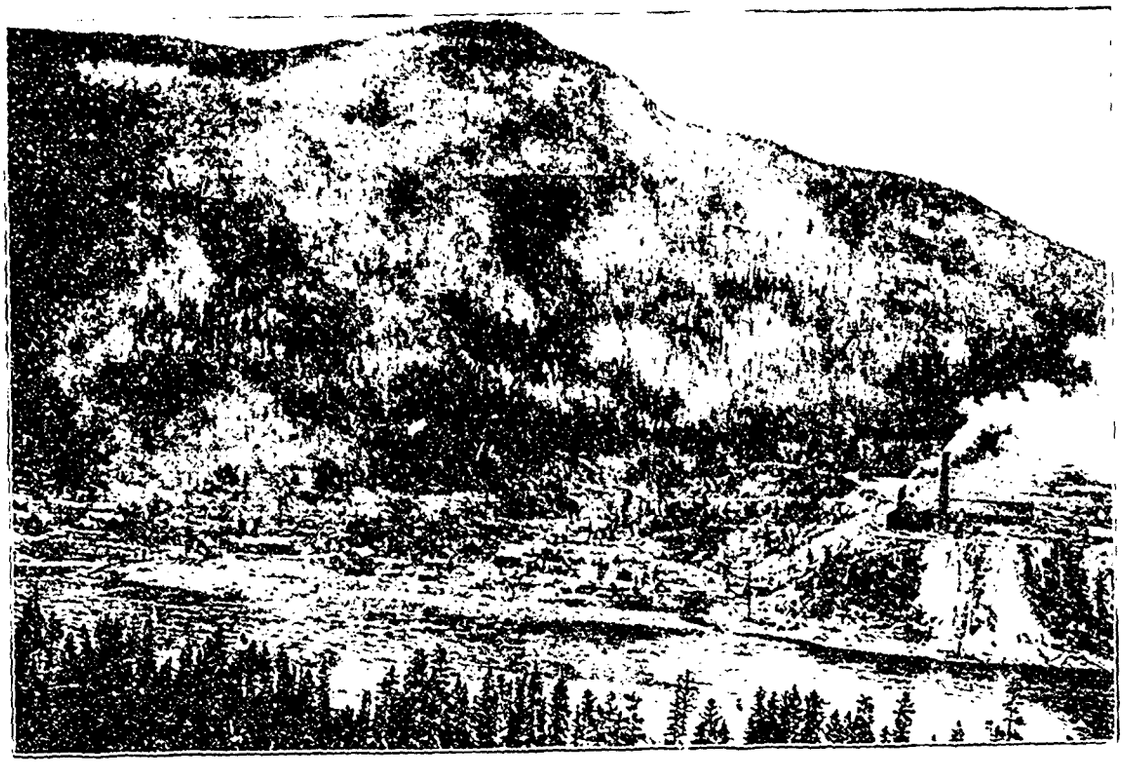
John B. Hobson, M.E., Cariboo and Horse Fly Hyd. Mines Quesnelle, B.C.

F. Cirkel, M.E., Ottawa.

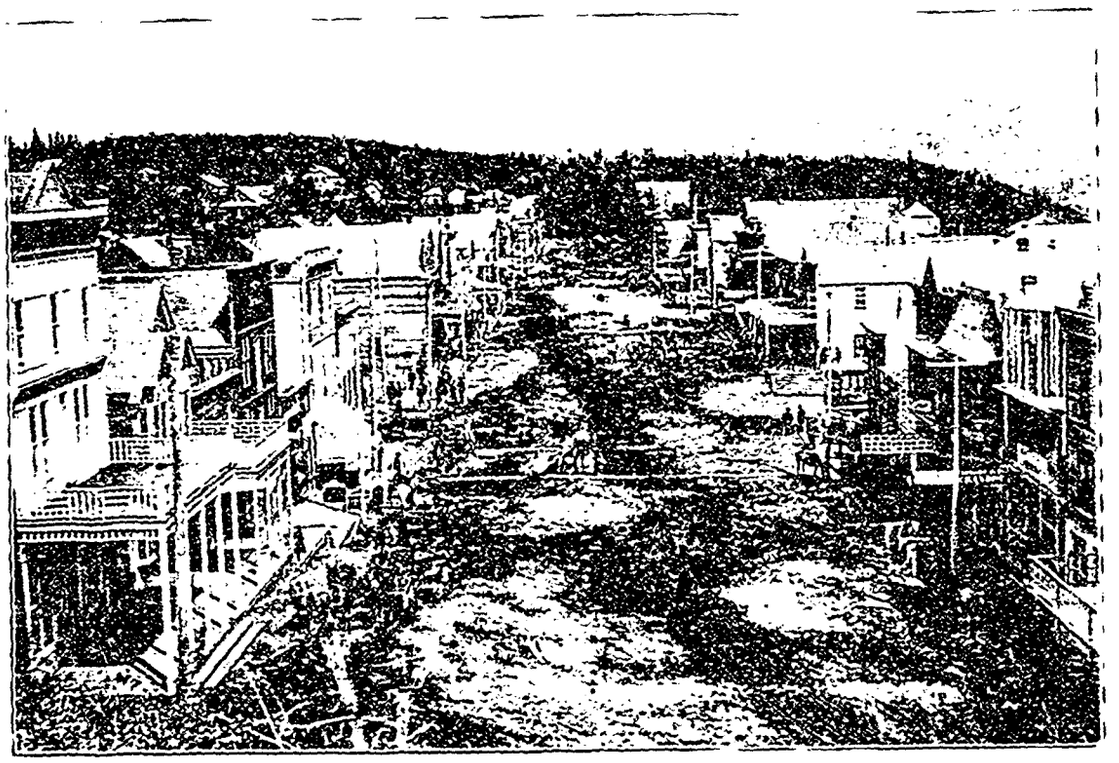
H. E. D. Merry, Rossland, B.C.

Wm. Blakemore, M.E., Dominion Coal Co., Glace Bay, C.B.

G. N. Guess, Greenwood, B.C.



Town of Trail and B. C. Smelting Works.



Columbia Avenue, Rossland, B. C.

Notes on Some Mining Districts in British Columbia.

By JOHN E. HARDMAN, S.B., M.E., Montreal.

At the present time, when the mineral riches of British Columbia are attracting so much attention in both Canada and Great Britain, no excuse need be offered by one who attempts to add a little to the general store of information accessible regarding that province, at the same time I desire to preface that it is not my purpose to present a complete description of those districts to which I shall presently refer, but only to record such facts and observations as were obtained during a somewhat extended trip in the summer of '96. The sections to which I shall call your attention are all in the Kootenay country, and are the following. The Rossland Camp in Trail district, the Nelson Camp, the Slocan Lake Country, and the Fort Steele district.

In attempting a description of any of the B. C. camps, one is met at the start with the difficulty that such camps grow faster than weeds, and that the developments of to-morrow may shed a very different light upon figures and theories than the development of to-day, and hence that any description of such a rapidly developing country must be read in the light of such an understanding.

Naturally, by right of size and prominent notice, the Rossland Camp comes first. This camp is situated in the Trail mining district, which embraces an indefinite area, lying upon both sides of the Columbia river in the southern part of West Kootenay, extending as far south as the International boundary line, and nearly as far north as Robson, with its eastern and western limits not defined. Rossland lies about six miles west of the Columbia river and about seven miles north of the International boundary, and has an altitude of about 3,500 ft. above sea level. It is built upon the southern and south-western slopes of a hill draining into the north fork of Trail Creek, which is a tributary of the Columbia. To the west, north and south of it lie hills on which mineral has been discovered, to the north are Red, Monte Cristo and Columbia and Kootenay mountains; constituting what is known as the North Belt. To the south lie Lake and Lookout mountains, constituting the south Belt. To the west lie Deer Park and Spokane mountains, upon which mineral has also been found. It is therefore a city of six hills, or of seven if we include Lookout mountain, which, however, should really be tributary to the Town of Trail.

The brief early history of this camp shows that the first claim was located by a French-Canadian in the summer of 1889, and was recorded the following May. In 1890 several claims were located, among them the two which have since been developed into mines, and upon whose success the fame of the camp is founded. The first shipment of ore was made in the Spring of 1891, from the Le Roi, which amounted to ten tons and yielded about $86 per ton. Work was intermittent during '91 and '92, but in the winter of '93 and '94 the Le Roi made shipments of ore and began active operations, which have since continued, amounting, according to a statement from the mine officials, in all to about 37,000 tons, of a gross value of $1,500,000. During this period operations were also being carried on upon the Centre Star and War Eagle claims, so that the camp may be said to date its life from the winter of '93-94, and is therefore about three years old.

GEOLOGY.

The geology of Rossland and vicinity is now being worked out by members of the Geological Survey, but briefly it may be said to consist of an area of eruptive rocks, having for a centre a mass of gabbro or diorite overlaid in part by porphyrite, which in turn is surrounded by rocks which are granitic. The line of contact between this diorite and porphyrite is nowhere clearly defined, but the portion of Red mountain in which the highest grade ores have yet been found appears to lie near this line of contact, although further research and the labors of the survey may change this view. It is not clear that the difference in these two eruptives makes any difference in the grade or character of the ore bodies found along the fracture planes which cut both, but it is a fact to be noted that away from this line of contact no large bodies of high grade sulphides have been opened at this date; and the fact is mentioned rather as one to be kept in mind in studying the district than as one which has been proved to be significant of change of value.

The diorite of this section presents many varieties, running from fine to coarse grained, often (as in the Deer Park mine) affording magnificent crystals of amphibole and actinolite, and frequently showing a variation to diabase by the introduction of augite, and also biotite mica.

The country is much cut up by dykes which frequently intersect each other, but no extensive faulting on the line of these dykes has been observed. Much development is required yet before the structural geology can be definitely announced.

ORE BODIES.

The ore bodies or deposits of the Rossland Camp appear to lie along fracture planes, which, so far as at present discovered, have two general trends, one nearly due east and west as in the War Eagle, the St. Elmo and Monte Cristo claims, and another about north-east by south-west, as in the Le Roi and Josie. Along these fracture planes (which are not to be taken as one continuous fracture, but rather as a series of more or less parallel fractures in one zone of country) occur deposits of pyrrhotite associated with other iron sulphides such as pyrite, chalcopyrite and occasionally marcasite and arsenopyrite, and also with calcite and quartz.

A minor series of fracture planes, usually, but not always, faulting the larger ones, are found occurring in a general north and south direction or transversely to the main planes which, so far as yet known, do not seem to have been faulting ones. The ore bodies thus formed carry their prevailing mineral (pyrrhotite) in several forms from coarse grained to lamellar and fine grained. In the south belt a change in the filling takes place, both blende and fine grained galena coming in, especially near the surface, and the ore then carries a perceptible value in silver. These deposits of iron sulphides do not always carry gold in paying quantity, in fact it may almost safely be said that the majority of the ore bodies are too low in grade (from $2 to $10 per ton in gold) to become profitable at present rates of treatment, and the ore chutes carrying values in excess of $20 per ton are the exception, which means, of course, that paying mines will be the exception, unless increase of depth may show increase of value for which idea there is no valid reason, nor is it borne out in practice. Both high and low grade ore chutes are found along the same general ore zone or "vein," as such deposits are locally called; as for example, No. 1 chute of the War Eagle mine, which on the surface gave $12–$16 per ton, and which has never yielded any pay ore with increased depth, and No. 2 chute of the same mine lying 300 ft. west of No. 1 chute, which has had pay ore running from $40 to $75 per ton from the grass roots down to the present depth of 250 ft. or more. When these bodies of pyrrhotite ore have reached to the surface, the iron sulphides have decomposed and oxidized, forming the genuine "gossan" or "iron hat" of mining parlance, and staining by the flow of surface waters much of the adjacent country rock. The inexperienced prospectors of the district have assumed this iron stained diorite to be in all cases the cover of an ore body, which experience has shown to be a costly error, as the diorite of this section contains impregnations of iron sulphides sufficient to form a stain which has received the local name of "Iron Capping" but which is really a very different thing to the "Iron Hat," and which does not have the significance attaching to the latter. The length of these chutes, horizontally, varies greatly, running from 40 feet. (as in No. 3 chute, No. 1 tunnel, War Eagle) to 172 (as in the Le Roi between the west and east faults), and in the No. 2 tunnel of the War Eagle the ore body had a length of 310 ft. and a width varying from 30 inches to 14 or 15 feet.

It is to be noted that all these main fracture planes dip north at angles varying from 45° to 80°, the majority having dips ranging between 60° and 80°. In some cases they appear to be continuous for considerable lengths, even up to 3,000 or 4,000 feet, yet their continuity is frequently broken by faults having a general north and south course, which dislocate the ore bodies from a few inches to several feet; the fault at the west end of the War Eagle having a throw to the south of about 50 feet, and in yet other cases this line of fracture appears to split up into two or three smaller fracture planes which deviate in course from the original, as seen for example, on the western end of the Le Roi.

Frequently these main fracture planes have lying parallel to them minor fracture planes, which, however, do not have the continuity of the main fissures, but which when clearly defined (as in some parts of the War Eagle mine) have led to the supposition that both walls were present, and that these deposits were of the type of "True fissure veins." In the C. and K., Monte Cristo and Centre Star claims occur six or seven of these parallel fractures between which are found different types of ore from extremely coarse grained to very fine grained gray pyrrhotite, also lamellar, bronze colored pyrrhotites, and in one case in the Centre Star a streak of fine grained compact bronze pyrrhotite, with a slightly curved fracture such as to strongly resemble in appearance a low grade copper matte. Upon the surface cropping of the Le Roi there are apparently two walls, from 5 to 15 feet apart, owing to the parallelism here of two lines of fracture, but in the deeper workings, say from the 350 to the 450 level, one of these fracture planes disappears and the main crevice occupies the centre of the large ore body which at the time of my visit in August '96, had a width of 36 ft., and which then had for its limits simply the diminution of the sulphides on either side of this crevice until there was a preponderance of rock over ore.

In addition to these lines of east and west and north-east by south-west fractures, there are the smaller cross fissures with a north and south course already referred to, which in most cases are faulting planes. In some of these, as in the Le Roi, there is brecciated matter composed of diorite iron sulphides and calcite, and in many others there is only a very narrow crevice or seam, which, as notably in the War Eagle, is frequently filled with sulphides or calcite, or both.

On Columbia and Kootenay mountain are met many examples of segregations of quartz and calcites in the diorite of the country, and it is to be noted that throughout the eruptive rocks of this district local segregations of pyrrhotite having a general lenticular form and frequently reminding the observer of gash veins, are common. This is to be expected when observation shows that the diorite of the district is impregnated with a very considerable amount of iron sulphides which form a constituent part of the whole mass.

The fact, however, that pay orebodies of iron sulphides occur in these basic rocks, does not by any means imply the reverse, that such basic rocks will always carry paying ore bodies, which implication seems to have been the basis in this district upon which many promoters have formed stock companies.

It is to be noted that along the main easterly and westerly lines of fracture which pass through the War Eagle and Le Roi claims, very little evidence of motion along that line is to be observed; occasional examples of slicken sides being however found, but no gouge nor breccia. But in the ore zone which traverses the Cliff, St. Elmo and Monte Cristo, there are many and distinct evidences of movement.

In remoter parts of the district, as at Champion Creek, I am informed that the seams which constitute the cleavage planes are filled with iron sulphides, which have apparently eaten off the sharp edges and corners of the blocks of country rock.

These facts taken as a whole, are the basis of the opinion entertained by many, that these deposits of the Trail district are replacement deposits having been formed by the metasomatic action of solutions which have entered the country through these fracture planes (which may or may not at the same time have been faults), and have used these same fractures as channels, by which to dissolve out the more or less shattered country rock, depositing in its place the minerals above mentioned. Whether these minerals have been derived from the surrounding gabbros, or have come upwards with an ascending current from some deep source is a question requiring further study and greater development.

The absence of two walls of a distinct gangue material, differing from the country rock, and of the usual gouge or product of motion of the walls along the fissure, have precluded many from considering these deposits as fissure veins in the ordinary acceptance of the term. But the fact that these deposits of auriferous sulphides do not present the usual type of a fissure vein, does not in the least detract from their value as workable deposits, nor does it militate against their permanency as mines, for be an ore deposit a fissure vein, a bed, a fahlband, or any other of the indefinite number of types of ore deposits met with, its value commercially is dependent upon the continuity of its chutes of pay ore, and facts are not lacking to show that many fissure veins become unprofitable and are abandoned not because the vein pinches out, but because the pipes or chutes of pay ore cease—every large vein from California to Montana affords examples of this.

There is in very few, if any, cases a distinct vein stone or gangue, rather the material contained is the diorite of the country impregnated in greater or less degree with iron sulphides, in fact, the vast bulk of the second class ore of the whole camp is of the character described by Mr. Carlyle, in his Report on the Trail Mining District, as being a "diorite with a comparatively small percentage of sulphides," but carrying a considerable value in gold. On the authority of Mr. Carlyle's report this ore has the following composition: Si O_2 45 p. c., Au 1.34 oz. or $26.80. FeO 22 p. c., Ag 1.4 oz. or 84c. CaO 7 p. c. MgO 3 p. c. Al_2O_3 18 p. c. Cu_2O_3 1.5 p. c. S 6 p. c. It is apparent that ore of this character carrying so little sulphur is not favorable to true pyritic smelting, *i. e.* a smelting without any carbonaceous fuel.

The deposits so far as worked (the deepest working being the Le Roi shaft, which has a depth of 500 feet) appear to have an increase in silica as depth is attained, and instances are numerous in which segregations of quartz and stringers of the same material are found alongside of the ore bodies, in the cross fractures, and even in the country rock apart from any fracture. These stringers are often also composed entirely of calcite, and the main ore body of the Le Roi has in places a seam of calcite running along the joint of fissure seam, which runs through the main ore body now working.

The ores of the camp are essentially pyrrhotites, having admixtures of chalcopyrite, pyrite, arsenopyrite, zinc blende and galena in varying proportions. The pyrrhotites as before mentioned having every conceivable variety of structure. So far as observation has gone, the coarsely grained and lamellar pyrrhotites carry little or no value in gold, the finer grained ores carrying more value, yet this distinction is hardly universal enough to constitute a hard and fast rule. In some cases the value has appeared chiefly in the chalcopyrite, in others in the arsenopyrite. In the south belt the sulphides run high in silver, owing, doubtless, to the presence of galena and blende, which are absent from the north belt. In the Le Roi, Cliff, and Evening Star, free visible gold is sometimes seen and often gotten upon the sieve by assayers.

Up to the first of January, '97, the chief producing mines were the Le Roi and War Eagle; with the advent of the standard gauge railway in December last, the opportunity is now afforded to other properties which are in Rossland opinion equally valuable to become regular shippers. The shipments recorded, however, for the month of January, some 4,800 tons, do not seem to indicate that many of these other mines are in haste to market their ore.

The conditions under which operations are carried on in Rossland, such as the hardness of the country rock, price of labor and of fuel make mining costs high, but owing to the diversity in the size and extent of the ore bodies and the few mines that have been developed to a stoping point, it is impossible to give any satisfactory estimate of what the average cost of mining a ton of ore is in Rossland, moreover it is doubted whether any of the properties now working keep such a system of cost accounts as would include in the mining cost the proper proportion of the cost of development work, superintendence and general expense.

The ores are shipped for treatment to smelting works in the United States and also to the furnaces at Trail and Nelson. The pyrrhotite by itself is almost in the condition of the natural matte, but as the bulk of the ore shipped carries 50 per cent. silica and only 20 to 25 per cent. FeO, with rarely over 6 per cent. of sulphur, it is, as before stated, not an ideal ore for pyritic smelting. One of the American authorities on pyritic smelting (Sticht) says the process "is always limited to the presence of enough sulphur and iron in the ores to maintain fusion without the auxiliary addition of too much coke—a deficiency of sulphur must be corrected by a greater use of coke"—and the early experience of the Trail Smelter has shown very clearly that the ores it received did not contain any surplus of either sulphur or copper.

PRODUCTION.

So far as I have been able to learn, the production of the Trail Creek District for the year 1896 was 38,600 tons of a value of $1,100,000, of which $1,000,000 was gold and $100,000 copper. These figures are based on the ore paid for by the smelter and do not include ore in transit and unsettled for. The Smelter returns for 1895 gave a total production of 19,700 tons, worth $702,000, of which $42,000 was from copper, $30,000 from silver and $630,000 from gold.

The average value per ton for 1895 was $35.63; for 1896 was $28.50.

FUTURE.

While it is improbable that one per cent. of the 3000 and odd claims located in Ross[illegible]nd Camp will ever turn into dividend paying mines, it is an assure certainty that the Camp will have from six to ten and perhaps more good permanent ore bodies. With such number, or the half, a permanent population is ensured.

I take this opportunity to note with pleasure the confirmation of these views in the interview with Mr. F. Aug. Heinze, which appeared in this morning's "Gazette" in which Mr. Heinze, stated that if Rossland possessed half a dozen good mines, it would have as many as the world famous Camp of Butte, Montana, in which at the present time there are but six producing Companies.

I also take the opportunity of saying publicly that a similar interview with myself has been construed as condemnatory of the Trail District. This is a gross misapprehension, as the paper I have just read will show; I sought in that interview to warn clerks, women and dependent persons generally against indiscriminately purchasing the shares offered by the unscrupulous, and misrepresenting stock brokers.

THE NELSON DISTRICT.

The Nelson District includes a large and irregular area. It runs north for 50 miles from the International Boundary, including the Salmon River country of recent fame, and beginning west of the lower end of Lower Arrow Lake runs 60 miles easterly nearly to Kootenay Lake. So far as these notes are concerned, however, only that portion included within a ten mile radius from the Town of Nelson will be considered.

The prominent mine of this district is the "Silver King," one of a group of several claims owned by the Hall Mines Co., Ltd. The ore body in this claim appears to be unique in the district, no similar deposit having yet been found.

The country rock of the Toad Mountain portion of the district consists of a series of grey and green schists, which occasionally lose their schistose character and become massive. These schists have many forms, being felspathic, chloritic, hornblendic and micaceous, and in structure are often amygdaloidal. They are said by Dr. G. M. Dawson, to be composed of altered volcanic material.

These schists are surrounded by granitic and granitoid rocks of several distinct varieties or periods.

The coarse-grained are evidently intrusive and of later date than the schists wich are altered by them.

Limestones of crystalline structure are also met with, and on both sides of the "West Arm" or Kootenay River.

The copper-silver deposit of the Silver King appears to be a segregation of mineral along a twisting line of fracture whose general course is east and west, dipping southerly at a high angle. From this main body of mineral (whose horizontal dimensions so far as stoping is concerned are about 250 ft. in length by 40 or 50 ft. in width) small veins and stringers of nearly pure mineral ramify in all directions, gradually dying out in the country rock. The mineral contained is chiefly bornite, with chalcopyrite and pyrite in smaller proportions near the surface and in larger proportions as depth is attained, apparently confirming the theory that bornite is the result of alteration of the chalcopyrite.

The grade is low, the average being about 4 per cent. of copper and 20 ozs. of silver to the ton.

It would appear that closer work at the mine could raise this grade considerably without much extra cost.

With the exception of this copper-silver deposit, the claims worked in the district are on gold-bearing veins, which belong to the type of fissure veins, being well defined, cutting cleanly through the country rock, possessing two distinct walls often carrying a gouge and filled chiefly with gangue material of clean vitreous quartz carrying copper and iron pyrites. These veins appear in a grey coarse-grained granite, having many variations in its constituents, (being frequently a mica syenite,) and seem to be mainly confined to the area between 5 Mile Creek on the east and White Water Creek on the west, getting their greatest development at or near the head waters of Eagle and Forty-nine Creeks. These quartz veins carry from $10 to $30 in value of gold, being free milling on the surface, where the sulphides have become decomposed, and being refractory below this line of decomposition; the value being contained chiefly in the sulphides. Their width varies from 15 in. to 5 feet, but with the exception of the "Poorman" and "Fern" mines so very little work has been done that no safe predictions as to the continuance of the pay chutes is possible.

These gold veins have produced some very fine samples of specimen quartz and gold, and their future systematic development will doubtless be productive of profitable results. Operations on this line have recently been begun upon one lode (the Athabasca) which so far have been productive of highly satisfactory results.

Below Nelson, upon the opposite or north side of the Kootenay River occur peculiarly formed somewhat massive doposits, ("Victoria and Copper King,") apparently segregations in a granic rock, carrying much copper and a value in gold.

So far as production is concerned, the district hitherto has been a copper silver one, from the predominating value of the Silver King ore. But there are grounds, as stated, for the belief that the gold yield will be substantially and steadily increased.

The production of the section for 1896, so far as I have been able to learn, was about $540,000, made up of $420,000 worth of silver, $110,000 of copper and about $10,000 in gold.

It is needless to say that the completion of the Crow's Nest Pass Railway to this point will give to this section unusual advantages for cheap transportation and fuel, and permit the successful working of many properties that are now only undeveloped claims.

SLOCAN LAKE DISTRICT.

The section referred to as Slocan Lake District is a part of the Slocan District proper, but comprises that portion running south from Four Mile Creek to and including Lemon Creek, and reaching from the Lake Shore as far easterly as the divide between Slocan and Kootenay Lakes.

Its dimensions. therefore, are not great, being about 20 milss long by 7 or 8 wide, but its possible developments are enormous.

In contra distinction to the Slocan proper, it is characterized by a preponderance of dry ores, whereas the argentiferous galenas predominate in the Kaslo-Slocan country.

It is worthy of note also that gold values in the ore appear to increase as one proceeds southerly from 10 Mile Creek; some free gold quartz veins having been discovered on tributaries of the Lemon Creek.

From the territory drained by Springer Creek some remarkably high assays have been obtained, 700 ozs. in silver and $90 in gold having been obtained in one case, while assays of 150 to 200 ozs. silver and $15 to $25 in gold are common. Some small shipments have been made which yielded from $70 to $160 net to the owners.

The country is high and mountainous in this section; the summits rising to 7,000 or 8,000 feet above sea level, or 5,000 to 6,000 feet above Slocan Lake. The first discoveries were made in the fall of 1895, but the bulk of the claims have been located during the summer of 1896.

The country rock in this district consists of shales and slates to the north, with gneisses and granites coming in as one proceeds to the south, the country about Springer Creek being granitic. The veins lie at a low angle near the surface, being from 28 to 40 degrees from the horizontal. They vary in width from six to seven inches to about three feet. The paystreak, however, is confined to one wall (usually the hanging wall) and has a width usually not exceeding six inches, and in some cases being as small as 3 inches.

The ores, as stated, are of the kind usually classed as dry ores, but the development of the Enterprise Mine on 10 Mile Creek has shown that contrary to the usual law in the Slocan country, zincblende may and does carry very high values in silver.

Although this section is quite distinct in the character of its ores and country rock from the Slocan District proper, its production will be credited to the Slocan country, and before passing to the last district to which I shall refer, I desire to give you an idea of what this unboomed, unnoticed Slocan District did for for British Columbia in 1896.

My information gives the following figures:

Gold	$ 3,000
Silver	1,500,000
Lead	550,000
Total	$2,053,000

If to these figures we add the production of Ainsworth, which belongs to this section through similarity of ores produced, we get:

Silver	$125,000
Lead	60,000
	$185,000

Or a grand total of $2,238,000. Such a district needs no newspaper boom.

FORT STEELE DISTRICT.

The Eastern Division of Kootenay was one of the first portions of the Province to receive attention after the advent of the C.P.R. through Kicking Horse Pass. But the galenas of the Otter Tail and of Mt. Stephen, the free gold and copper-silver ores of the Spillimicheen, and the copper ores of Jubilee and Windermere have never proved remunerative, and soon ceased to attract the attention of the prospector and the capitalist alike.

Farther to the south, some years ago, the enormous ore bodies of the North Star Mine on a branch of the St. Mary's River drew attention to the southern portion of East Kootenay, but so far as vein mining is concerned, Fort Steele District may be regarded as a new country.

The Placer excitement in Wild Horse Creek, in 1863, carried in thousands of men, of whom but a handful remained, and they chiefly concerned themselves with gravel diggings, and not with veins of ore.

In ascending the valley of the Columbia, to the south, the main range of the Rocky Mountains seems to carry mineral, but in too disseminated a form to be profitable. As soon, however, as one passes the little ridge at Canal flat, which forms the dividing line between the waters of the Columbia flowing north and of the Kootenay flowing south, a change occurs in the rock formation, and slates and quartzites become more frequent, taking the place of the limestones and dolomites.

And in the course of the next 30 miles proceeding southerly, the western slopes and spurs of the Rockies begin to show quartz veins carrying ores of gold and silver, such as tetrahedrite, galena, and the black sulphurets of silver. Veins of milling ore, of free gold quartz, are also met with in the tributaries of Wild Horse Creek. The basins of the creeks from Wolf Creek to Bull River are now being prospected, and sufficient work has been done to justify the belief that development will show many of these veins to contain profitable ore.

On the western side of the Kootenay the Purcell Range of the Selkirks shows easy rounded summits of from 4,000 to 5,000 feet altitude, and from the eastern slopes of these mountains run three streams, the St. Mary, Perry and Moyie Rivers, whose watersheds are now receiving a good deal of attention from prospectors and with the most promising results.

Along the St. Mary's River and tributaries are found ores of argentiferous galena and of grey and yellow copper with satisfactory amounts of the precious metals.

On Perry Creek and its tributaries are found wide veins of quartz, some cutting the formation like true fissures, and having a width which delights the lover of large tonnages.

On Moyie River and its branches occur a number of true fissure veins, carrying galenas, grey copper and also on Weaver and Ryder Creeks, free gold. The Ste. Eugenie group on this river presents a type of vein similar to those found in the Slocan district, having a strike across across that of the formation, presenting two clean walls and carrying argentiferous galena of a high grade.

Enough has been done in this district to warrant the most pessimistic observer in predicting a very substantial, if not a brilliant future.

It will be evident from those very crude notes upon the districts mentioned, that no one camp in British Columbia can as yet proclaim itself "the" camp of the Proviuce, and there are many other districts which I have not mentioned which may shortly come to prominence as permanent producers.

There are climatic and topographical reasons why British Columbia cannot develop her mining regions as quickly as her neighbors to the south, but give her five or ten years time, kill the over capitalization of stock companies and the illegitimate boom, safeguard the investor, and there is no question whatever but that British Columbia will shine as the brightest gem in the whole Dominion Crown.

A Review of the Report of the Commission on Fires in Pictou Mines.*

By H. S. Poole, A.R.S.M., F.G.S., &c.

In this report we have what purports to be an exhaustive inquiry into the cause, history and effect of fires in the mines of Pictou county. The report itself occupies some thirteen 8 vo. pages, and is supplemented by 90 pages of evidence collected by the Commission. The personnel of the Commission consisted of the Inspector of mines, Mr.

*Paper read before the Mining Society of Nova Scotia, March, 1897.

Gilpin and his deputy for the district, Mr. A. Dick then employed as instructor of surveying by the Department of Mines, and a retired mine manager of Cape Breton.

Questions had been put in Parliament in the session of 1895, to which the Department of Mines had replied, but regarded as not sufficiently ample, the Commission in question was appointed to investigate further and report.

On verbal instructions the Commission met in May, 1895, and heard a few witnesses. They then adjourned and obtained formal authority to proceed under Chapter 120, but the document giving the authority was not made public.

The Commission had in this enquiry an opportunity to collect information of considerable interest. The history of the Albion Mines has been most eventful. Success and honors have been won and troubles, not a few, have been their lot. They have a world wide reputation for the great size of their coal seams. They have been visited by men of note and acknowledged great attainments. Members of all social ranks from the highest to the lowest have dined and slept within their borders, from the Prince of Wales in Mount Rundell to the humblest tramp under the shelter of the coke ovens. Science has sent such notaries as Lord Dundonald and Sir Charles Lyell. Here Lord Mulgrave, the Lieut.-Governor, rusticated and threw aside his cares of State. The merrymaking of the colliers at New Year and after pay day, and how rum that had no headache in it was bought by the bucket, would come in also for review. It was here in 1838 the first locomotive ran on a railway in Nova Scotia. Of the mechanical applicances in use the range has been wide, and from the foundry erected in 1828 have issued a varied assortment of castings. Here boilers under but 5 lbs. pressure, have been used to supply a Watts condensing engine; wagon and haystack boilers had their representative. Coal has been here hoisted in ships, and trolleys with edged wheels have run on angle iron rails.

Mr. Richard Smith, before the select committee of the House of Commons, 1835, remarked: "The firedamp at the river boiled similarly to that of a steam boiler with the same kind of rapidity; so that in putting flame to it on a calm day, it would spread over the river like what is commonly termed setting the Thames on fire; it often reminded me of the saying. It is very common for the females to go to the river with the washing they have to perform for their families. After digging a hole in the side of the river about 10 inches deep, they would fill it with pebbles and then put a candle to it; by this means they had plenty of boiling water. I mention this to show how highly charged the coal was with gas. When we first struck the seam at a depth of about 180 feet, the gas roared as the miner struck the coal with his pick; it would often go off like the report of a pistol. The noise which the gas and water made in issuing from the cove was like a hundred thousand snakes hissing at each other.

Then two small accumulations of gas were purposely fired without dread of possible consequences, and cannon and butts of water were everywhere on hand to extinguish the fires that as a matter of course were expected to at times follow powder shots in the more gassy places of the mine.

Notice might also have been taken that here the first blast furnace for the production of cast iron was erected in 1829.

In the memorable contest between the manager, Mr. Smith and Mr. Young, political strife would find a place; and interesting items respecting trade and navigation would be found in the rates of freight that brought in the days of wooden ships, much tonnage to Pictou and filled the harbor during the shipping season with a forest of masts. The iron interests of New England would not be forgotten, and reciprocity with the United States would be a burning question.

But the Commission did not embrace so wide a field, although they did allow themselves some latitude, and in their inquiry felt unhampered by ordinary rules of evidence.

The departure that they did make, however, was felt to be novel for such a matter of fact subject as coal mining; and their method of treatment proved a surprise not altogether acceptable to the individuals singled out for notice of whom I am one. The report only issued during the closing hours of the session of 1896 could not then be considered by committee, and no opportunity for the aggrieved to be heard could occur until the re-assembling of Parliament. Nevertheless the report was widely circulated as soon as issued to individuals, to libraries in the province and elsewhere, and in some cases with the author's compliments to societies of which I am a member and he is not. As one of those empaled by this report, but not endowed with such a printing bureau as the Department of Mines at my b k wherewith to reply, I now appeal to this Society to grant publicity to my counterstatement. I also ask the Society to consider whether this departure of the Department of Mines touching the reputation of individual members of this Society is not one to be jealously watched.

On the re-assembling of Parliament I appeared by petition before the committe of mines and minerals and presented a reply criticizing the report as a record of facts and impugning the findings of the Commission. My reply was accepted and ordered to be filed. When published it will furnish to anyone disposed to inquire further into the matter the authority for the charges I therein make. It gives the ground for contending the whole proceedings were irregular, that the evidence taken was improper and the findings unsound.

As yet no explanation has been given why the usual practice elsewhere of making such a report as far as possible impersonal, has been in this case departed from. It would have been bad enough had the statements made respecting me, a predecesor in office of inspector, been correct, and the censure indulged in the expression of a competent tribunal. But incorrect I claim the report to be and I ask you not to be led by it until you have studied the matter set forth in my reply accepted by the House of Assembly.

In it I give a correspondence with the Department of Mines extending over some years, and extracts from other letters in support of my contentions.

Among others, that while the report accepted a statement to the effect that the president of the Acadia Coal Co. vetoed a proposition to secure the Foord shaft, I gave his actual reply of February 28th, 1891, in which was the remark: "The board is exceedingly desirous that the Foord pit should be placed in complete order and will make the requisite expenditure."

The report says: "The evidence showed that there was a lack of co-operation between Mr. Wills, the manager, and Mr. Poole, the agent of the company." The tittle tattle that the Commission collected and called evidence showed a difference of opinion certainly, but no lack of co-operation. What Mr. Wills thought years after he left the company's employ, he had said or done while in it is not proof, especially in the points in which he is not sustained by the records. His letters I publish in my reply are conclusive proof of this. In matters of fact the report in details is often misleading, for example:

It says: As the fire (at the Drummond mine) was promptly extinguished and work resumed, it was not considered necessary to make any formal inquiry into that explosion." The mines reports for 1873-6 show that the word "promptly" covers operations extended over three years.

The report, page 4, speaks of a distance of 700 feet or more as "a few yards."

It cuts 1,000 feet off the length of the English slope. On pages 5 and 11 it expresses belief that "the explosion of 1888 in the third seam extended the fire in the Cage pit seam to the east of the Big Brake line of stoppings." The fact is the fire broke through the stoppings some six weeks before the explosion.

It implies page 5 that I held one view in 1872 and another in 1895 respecting ingress of fire to the Cage pit. The fact is it was the head

of the Commission himself who wrote in his report for 1883, page 7: "In 1872 its (the main seam fire) smoke was found in the workings of the underlying or Deep seam at a point where the removal of pillars had allowed the roof to break away up to the overlying seam." In 1895 I shewed by plan such was not possible.

The report says I presented the statements page 98. In my reply page 26, the letter of the solicitor says *he* presented them.

I am made to say there was fire in the Foord pit, although it was full of water at the time.

The report makes me say, page 74, I never was down the Foord pit. Everyone at Stellarton knew to the contrary and thought it strange I should utter so glaring an untruth. The fact was my answer applied to the Forster pit, as the local press correctly gave it at the time the evidence was taken. This substitution of names in the official report makes the implication the more marked as evidence of me was demanded under oath. A condition not required of manyof the witnesses and in my case an open indignity.

Speaking of the prior publication of the evidence by the local press it is well to note in the letter of August 8th, 1895: "The Commissioner further states that he has nothing to do with the publication of any evidence tendered before the Commission," and yet the official reporter was the only one present at the inquiry.

In calling attention to this remarkable production I do not propose to say more than sufficient to show its style. Of the evidence appended, its nature and value can only be judged of by examination of the report itself. On reading what was imputed to me I protested in my letter of August 7th, 1895. It was so grossly inaccurate. As to the evidence of others, I believe it to be faulty, but there are no independent notes to compare with the report.

It is especially worthy of note there was no cross-examination of witnesses, and in connection therewith that the Commissioner of mines "was of opinion that in an inquiry of the nature of the Commission *re* Pictou Coal Mine Fires there exists in no party either a witness or an outsider any right or power to cross-examine any witness that may be summoned by the Commission." There *he* would claim for Chapter 120, R. S. 5th series, a right to put all sorts of questions, relevant or otherwise, to make all sorts of damaging suggestions and even accusations, yet acknowledge no right to the party so accused to cross-examine or produce rebuttal testimony. I am happy to say that so far his law has not been sustained.

The claim of the Commission to the right to act under Chap. 120 may be questioned, for the Chapter itself explains it is for inquiry into any matter in which "inquiry is not regulated by any special law." Mining matters are regulated by the well known Mines and Minerals Chapter and the Mines Regulation Chapter, of which section 21 the Department of Mines proposed to apply to this inquiry in the letter of December 30th, 1892.

What may be called the practical suggestions in the report will appeal most strongly, I assume, to this society and I would especially direct your attention to the more prominent of them.

As one of many examples that might be taken of the soundness of the views expressed by the Commission, I take from page 10 the following: "Evidence shows," says the report, "that in the burnt mines the bottom coal is untouched. * * * That there is a certain amount of pillar coal left in the upper or worked portion of the seam. The evidence as to the quality of the bottom coal while not conclusive, points to its being workable for ordinary purposes." Now this is what Mr. Smith said in 1835 about this pit: "I worked 25 to 27 bords, six yards wide each, and the ribs of coal three yards. I got the coal out at once, *not leaving it to work over again*, but in the first instance, some of the ribs were three yards thick, some two yards and a half, some two yards, according to the weight of superincumbent strata they had to bear. The seam was nearly 40 feet thick, our operations were confined to about 10 feet, the lower part of it was not so good.

And this is a part of the field that the Commission would have the public believe can be profitably worked over, claiming that "every possible effort was made to secure all available information," the report assumes to have exhausted all sources and yet evidence might have been obtained from many competent men who had been in positions to know facts relating to these mines: Mr. Hudson, general manager at one time; his son, a certificated manager; Mr. Hall and Mr. Greener, former underground managers; Mr. Rutherford, inspector of mines 1865 to 1872, and later consulting engineer; then there was Mr. Gilpin and his deputy, whose knowledge and cross-examination would have been invaluable. Nor was reference made to Mr. Gilpin's special report of April 3rd, 1883, or his regular report for that year wherein he shows that at that time underground fires had existed for 13 years and long before the present lessees took the Albion area.

The casual reader might assume the censure so generously bestowed applied to only one management, that of to-day, but the operations swept by this review extended over half a century; and the Commission never individually having made mistakes can afford of course to speak disdainfully of the shortcomings of others.

A sixth of the report is devoted to Barriers that were reserved for a time during the many years the pits were open, and that were sometime or other cut and destroyed. The censure on the latter practice is given with no equivocation, and the Commission feel so strongly about it that not only are they constrained but "wish to put on record their regret that such a course of connections should have been so persistently followed." As they grasped the situation of what might have been, had they had the directing of matters, their language becomes more emphatic. At first they speak of "the importance of isolation of working," which would give "in case of an explosion, a fair chance of saving one part of the mine," then as their indignation warms the connections "at various times, now appear, they say, so far as information is available, to have been most improvident, deliberate, and do not seem to have been necessary at any time."

And then culminating in the charge that "the management, not contented with incurring the risk of penetrating the barrier * * * connected the Deep and Main seams by a stone tunnel;" they finally point the judicial finger and proclaim: "In the present system of working at the Albion Mines, there are now four seams connected, viz. The Third, Cage Pit, Four Feet and Main seams, and it must be remembered that an accident to the works in one seam may mean the closing of those in all three." How very improvident, how very deliberate! I thank the Commission for teaching me how to use these words, they are so opposite. Let me repeat them: How very improvident, how very deliberate on the part of—may I say it—the Commission, to say such things and to charge such things, for both statements happen, will it be credited, to be lacking in essentials.

In the first statement the order of events is transposed, the stone drifts in question were driven in 1877, while the penetrating the barrier and the subsequent explosion occurred three years later and since Mr. Gilpin became inspector.

Did the Commission remember this when they wrote these strictures? Did they realize that they reflected on the Department of Mines and the head of the Commission, that knew so well as this report has it of the value of these barriers put away and yet did not step in and secure their pretention.

In the second statement, four seams the Commission say are now connected. I ask you, as practical mining men and knowing all the conditions, would such a course necessarily be bad practice? However, that is not the point at present. The point I wish to make is that the Commission say: "There are now *four* seams connected, and an accident in the works in one seam may mean the closing of those in all three." The Commission name as one of the four, a seam called the Four Feet, but they do not give it in the section of strata they publish

on page 3; and rightly enough, for the fact is, it is a name only for *a part* of the Deep seam, used conveniently to distinguish it from the main portion. It could not possibly be worked independently, for it is only separated by 3 to 5½ feet of shaley coal. To imply that the Four Feet is a distinct seam is therefore misleading, and it is clear that the four seams the Commission say are worked together cannot be more than three seams. Of the three seams that remain to be considered, the Main seam is one. At the time the report was dated there were no workings in the Main seam, and there are none now in connection with the Third seam. The connections of 1880 have remained since that date sealed by water, so that as a matter of fact the present system at the Albion Mines works two seams together and not four seams, as deliberately stated by the Commission. As to whether it would be better practice to work the Deep seam and Third seam distinctly would be a question for experienced men to decide after carefully considering the actual conditions of working. Among which would be seams, of which say 9 to 14 feet may be worked, with at one part but some 45 feet of strata, chiefly tender shales between, and dipping with an inclination of 20° to 30°.

These barriers done away with, that are to carry down the ages engraved upon them the regret of this commission, did ordinary practice, it may be asked, require them? If retained, they would have made two distinct operations in each seam entailing inseparably extra expense by so working; of how much ground do you think? A strip three miles long? a by no means unusual length; two miles? No! a division of less than one mile, and that in the case of the third seam not in two equal parts. For in that case the barrier had on the east side only one working balance less than 500 feet wide. For this narrow strip the commission would have the public believe good practice would have made an independent working. Laying all sham regret aside the width of these workings as they are would be regarded as small in every important coal-producing country, and no such limitation is required or practiced in Nova Scotia.

If one may be permitted to adopt the tone of the report, not among the least remarkable of the many ideas in it that demand recognition for profundity of study and depth of experience, is the recommendation summed up in the paragraph—'The Commission believe that the future mining of much coal in this (the Main) seam, and of larger amounts than at present in the lower seams would ultimately be secured by the course suggested.'

That so simple a method to produce so satisfactory a result should not have previously occurred to any one to suggest, strikingly illustrates the good fortune of the country in having this whole matter put into such competent hands. That my friends may fully appreciate the difficulties that hitherto have stood in the way, and that this, may I call it, inspired, suggestion, have removed, I will briefly and mention some of the conditions that the problem presented:—Several thick seams inclined at 17° to 30°, separated for the most part by tender bituminous shales, operated for some seventy years on the bord and pillar system, and with no expectation of the pillars being ultimately drawn; with workings high, from 10 to 18 feet, and even in parts still higher; and with pillars irregular and widely separate and with openings much fallen and partly crushed; spontaneous combustion a possibility; coal of a variable quality; the face in each seam to be continuously operated as the water receded, of great extent, operated from points of access yet to be established, and finally with smouldering fire unextinguished above the drainage level:—The suggestion presented by the Commission will, I am sure, call for your unqualified delight—this is it, quoting verbatum from the report:—"The only effectual method apparent to this end would be the flooding of the workings up to the level of the river. This would involve filling up all the present workings in the lower seams, except the McGregor When this had been done any fire existing in the crop could be isolated and the coal gradually worked out as the water was lowered." I must not, however, forget to mention that the Government, strange as it may seem to be, have not yet compelled the lessees to adopt so wise a course.

It will be noticed that the complaints for having unworked seams and idle pits are made against one lessee only, let the questions put in Parliament respecting this matter be made general throughout the province, and the impossibility of compliance with compulsory working will at once be self-evident. As to the Commission's views on the working of pillars, it must be remembered this is only now done in Pictou and Cumberland mines, while nothing is said of the pillars standing over thousands of acres in Cape Breton, that there is nothing in the lease or law requiring pillars to be worked.

The style of the attack in the report is not altogether new, although it is in this case more sustained. A milder form is to be found in the debate of March 14th, 1888, when the Commissioner of Works and Mines remarked when the matter of the Albion Mines' fires was again considered: "No doubt the manager was under the impression that the fire was out. The inspector thinks they were wrong about that. However, they undertook to work, and the result was another fire. I suppose one reason why they do not wish to flood the works to put out the fire is that it would seriously interfere with the works and no doubt the greed of the company operates against such proceedings being taken." The "greed" of a lessee sounds well from the head of the Mines Department, especially when the inspector stated in his report for 1883: "As this part of the outcrop is from 75 to 150 above the level of the East river *it will be seen that no successful attempt could be made to flood the coal immediately along the outcrop.*" Then as to the remark about the inspector thinking the manager was wrong about fire being out, the Commissioner must have forgotten the special report of April 3rd of that year when the inspector wrote of himself: "The steps taken by the inspector have led him to consider it probable that the fire in the Cage pit is extinguished."

It is of the same ground that the Commission of 1895 discuss so fully on page 11 of their report and finally say: "The Commission believe that in view of the evidence offered this section only of the old workings (in the Deep seam) would warrant an attempt at re opening at present."

In doubt as to the exact site of this chosen section, the correspondence given on pages 18 and 19 of the Reply followed, but no response met the repeated request for more definite information. The public is led to believe a suggestion of a practical nature of provincial benefit is made by this Commission in the above extract, but the lessee who would have to give it shape is not told where "this section" lies. The application read: "In order that this company may obtain the benefit and carry out to a practical issue the advice you offer, and free from any possible misunderstanding on my part, I beg to again prefer the request that you return the skeleton plan marked as requested in the letter of Sept. 24th."

This letter remains to this day unanswered.

"Notes on the Western Ontario Gold Fields."

(Address before the Federated Canadian Mining Institute.)

DR. COLEMAN.—Mr. Chairman, I see that both Mr. Hille, and myself are down for this subject and if Mr. Hille, is ready I will be very glad to allow him to read his paper, because I have been so crowded with work that I have nothing but rough notes put together.

THE PRESIDENT.—Mr. Hille, is not present.

DR. COLEMAN.—Then, if you will allow me, I propose simply to talk for a time on the subject. If you will allow me, I shall call attention to these maps that I have here. I have not taken the excellent maps belonging to the Geological Survey for the reason that they are on

a smaller scale. These I have here are on the scale of two miles to the inch. The maps of the Geological Survey of the Rainy Lake and other districts, while more accurate and better colored, are, however, on too small a scale.

It was intended in this paper to take up the Geology of the Western Ontario Gold Mining region. The geology of this region is very interesting in itself and we have to credit one of the members of the Geological Survey, Dr. Andrew C. Lawson, now of California University, for the first really careful description of that region that I am going to speak of—that is of the Rainy River and Lake of the Woods District. He must be accepted as laying the foundation of our knowledge of these districts. He found that we have there Laurentian and Huronian rocks in very peculiar relationship. The Laurentian rocks are in rounded areas, half a mile or a number of miles in width enclosed by Huronam rocks in a wide set of meshes. The Laurentian rocks in this region consist chiefly of granite, granite gneiss and syenite gneiss, while the Huronian rocks are chiefly volcanic, eruptive flows and metamorphic volcanic ashes, but sometimes water-worn conglomerates. Now Lawson's idea was that these granitoid rocks pushed up as eruptive masses through the schists nipping in the latter as synclinal folds with bedding having a steep dip away from the Laurentian. This theory is one that does not correspond with the usual idea of the Laurentian as being formed in a great many cases of modified sedimentary rocks laid down in greatly disturbed territory. However, we have evidence that the Laurentian rocks in very many cases, if not all, are of an eruptive character so that the term Laurentian is used in a petrographical, not an historical sense, from the geological standpoint. Lawson was not quite sure about the Huronian age and therefore he called these rocks, Keewatin. An area of more or less modified sedimentary rocks, consisting of sandstones, mica schists and gneisses, Lawson names Couchiching and places beneath the Huronian; but as they are seldom or never gold-bearing they require no further mention here.

I now propose to take up the different types of gold-bearing deposits, and give you a few of the most prominent examples that illustrate them. The first and most important of these types is that of the true fissure veins of which we find a large number of cases. In this region there are confined chiefly to eruptive rocks especially granites and less frequently occur in schistose rocks. In the Shoal Lakes hundreds of fissures have been formed in the granite, and these fissures have been filled with quartz containing a certain amount of gold. There was a time when it was supposed that these veins were not likely to go very deep; in fact, some supposed that they would soon run out. That is not true; they have been traced along the surface in many cases thousands of feet, and they may just as well go down thousands of feet. The deepest shaft is now down to a depth of about 200 feet, and the vein is as wide there as at the surface, in some cases wider. The Foley, the Ferguson, the Lucky Coon and other mines are now being developed on deposits of this kind. Two or three of these are well established mines and it is probable that a large quantity of gold-bearing quartz will be obtained. Fissure veins sufficiently rich to be of importance have been found nearly always associated with eruptive granites. On Sawbill Lake however, there occurs a deposit which is not in granite but in a gneissoid rock, but the veins are of the same character, true fissures quite rich in gold. One of the shafts in the Sawbill mine has been sunk to a depth of 160 feet. We have examples of the same sort in the Harold Lake mine.

True fissure veins may occur also in Huronian rocks. The best example I know of at present is in the Manitou region, on the Crawford property, H. P. 301, north of Lake Manitou, where a well defined true fissure vein three or four feet wide may be traced for a quarter of a mile or more, across the strike of the schistose country rock; and a somewhat narrower one for a still greater distance.

The next type of ore deposit that is valuable in this region is what may be called the bedded or segregated, or lenticular vein. Bedded veins are interpolated between the schists and run parallel with their strike. They are generally lenticular in shape and when a lens runs out another often replaces it a little to one side. Frequently several layers of schists are more or less parted, bands of quartz of varying thickness filling the space between, where the ore body may have ill defined limits; but in many cases the lenses have tolerable definite walls though seldom so distinct as in the case of true fissure veins. There may be a single lens or there may be a series of them in the Huronian rocks. There are cases of lenticular deposits, however, that occur in what has been called, Laurentian. The best example that we have of this sort is the Sultana mine where at least two large lenses have been found; one of a considerable width has been traced along the shore for 1,800 feet, the country rock being a grey schist probably formed by the heaving of a mass of porphyritic gneiss as it pushed up through the Huronian rocks, the latter now largely removed. When the upper lens was about worked out, Mr. Caldwell, was so fortunate as to strike another very much larger body of quartz, hundreds of feet long, and at some points 40 feet wide with a little schist included. While the most important instance that we have of lenticular ore deposits occurs in what is generally looked upon as Laurentian rock, a great many examples of bedded deposits occur in the Huronian where there are sometimes whole series of quartz stringers in the schistose rock uniting at some points perhaps to larger quartz masses. An example of this kind is to be seen in the Little America mine on a small island just south of the border in Minnesota. In other cases there are bedded veins that do not differ much from fissure veins. Probably one of the most prominent examples of this kind is at the Empress Mine, near Jackfish Bay, at a point not shown on this map. There bedded veins have been traced for miles and the majority of the locations that have been taken up by the gold miners of that region are to be looked upon as of this character. Next contact deposits may be referred to, where one great mass of rock comes in contact with another. The Mikado mine on Shoal Lake has been said to be of this character, but in reality cannot properly be so classed, since the vein does not lie to any appreciable extent between Granite and Huronian rocks, but cuts across the contact, being enclosed at one end in granite and at the other in diabase in both a more or less regular fissure vein. Again the Regina mine has been spoken of in the same way. Here also a true fissure vein begins in the granite and passes into the schistose rock afterwards. I do not know in fact of a single typical instance of a contact deposit, except one, and I am not aware that it has been proved especially rich in gold.

Besides these varieties of gold-bearing deposits there are two or three that may be of value but have not so far proved to be of great importance. Among these are Fahlbands, bands of schistose rock, impregnated with sulphides. They may carry a little quartz and in that case they will form transitions to the lenticular variety of ore deposits. The best known of these fahlbands is one near Rossland, north of the Canadian Pacific at Rat Portage. This runs north-east and south-west including the Scramble, Benson, and other locations, is 25 or 30 feet wide in places and it is stated, has been traced for several miles. The gold carried is very fine, but is easily shown by panning. These locations were taken up in a very singular way. A prospector of Scandinavian origin had a friend in the Old Country who owned a divining rod of great power. He sent for it and located with the divining rod several of these claims. There are examples of similar fahlbands in the Manitou and Little Turtle regions though not quite so extensive as near Rat Portage. Some of these deposits will be important if they carry even three or four dollars a ton of free milling gold, because they are unlimited in extent. Up to the present they can scarcely be called mines, but rather prospects. Another variety of deposit occurs in dykes of porphyry or felsite, which are found wherever granite or gneiss comes in contact with Huronian rocks. These dykes are usually found spreading for instance from the Laurentian into the Huronian. Quartz has been deposited in fissures that were formed from the shrinkage of the dyke rock while cooling, or the dyke may have formed a line of weakness along which later fissures were made. The quartz thus associated with felsite or porphyry often carries gold. Whether the dyke as a whole will be workable is a question, since the gold ore of these dykes has never been mined as yet to any important extent. As in the case of Fahlbands the question as to their value has not yet been settled. Whole bosses or masses of eruptive rock are said to be in some cases gold bearing, as for instance the whole mass of granite at the Treadmill mine in Alaska. The only instance of the kind in Ontario that I know of is on Round Lake not far from the Huronian mine. Here a considerably altered quartz porphyry contains iron and copper, pyrites, fluor spar, and other minerals, and I can testify that there is gold in it, but the assays so far made do not seem to show that there is enough to pay. However, if you have a square mile of material there need not be a great deal of gold to make it pay.

Now I have taken up the main types of ore deposits in Ontario. You will find that there is a considerable variety, but I am not aware that there is a single example of a mine that is more than a mile or two from the contact of the Huronian rock with the Laurentian rocks or granite, and several of the best are just at the contact. Wherever you find this contact there may be gold deposits: that at least is the present experience. They may occur either in Laurentian granite or Huronian schists or in bosses of eruptive granite.

Since I had this subject in my mind I have been informed that a quite similar contact zone near Lake Winnipeg has proved to have gold-bearing deposits and there does not seem any limit to the possible discoveries of gold where Laurentian meets Huronian in our northern territories.

The Utilization of the Mill Refuse and Peat Mosses of the Ottawa.

By Ernest A. Stostedt, M.E., Bridgeville, N.S.

Having been requested by your secretary to present some facts at this meeting, it occurred to me that certain features of the fuel question —itself of vital importance to every industry in the land—would possess special interest to some of the members of the Institute engaged in the development of the industries of the Ottawa district, which, lacking in mineral fuel, in its stead possesses a mine of wealth in the enormous amount of mill refuse now going to waste, and in its large but dormant peat bogs, which by proper care and judicious adaptation could be made to yield a handsome profit.

To prove this assertion it is but necessary to direct your attention to the means adopted in some of the countries of great industrial importance where mineral fuel is scarce or altogether lacking, among which Sweden, Germany and Holland stand out most conspicuously. The first mentioned country is in fact the very home of such adaptation of wood, mill refuse and peat for metallurgical purposes, and the utilization of peat for fuel in Germany, Holland, Denmark and other European countries is of the greatest importance, if not the very possibility for many of their industries. With them necessity has been the mother of invention, "but as they have marked the way shall not we follow whenever true business policy would dictate?"

The history of the European peat industry is a checkered one, as shown by a recent article by Prof. Klason in Teknisk Tidskrift. According to this authority the modern peat enterprises began after the Napoleonic wars, when a general revival in all branches of business was experienced, and a special need felt for cheap fuel, light, iron and paper. The railways were then, also, in their infancy, and no knowledge was had of the great quantities of mineral fuel which the earth possesses. Besides, the price of coal was then about double to what it is at present, owing principally to the high cost of transportation. It was, therefore, most natural that the attention was early directed towards the peat mosses, which long had been known to supply fuel for the inhabitants about the moors, and from which now it was expected to receive both heat and light. Ireland, with its enormous bogs, and England, the centre of industry, were among the first to take up the peat problem, and in 1849 the Irish Peat Working Co. was formed with a capital of £500,000. Their idea was to make a concentrated fuel equal to that of coal, by compression and partial carbonization. Two other companies were also formed with a total capital of £620,000 for the dry distillation of peat and the utilization of the by-products; and their exhibit on a large scale at the London Exhibition in 1851 created much comment. But in 1853 not a peat plant was in operation. The experimental stage of the peat industry in many of the other European countries was equally disastrous, as, for instance, in Bavaria, where the government expended hundreds of thousands of florins in aid of the peat industry, and in Sweden, where many different methods were tried in succession before the peat came to be recognized as a source of wealth. And from the catalogue of the minerals sent to the Colonial Exhibition in 1886, we find that the same discouraging results were met with here by the Canadian Peat Fuel Co. in their attempts in 1875 at St. Hubert and St. Bridgide to manufacture peat fuel for domestic purposes, and for the G. T. R. Co. in their locomotives.

After much careful investigation and persistent experimenting this industry has now, however, been brought on a paying basis and become of national importance in many parts of Europe where mineral fuel has not been found.

Possibly it is in Holland that the peat mosses are at present most extensively worked, and of the results there obtained we can get an idea by quoting from a late number of a Danish agricultural report: "The peat industry in Holland is of a very great magnitude and ranges first among the economic questions of the land—several milliards of gulden having been here saved by its use as fuel As an instance only may be mentioned, that the Rahder Co. of Ninweroord has eight steam machines in operation, which daily produce 200,000 peat bricks, selling at the bog for 3.70 gulden per thousand. At a minimum of one hundred working days, this means an annual production of 20 million bricks, which are obtained from about seven acres of peat bog, and represent a value of 74,000 gulden (or nearly $30,000) for this mill alone. And it is estimated that Holland has recovered the peat from 300,000 to 400,000 acres of bog of a value of about $1,400,000,000."

Denmark, also, leads in the peat industry, and the model works at Sparkjars produce annually 15,000 tons of peat for local consumption alone, making a profit of about 90 cents per ton.

And from Germany we read in the Consular report to the United States (see Cassier's Magazine, June, 1896), that "peat, or turf, is used throughout Europe generally whenever the ordinary cost of its production is not materially increased by cost of transportation. In the large and small cities, as well as in the country districts, it is used for fuel—in fact in many localities it is the only substance used for heating purposes. It is used, likewise, in industrial establishments; but its use in locomotives had to be discontinued in order to prevent danger of forest and field conflagrations. Besides its use as fuel, peat is turned into account in Germany as a fertilizer and as building material, it being successfully used as a filler for vacant spaces, separating layers for waterworks, reservoirs, ice houses, etc. By means of a process patented by a tanner in Mayenne, it has also been made to do service in tanneries."

Having thus seen that this despised and neglected substance is receiving due recognition elsewhere, it may not be amiss to tarry a while and consider its nature and technics.

Peat is the product of spontaneous decay of vegetable matter, more especially of marsh plants, mixed with various mineral matter—an "unmineralized coal," as it has been named—which covers vast parts of the earth's surface within the temperate zone. (In Ireland 2,830,000 acres, or nearly one seventh part of the entire area of the island is estimated to be covered by peat bogs, and in Sweden we have about 10,000,000 of acres of bogs, and in Germany about 5 per cent. of its surface is covered by peat bogs.) The different qualities of peat are chiefly due to the more or less complete decomposition the plants have undergone, the mineral substance mixed with it, and the degree of compression to which it has been subjected. The least decayed kind is called "moor-peat," and from it *moss peat-litter* is manufactured. The peat of a more advanced state of decomposition is known as "*fuel-peat*" and is of a dark, compact character. This kind of peat, again, receives different names according to the different methods by which it is manufactured into a commercial product, as cut-peat ("Skartorf") moulded peat (alt-torf) machine ("tube" or "ball") peat and peat-coal.

The peat or moss-litter was first made on a large scale in Hanover (in 1879), and since then it has been gaining steadily in demand, owing to its many useful qualities. As a bedding for domestic animals, it is soft, elastic, dry and absorbent. By reason of its latter characteristic it thus becomes a valuable fertilizer, as well as a disinfectant (absorbing the malodorous gases, especially ammonia, formed by the decomposition of the manure—a quality not possessed by the straw-litter). Saturated with the waste-liquids from the sugar refineries, it leaves a highly prized fertilizer for grain and sugar beets, and as a packing for fruit and fish, it has proved to keep these perishable goods in good condition during a long time and under transit. It has also been made to do duty in the fishery department, it being pronounced a most suitable substance in which to pack and ship spawn. Owing to its hydroscopic qualities

(absorbing six to eight times its weight of water) it can also be used for drying out damp rooms, is used in the manufacture of porous brick, as filling material of mattrasses in hospitals and for children, for storing ice (being a poor heat-conductor, on account of its porosity), for filtering oils, etc.

Peat fibres have long been used for texture manufacture. Thus in Holland, England and Ireland, it is made into mats, blankets and even finer goods for wearing apparel; and in France and Russia it is made into cloth for bandages and other surgical purposes, owing to its anti ceptic properties (peat retarding the development and increase of microbes). During the last few years it has also been much spoken of in connection with Ekelund's method of manufacturing peat-dust, by which operation it is obtained as a by-product. After drying and crushing the peat, namely, the fine particles are separated from the coarser fibres, which latter are subjected to a washing process and freed from adhering peat dust. In this state they are ready for use as a yarn, or are compressed into bales for export, obtaining a ready sale in England at about $25 per ton. The peat fibres can be bleached quite white, but are also used in its unbleached state.

Peat as a fiber for paper manufacture is also receiving attention in England. And some years ago a method was developed in New York City for the making of kindling, by immersing the dried peat blocks (which first have been sawed into small bricks of · in. x 5 in.) in raw petroleum, when they absorb from 15 to 20 per cent. of weight, and then coating them with rosin, in order to prevent evaporation.

The manufacture of artificial wood from peat is the subject of a German patent (Wekn-Tidsk, Nov., 1896). After the peat has been thoroughly washed and broken up to fibers and peat dust, it is agitated into a pulp, which is dried and then mixed with plaster-Paris water, to which is added a little lime. This mixture is thereupon put into moulds and subjected to a strong hydraulic pressure, until most of the water is eliminated, after which it is kiln-dried and coated with oil, or a solution of rosin and alcohol. This artificial wood is said to be very durable and to well resist the influence of heat, cold and pressure and can be worked in the same manner as common wood.

The value of peat as a fuel, naturally, depends on its caloric effect and its cost of manufacture. To ascertain its heat value, most thorough tests were made a few years ago by Prof. Klassan, one of a committee appointed by the Swedish government to investigate the merits of peat coal made by Messrs. Angel and Lieutenant Ekelund's methods, and the results obtained are embodied in an exhaustive article in the jubilee number for 1896 of Teknisk Tidskrift, from which the following table is taken, showing the average composition of the organic substance in different kind of fuels, together with the mean calories of the absolute dry and ash-free fuel, and the average percentage of moisture in its dried state. With caloric is here understood the metric centre caloric, or the amount of heat required to raise the temperature of one kilogramme water at 0° C to 100° C (or 2.204 lbs. avoirdupois from 32° F to 212° F).

	Wood.	Peat.	Brown Coal.	Swedish Coal.	English Steam Coal.	English Gas Coal.	English Cooking Coal.	Welsh Anthracite.
Carbon	52·0	58·0	66·0	78·0	81·0	87·0	89·0	91·0
Hydrogen	6·2	5·7	4·6	5·1	5·2	5·2	4·9	3·5
Oxygen	41·7	35·0	28·0	14·8	11·5	5·5	4·1	3·5
Sulphur				·8	1·0	1·0	1·0	1·0
Nitrogen	1	1·2	1·0	1·3	1·3	1·3	1·0	1·0
Calories	49	57	60	75	80	87	86	86
"Hygroscopicity," p.c.	20	22	25	13·5	7·6	1·7	1·4	2·0

From the several individual tests made it is shown that the composition of each special kind of fuel is nearly constant, consequently the heat-values differ but slightly from the average value of the corresponding class; and in order to determine each individual fuel's caloric value, it is therefore sufficient, for all practical purposes, to determine to which class it belongs, its percentage of moisture and ash. The calorics of the organics substance, multiplied by the percentage of organic substance it contains, less the amount of heat required to evaporate the water it contains, as well as that formed by the combustion of the hydrogen present gives the heat value of the fuel in question.

The great importance of a *dry* fuel is here at once made evident.

In the report of the above mentioned committee the average cost of manufacturing the different kinds of fuel peat in Sweden is stated to be as follows:

Cut peat.....	$1.05	per short ton	$1.70	Including interest and depreciation of plant.
Moulded peat	1.16	" "	1.82	
Tube peat....	1.60	" "	2.19	
Machine peat	1.86	" "	2.45	

These prices are for peat principally recovered by manual labor; but recently ingenious machines have been invented for cutting and taking up the peat from the bog, besides which many improved methods have lately been adopted, which have materially reduced the cost of manufacturing, and in the July 1896 number of Teknick Tidskrift the average cost price for Sweden is stated to be 55 cents and 60 cents respectively for cut peat, and $1.01 and $1.14 respectively for machine peat, with an average of 20 per cent. of water. And at Sparkjar works in Denmark the very best machine peat, weighing 28 lbs. per cubic foot, is there manufactured for 36 cents per ton, or when interest and depreciation of plant are added, and the price of the bog estimated at $155 per acre for 71 cents per ton. The wages here range between 82 cents and $1.10 per working day. In Wurtemberg the cost of cutting, drying and storing, by combined manual and machine work is *94 cents per ton.*

The conclusions arrived at by the committee, as well as by Prof. Klassan, in regard to the peat-briquettes, peat-coal and the peat-dust, were that they are all good and satisfactory fuels, but that the peat-coal, of which so much had been said and written, and so many great advantages expected, is not, economically, what it was claimed to be, 16 per cent. of the heat value of the peat being lost in the process of distillation (carbonization). Peat in the form of a highly dried powder, on the other hand, has lately been recommended as an easily transportable, cheap and effective fuel, especially when used in connection with some of the late devices for continuous firing with or without the application of blast.

Peat as a fuel for air furnaces, as well as for domestic purposes and for steam generating thus has gained in favor at the same rate as its suitability and cheapness has been recognized, but it is as raw material for generator gas where it, to my mind, has its greatest possibilities. In this connection we will now consider it together with the other wet fuels—the saw dust and other mill refuse. The employment of gaseous combustibles has long been known, and its use was greatly extended with the successful application of the regenerative principle by Siemen. But it was not until Lindin invented his condenser that wet fuel could be utilized in this manner. The manufacture of fuel gas from carbonized fuel (charcoal or coke), namely, is very simple. Air is forced through the mass of hot coal in the generator, and when this air meets the coal carbonic acid is formed, which gas is reduced to combustible carbonic oxide during its further passage through the glowing coals. But when peat, wood, sawdust or similar fuel is used the process becomes a more complicated one. The carbonization of these materials must first take place in the generator, besides which all the water they contain (varying from 20 per cent. to 50 per cent.) must

be evaporated. But as the steam thus generated would dilute the gas too much and cause a great heat-reduction in the gas-furnace, it becomes necessary to condense the steam, and this is now accomplished by placing a so-called condenser between the generator and the combustion chamber. Of these there are two types, the Lindin's and the surface condenser. In the first mentioned one the gas first passes into a chamber in which small streams of cold water are discharged, crossing each other in various directions. It then goes through a second chamber filled with wrought iron bars, arranged in cross-layers, and kept cold by a stream of water trickling over them, and condensing nearly all of the remaining vapor.

Another arrangement, on the same "direct-condensation" principle, is where "the gas produced passes downward by a rectangular iron box, divided internally by partitions reaching nearly to the roof and floor, alternately, into a series of cells, through which the gas is made to travel in a zig-zag direction, and encounters at the top of each alternative division a series of jets of water, which cool it and removes the steam and other condensable substances with which it may be mingled and deliver it in a dried state to the main flue."

But as the condensed tar gives to the water a strong smell and taste of creosote, and the water consumption is considerable, the fish were found to die in the streams in which the condenser water was discharged, and in order to remedy this evil Bjorklund constructed his surface condenser, "consisting of brass tubes, surrounded by cold water, through which tubes the gas was forced to pass. These tubes being difficult to keep clean, Wiman designed as a substitute, thin sheet iron boxes, placed near together, into which the cooling water is admitted at the bottom to pass out at the top, while the gas passes between the boxes from the top downwards. This method makes it practicable to separate independently the water, tar and acetic acid from the gas, and permits the transportation of the noxious substances by rail to places far from the river."

It is true that a considerable quantity of heat is lost by this cooling of the gas, as well as by condensation of some combustible hydrocarbons, but, nevertheless, it has proved advantageous and more economical than to use the fuel direct, as the combustion of the gas is more complete and accomplished with less excess of air, the gas-fuel easier applied where needed, and because an inferior material can be used in the generator. Besides, the generator-tar is now saved in many places and mixed together with charcoal braise or sawdust, this mixture passes through a peat machine and the tar-fuel is dried and used for steam generating. From results obtained in practice at Fogersta Iron Works, Sweden, it has been proved that one cubic metre of this fuel corresponds in heat value to 0.76 cubic metre best South Yorkshire coal.

Another way of avoiding the loss of heat in consequence of condensation is to first *dry* the peat and the mill refuse, and to generate gas from the same on the Ekman principle. This drying is accomplished in specially designed ovens, which at Degerfors Iron Works, for instance, consist of vertical sheet iron cylinders in which the wet fuel is placed, and through which is forced air that has been heated to about 90°C by the waste heat from the Lancashire forges. And for drying wet fuel on a larger scale the so-called Kidd-Barff "half-cooling" process has, in Austria, received extensive recognition at such works where peat, slabs and all refuse from saw mills, and trimmings from the forest trees, are used as fuel. Here the drying takes place in batteries of brick ovens, each system consisting of four rooms, in which the fuel is placed on railway trucks, and dried from a separate boiler by superheated steam and the combustibles passing through these chambers on their way out to the chimney, the temperature reaching 300°C.

The advantages of such a drying has lately been emphazised by a Swedish metallurgist, Odelstjema, who writes that "he has had occasion to observe that tar condensed out of water containing fuels gives more heat, if it be allowed to pass into the furnace and be consumed there than the equivalent of the heat which the water vapors in the fuel carry from well constructed modern furnaces with large regenerators; and in accordance with this observation experiments were carried out with both green and dry wood, and refuse from saw mills for firing the open hearth furnace. These experiments led to the construction of a special producer type with drying apparatus, by means of which such a considerable saving in the wood is made that it now becomes much cheaper to fire with wood than with coal. As the producer is not larger than one of the commonly used coal gas producers, it can be run with coal as well. The apparatus for drying the wood consists of steel plate cylinders, covered on the outside with asbestos board, and this again is protected by a thin cover of wood. A certain amount of dry wood is taken out at a time, while the same amount of fresh wood is put in, so that the apparatus works continuously. The drying current is furnished by the products of combustion escaping from the air-regenerators of the open hearth furnace. These, instead of passing to a chimney, are drawn by a suction fan out and up through the drying cylinders. And in order to prevent setting the fuel on fire, an automatic heat-regulator is provided by inserting in the blast pipe a copper wire, which, expanding as the temperature of the drying current is raised, opens a valve, when at 120°C, which admits cold air.

We have now briefly shown how peat and mill refuse is being utilized in Europe, and especially how in Sweden nothing of a combustible nature is allowed to be wasted, but is gathered into store houses and used as fuel for various metallurgical operations. The example thus set I would now most earnestly recommend to the consideration of the owners of mills and peat bogs of the Ottawa as well deserving of their attention. The idle peat mosses, namely, could here be utilized in the several ways now mentioned, and the troublesome mill refuse be turned into a profitable material, especially in their employment as gaseous fuel for various metallurgical operations, in steam generating, in the ceramic art and brick making, in the glass industry, for burning lime stone and calcining sulphurous and refractory ores, etc.

There are many, I know, who consider the fuel gas inferior in heat intensity to that of coal or other solid fuel, owing to the lack of solid incandescent matter in the gas flame. But this is true only when a substitute for the incandescent matter is not introduced in the form of fire brick walls, or combustion chambers, to do the duty of the solid fuel. With properly constructed boilers and furnaces, however, where a complete combustion of the gas is possible, the gas possesses many advantages over the solid fuel.

In conclusion, I may add that the gas producer lately has found a wide promising field in producing gas for use in gas engines.* These have, until recently, been of small power, and the tendency has been to look upon them as substitutes for the steam engine under particular circumstances only. But the gas engine has latterly reached a stage of development which now warrants its assumption of the title of a large motor. It has been made of several hundred horse power, and in some instances has displaced the steam engine even for such purposes as driving flour mills and generators in numerous electric lighting stations. It has, in fact, proved itself sufficiently regular in speed for any purpose. This development of the gas engine has naturally reacted upon the gas producers, which are now neatly designed and cleanly in working, and equally applicable to bituminous and non-bituminous fuel, and can therefore be employed to utilize what has hitherto been considered "good-for-nothing rubbish."

And (to quote Dr. Sterry Hunt in his report on Lundin's gas-generator and condenser) "when such results can be obtained with saw dust, or with ordinary peat, the want of mineral coal need no longer be an obstacle to the development of the metallurgical industry of this country."

*Cassier's Magazine, April 1893.

The Mispickel Gold Ores of Deloro, Ont.

By J. Walter Wells, School of Mining, Kingston, Ont

Near the village of Deloro in Hastings Co., Ontario, there is found a belt of metamorphic rocks in which occur a series of gold-bearing veins. For the past two months I have been experimenting on gold ores from this district in the Mining Laboratory of the Kingston School of Mining, and the paper, which I have the honor of bringing before you this evening, contains a few of my results.

The country around Deloro consists of low, rounded hills, the most striking feature being a large irregular mass of granite whose longer axis lies in a north and south direction, and which is known as the Huckleberry hills. Surrounding this granite mass and conforming to its general outline, there is a series of metamorphic rocks of the Hastings series consisting of dolomitic schists, talcose schists and quartzites. The talcose schists are of most interest, as in them are found veins carrying quartz, dolomite, mispickel and gold. The veins are parallel to one another and have usually been considered to be bedded or segregated veins as they follow the strike of the schists. Most of them are found close to the contact of the granite with the schists. A similar occurrence is found in Barrie township, in the County of Frontenac. This is the Weber mine which is found in rocks of the Hastings series, near the contact with the Grenville series. The veins at Deloro seem to be similar in character and a description of the Gatling vein, which is now being worked, serves for all.

This vein has an average width of from seven to ten feet and runs nearly due north and south with a dip 30° west. It is composed of vitreous quartz, grey arsenical pyrites or mispickel, dolomite or "bitter spar" and in some places biotite is found. The mispickel is generally fine grained and compact but large silver-white, striated crystals, prisms of the Rhombic system, are often found. Native gold is sometimes seen adhering to the faces of the crystals. Analysis of the mispickel made some years ago by Thomas Thomas and J. H. James of Swansea, Wales, gave the following results:

	Fine grained varieties.	Coarsely crystalline.
Peroxide of iron	54 00	56 00
Silica	0 57	0 03
Sulphur	19 31	18 13
Arsenic	25 70	23 00
Nickel	trace	trace
Silver (per ton of 2,000 lbs.)	trace	$6 50
Gold " " "	$306 95	$2,920 67

The mispickel often contains a trace of Cobalt, which may be detected by blow-pipe tests. I also found several perfect crystals of zircon imbedded in the dolomite and associated with the mispickel.

Assays of the ore recently made in the laboratory of the School of Mining gave the average gold contents as $30 per ton. For the sake of comparison, I append assays made by ex-Prof. Chapman of Toronto University. Sample No. 19, $38.65 per ton, sample No. E $24.87 per ton, sample No. F, $36.60 per ton, sample No. G, $24.74 per ton.

The gold bearing veins in the Hastings series are found in schistose rocks, chiefly talcose, and are generally parallel with the strike of the rocks. Hence they have been called bedded veins. It is doubtful, however, as pointed out by Phillips in his work on ore deposits, whether there is any difference in origin between many veins of this class which occur in highly metamorphased rocks and those which are called "true fissure veins." Metamorphic rocks were considered by the older geologists to be derived from sedimentary material, and for this reason the schistosity was compared to bedding. Of late years, however, many of the most strongly schistose varieties have been proved to be altered igneous rocks. While many of the members of the Hastings series are undoubtedly of sedimentary origin, such as the metamorphic conglomerates and calcschists, there is as yet no proof that other members, such as the talc and mica schists, are not metamorpose igneous rocks. The schistosity in these latter may have been produced partly or wholly at the opening of the fissures, which were afterwards filled with the metalliferous matter and are now represented by the gold bearing veins. The schists in the immediate vicinity of many of these veins are cut through by dykes of different kinds, chiefly diorite and more basic rocks. And at the Deloro mine none of these dykes cut at one time across the rocks before the space which is now occupied by the gold bearing veins was formed. At the time of the formation of the fissure this dyke was broken across and pulled apart, thus giving the ore deposit. It seems to me the character of a true fissure vein just as much as if it cut through a large mass of igneous rock or across the strike of the schists. During my visit to the mine in the latter part of December, I obtained specimens of this dyke which, I believe, has not been referred to by other writers on the district, and I have since made a microscopic examination of these sections of the rock. Specimens were obtained in a cross-cut on the lower level of the main shaft, and on the hanging wall some distance from the side of the vein and from a "horse" near the foot wall of the first level. On microscopic examination both specimens were found to belong to the same rock. Although the material of the horse being nearer the edge of the vein, was much metamorphosed. The thin sections from the specimen on the lower level showed the rock to consist of plagioclase, orthoclase, biotite and some quartz together with other minerals in less quantity. The section from the horse showed it to contain orthoclase, plagioclase, a little brotite, muscovite and talc. The two specimens resemble each other very closely in the proportion of acid and basic minerals, with the exception that most of the black mica and some of the feldspar of that from the lower level is represented by their metamorphic equivalents, muscovite and talc in the horse. Thin sections were examined from other dark-colored dykes in the vicinity of the vein. They are similar to those described. The condition of gold in the mispickel seems to be a debatable point. Some of the gold undoubtedly occurs free, as may be seen by panning and in certain specimens showing native gold. But it is the invisible gold which causes the discussion. This is either chemically combined or in a mechanically fine state of division. Ex-Professor Chapman of Toronto University believed the gold to exist as an arsenide, but his reasons have not been published so far as I know.

I made a series of experiments to ascertain the real state of gold in the mispickel and the results, though not settling the question by any means, throw light on a few points. The experiments in favor of the "combined" theory are as follows:

(1.) Mispickel rich in gold was crushed to 70 mesh and treated in a hand Arrasta. The mercury refused to extract the assay value of gold.

(2.) A gold button was treated with hydrogen sulphide for nine days. A brown coating was formed on the button, which refused to amalgamate, showing that a coating of sulphide of gold had been formed.

(3.) Gold foil was fused with mispickel in absence of air. A dark grey powder formed around the button, which became brittle and refused to amalgamate due to formation of arsenide or sulph-arsenide of gold.

(4.) Gold foil was fused with arsenic trisulphide, a brownish-red powder formed, button became brittle and refused to amalgamate.

(5.) Mispickel known to be rich in gold was examined in thin sections, with highest powers of the microscope. No trace of gold was seen.

(6.) Gold was digested with strong solution of caustic potash and found to be insoluble. Trisulphide of gold (Au_2S_3) was digested with solution of caustic and found to be soluble. I also digested mispickel

with solution of caustic potash, reasoning that if I got gold in the potash solution the gold must be in a combined state as a sulphide. I obtained a black precipitate from the acidified solution by hyd. sulphide which was proved not to contain iron, copper. I also failed to get good tests for gold by stannous chloride, ferrous sulphate or blotting paper tests. This, however, may be due to the small amount of precipitate obtained. The reasons in favor of the "free" theory are as follows:

(1.) The gold may be in the allotrophic form which is known to resist the action of mercury.

(2.) Failure to amalgamate may be due to a coating of sulphides around the gold and arising from decomposition of pyrites.

(3.) The particles of gold may be so embedded in the pyrites that only chemical means will free the gold.

(4.) The particles of gold may be invisibly fine so that the highest powers of microscope cannot detect them.

It is commonly stated in text books that if gold exists in a combined state in an ore, it is dissolved out by treatment with nitric acid. This I found to be an erroneous statement with regard to arsenide of gold and the ordinary sulphides. The arsenide is decomposed by nitric acid, giving free gold and forming arsenic acid ($H_3 As O_4$). The sulphides are not attacked by nitric acid.

I digested pulverized mispickel with nitric acid and found no trace of gold in the solution. The residue on the filter paper was tested for gold and gave excellent purple colors in the blotting paper tests and also good result with stannous chloride.

Gold was first discovered in the Marmora district in 1865 and numerous attempts have since been made to extract the precious metal. The first attempt consisted of treating the ore by raw amalgamation in primitive stamp mills. The ore became refractory when the water-line was reached in the shafts and failure ensued.

A few years later the Canada Consolidated Co. commenced operations, and a large mill was constructed to treat the roasted ore by the barrel chlorination process. The ore proved refractory even by this process and the works were shut down. In connection with this, it will be interesting to know that the modern chlorination plant in our Mining Laboratory was successful on two different occasions in extracting gold from mispickel. Over 90 per cent. of the assay value was extracted in each case.

The next scheme was tried by the Hastings Mining and Reduction Co. in 1892. They proposed to treat the pulverized and roasted ore with mercury vapor, condensing and passing over copper and silver plates to catch the amalgam. The process, experimentally successful, proved to have too many working parts and work was soon stopped.

And now a new process has entered the lists against the hitherto victorious mispickel.

This process, known as the Bromo-Cyanide, was invented by Mr. Sulman, and has been successful in Australia. It seems in many respects to be a combination of the cyanide and chlorination processes. The solvent used consists of the ordinary cyanide with a small proportion of one of the haloid compounds of cyanogen, viz: Chloride, iodide or bromide. The bromide is mostly used as it is cheap and portable.

The solvent is claimed to be particularly successful in extracting gold from refractory ores, such as arsenical, antimonial, manganiferous and copper compounds. The ordinary cyanide fails to extract gold satisfactorily from such ores. According to Mr. Sulman, this is due to: (1) The oxidization of iron and other base sulphides with consequent destruction of the cyanide; (2.) the production of caustic potash as a necessary reaction product of the solution of gold. These defects are got rid of by adding haloids which cause no hydrolysis and take up the potassium set free. The chemical reaction is expressed thus:

$$Cy\,Cl \times 3\,K.Cy \times Au_2 = 2\,(K\,Au\,Cy_2) \times K\,Cl.$$

This equation also shows that the solvent power is not due to liberation of oxygen from decomposition of water by free chlorine since the stable chloride of cyanogen is used.

Comparing this reaction with that of the cyanide process, viz:

$4\,K\,Cy \times Au_2 \times H_2O \times O = 2\,(K\,Au\,Cy_2) \times 2\,K\,O\,H$, it may be seen that the fatal defect (necessity of a good supply of oxygen) is entirely obviated.

This solvent was tried on refractory ores of all kinds by the inventor, with surprising success. He claims the solvent is over 100 times more rapid on free gold than the cyanide, and he ascribes the results to:

(1.) The enormously accelerated solution of the gold, wherever its particles are easily accessible, by having potential cyanogen always ready at hand to effect the formation of aurous cyanide necessary for the soluble double salt of gold and potassium.

(2.) The avoidance of production of caustic potash, the product being quite inert as regards the further formation of cyanide destroying compounds.

To illustrate this rapidity of solution, I quote an experiment made by the inventor:

"A shaking test upon a sample of Canadian arsenical pyrites was made with 0.3 per cent. K Cy and 0.3 per cent. K Cy x 0.12 per cent. Br Cy. Half an hour's agitation of the ore (which originally assayed 7 dwt. of gold), yielded, with cyanide alone, tailings assaying 3 dwt. 22 grains, and with our solvent, 1 dwt. 20 grains of gold, or extractions of 44 per cent. and 74 per cent. respectively." The plant required is about the same as used in the ordinary cyanide process. A dilute solution of potassium cynide is used and to the contents of the storage tank, an addition of the bromide of cyanogen is made in proportion 2 of potassium cyanide to 1 of bromide of cyanogen. The ore is crushed dry to about 70-mesh fineness, treated in leaching vats with the solution from the storage tank for a few hours till the gold is all extracted. The solution is then filtered off and the gold precipitated by zinc flume, *i.e.* finely divided zinc and purified by the ordinary means.

The Canadian Gold Fields Syndicate is now erecting a large plant consisting of a mill for the crushers, rollers, and leaching tanks, assay and chemical laboratory, shaft houses, etc., for the purpose of testing the efficiency of the solvent on a large scale.

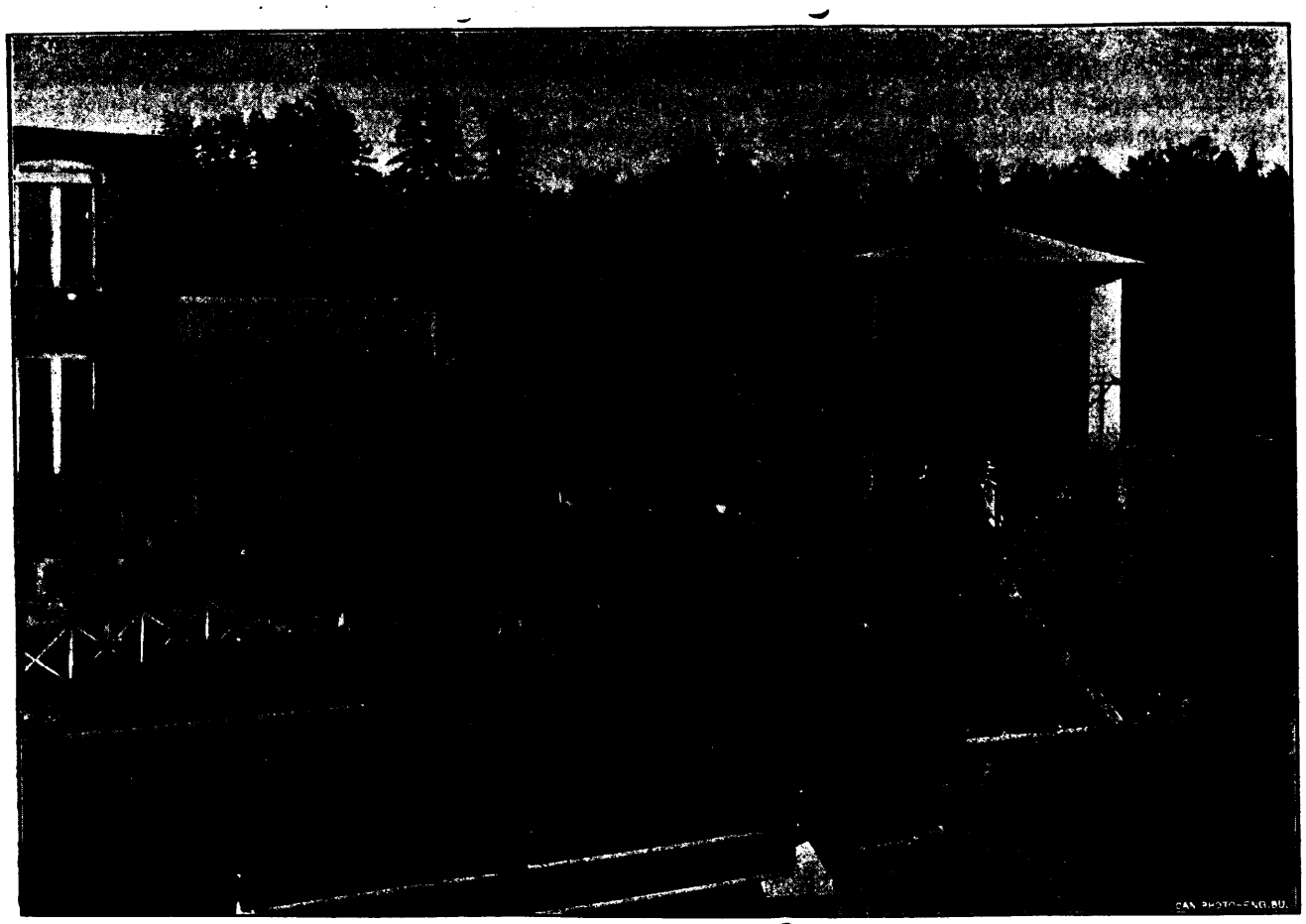
It is to be hoped that the venture will prove successful, as the Hastings district is rich in auriferous mispickel veins.

A Description of the 150-Horse Power Hydraulic Air Compressor erected for the Dominion Cotton Mills Company, at Magog, Que.

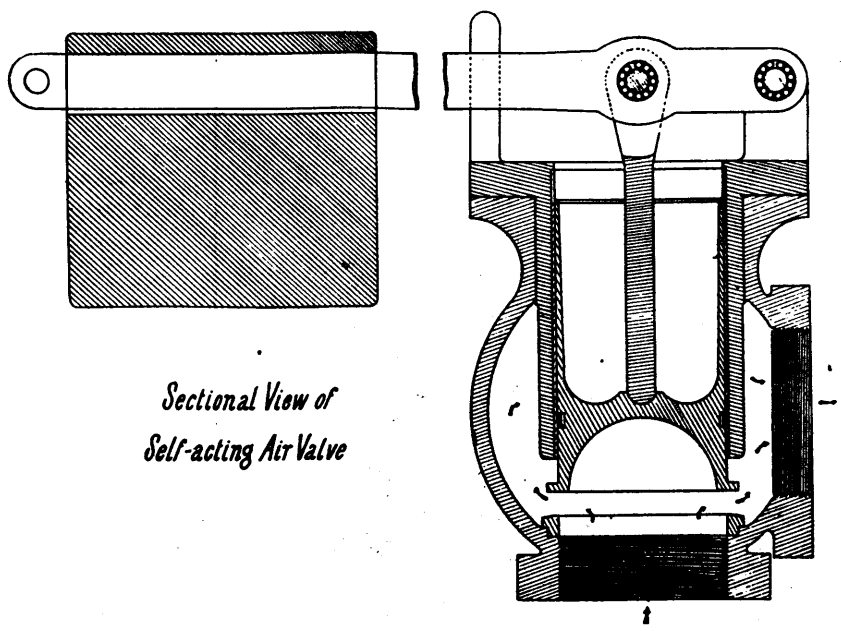
By C. H. Taylor, M.E., Montreal.

The construction of the plant consists in sinking a shaft to the necessary depth and erecting the separating tank, compressing pipe, head piece with the air inlets and penstock.

The shaft of the Magog plant has been sunk to a depth of 128 feet. The dimensions inside the timbering and rock are 6 feet by 10 feet from the top of the shaft to within 16 feet of the bottom, where it is enlarged to 20 feet in diameter. The timber used in the shaft is 8 in. x 8 in. hemlock, and sets being placed 4 feet apart, centre to centre. The timbering extends from a point 3 feet below low water level in the tail race down a depth of 72 feet, of which the last 20 feet is in the rock. All the timber above the rock is backed with 2 in. hemlock plank. As each set was put in, each plank was wedged separately, and the space filled up solidly with fine gravel. After timbering was completed, a lining of 2 in. hemlock plank was put in. The space between this lining and the rock was filled with concrete, thus forming a solid base upon which the upper timbers were supported. This careful timbering was necessary because of the nature of the ground, which is composed of layers of running sand. The rock below the timbering

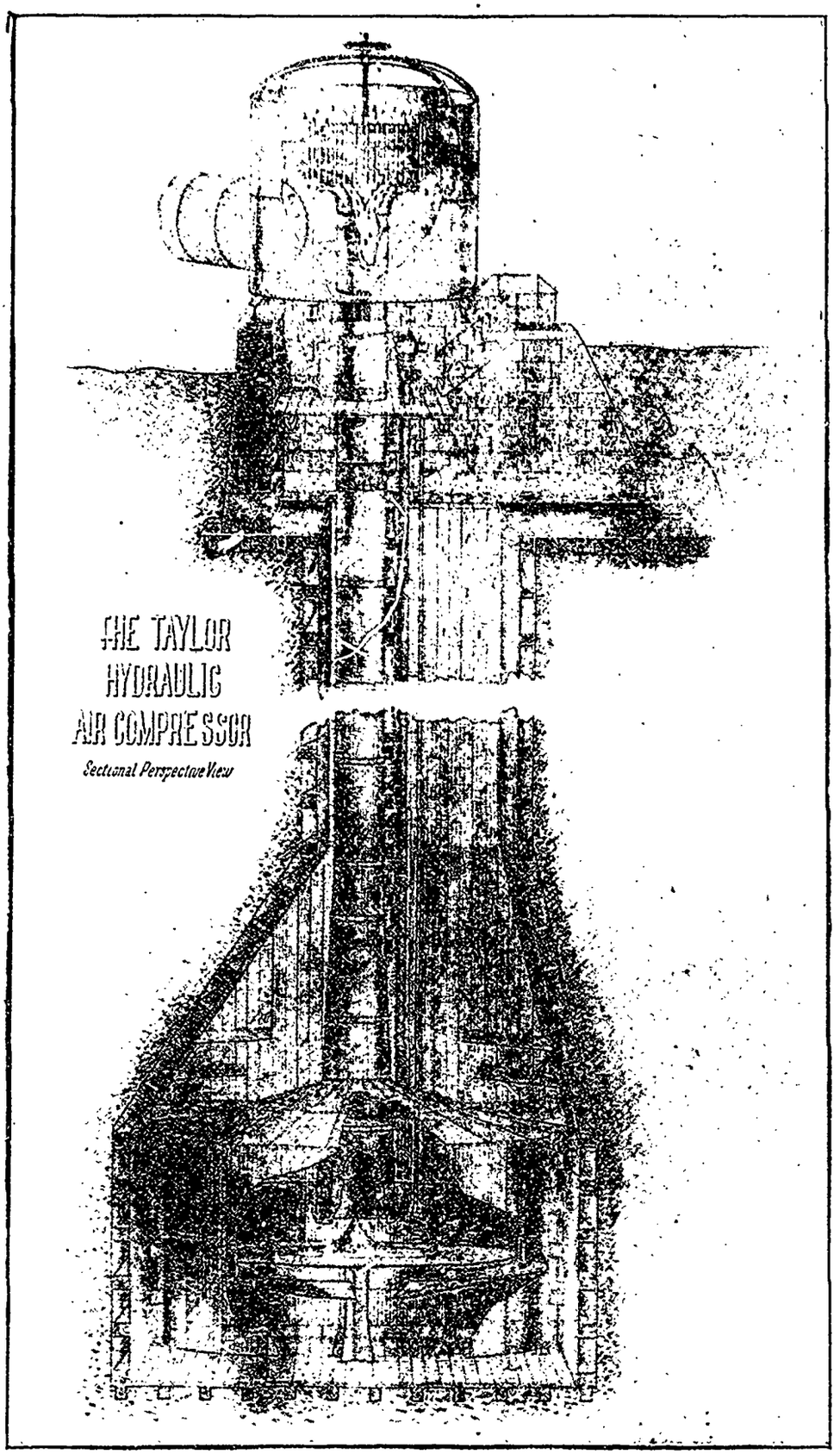


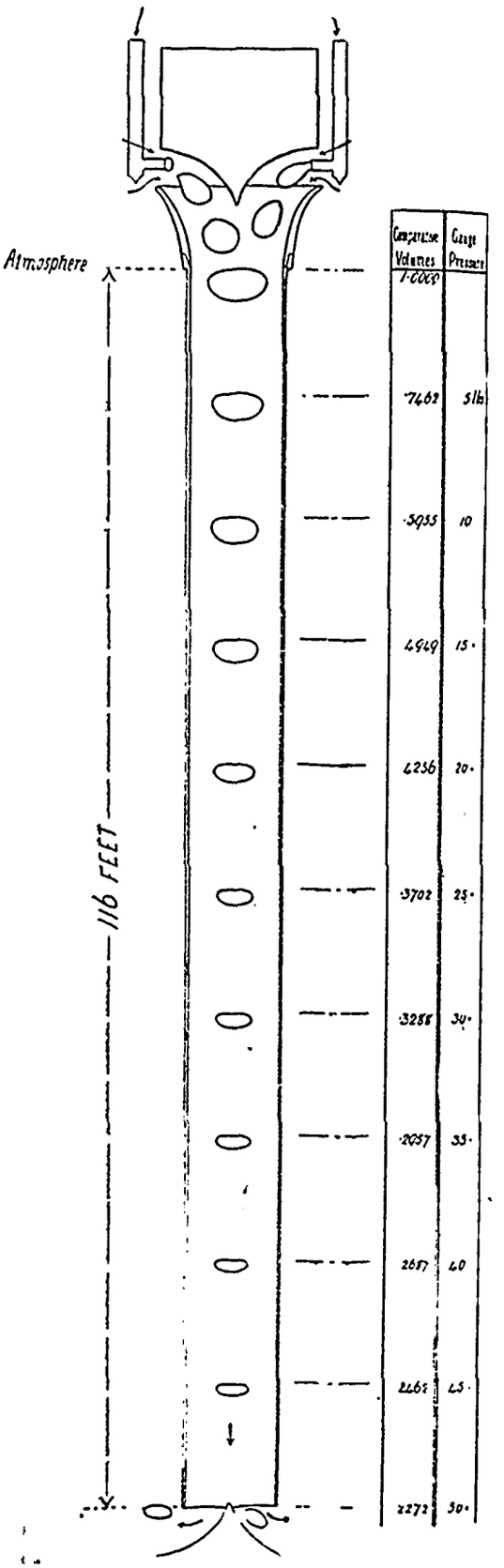
Taylor Hydraulic Air Compressing Plant at Magog, Que.



Sectional View of Self-acting Air Valve

Taylor Hydraulic Compressor at Magog, Que.


THE TAYLOR
HYDRAULIC
AIR COMPRESSOR
Sectional Perspective View


Atmosphere
116 FEET
Compressed Volumes
Gauge Pressure
1·0000
·7462
5 lb
·5955
10
·4949
15·
·4256
20·
·3702
25·
·3288
30·
·2957
35·
·2687
40
·2461
45·
·2272
50·

consists of a very firm slate. A mud seam an inch and a half thick cuts the shaft at the bottom of the timbering, separating the solid rock from rock of a loose nature above.

On three sides of the mouth of the shaft a stone wall has been laid in Portland cement. This wall is 3 feet thick at its base and batters upwards to 2 feet at the top. Its height is 14 feet. It has for its foundation two layers of 10 in. x 12 in. timbers laid crosswise, bedded in cement, with 10 in spaces between the timbers filled with concrete. The space between the walls, forming the tail race, is 13 feet. The timber in the structure will always remain below water level; consequently it will be of as permanent a character as the remainder of the plant.

The material of the compressor is ¼ in. steel plate. A penstock of 5 feet 6 in. diameter and 160 feet long conveys the water from the canal, or forebay, to the receiving tank at the head of the compressor. This tank is 12 feet in diameter and 12 feet high open at the top, and rests upon four 12 in. L-beams spanning the foundation walls. The compressing pipe 44½ in. in diameter, passes through the centre of the bottom of this tank and projects 3 feet up into it. A 10 foot telescoping pipe is inserted into the upper end of the compressing pipe. On the upper end of this is rivetted a cast iron bell mouth piece, 4 feet 8 inches in diameter, which is part of the head piece. Three lugs are on this casting by which the upper part of the head piece is a attached to the telescoping pipe. The upper part of the head piece is a casting in the form of a cylinder 4 feet 8 inches diameter terminated below by a conoid, of which the surface is concave. Three 1¼ in. bolts attach the lugs on the bell mouth piece and telescoping pipe to three corresponding lugs on the cylindrical piece above. Two flanges 6 feet 2 in. diameter encircle the cylindrical part of the casting above and below, which serve to hold vertically in place thirty 4 foot lengths of 2 in. wrought iron pipe equally distributed around the cylindrical casting. The lower ends of these pipes are flatly welded together. Near the lower extremity of each pipe five rows of holes are bored to receive thirty-three ⅜ in. pipes all within 15 in. of the closed end. In each of these holes a pipe 6 in. long is screwed and bent so that they are all directed towards the centre of the compressing pipe. These pipes serve to admit the air and direct it into the water. The combined head piece and telescoping pipe are supported by a 2½ in. square threaded screw, which passes through a timber spanning the top of the tank. A hand wheel with nut attached supports the screw and enables the head piece to be raised or lowered as desired. As before mentioned, the compressing pipe starts from a point 3 feet above the bottom of the upper tank and extends down the shaft. Its total length is 136 feet. Its diameter is uniform for 116 feet, but it enlarges in the last twenty feet from 44½ in. to 56 in. diameter.

This compressing pipe is constructed with butt joints held together by 4 in. straps rivetted to the sections. All the rivet holes are counter sunk, thus making a perfectly smooth interior. The lower or separating tank is 17 feet in diameter and 12 feet high. The bottom of this tank is open and rests upon eight cast iron legs which raise it 16 in. above the bottom of the shaft. The top or cover is conical, rising two feet to where it is connected with the compressing pipe. The compressing pipe extends down into the tank 9 feet below the cover, its lower extremity being 8 feet from the bottom of the shaft. Directly under the compressing pipe is placed a circular casting the upper surface, of which is a conoid similar to the one already mentioned in the head piece. Its diameter is enlarged by steel plates to 12 feet. The opening between this disperser and the lower end of the compressing pipe is 14 in. The disperser is supported on a pedestal and also strengthened by stays from the compressing pipe. 14 in. below the outer edge of the disperser is a conical apron 5 feet wide extending around, and rivetted to the interior of the separating tank. Both this apron and the disperser have two 5 in pipes 5 feet long, extending upwards to allow the escape of air, which collects underneath them, to the main body of air in the upper part of the tank. A 4 in. waste pipe, or "blow-off" begins on a level with the lower end of the compressing pipe, and close to it. On this end is an elbow and short piece of pipe, the latter having its upper half removed. On each side of this elbow and pipe a plate 18 in. x 20 in. is bolted to the pipe, leaving the top and one end open. The waste pipe passes through the top of the separating tank, extends up the shaft to a point 10 feet above water level, and is terminated by a return bend for the purpose of directing the spray and water into the tail race. Opening out of the top of the separating tank is a 7 in. pipe to conduct away the compressed air. This main extends up the shaft and is carried into the mill. After it enters the mill a self-acting regulating valve (of which a sketch is shown) is placed for the purpose of preventing the water from entering the air pipe, should the supply in the separating tank fall short at any time of the demand. As the air fills the separating tank the pressure increases by a few pounds. When the pressure lessens to a certain degree by the rise of the water, the valve closes automatically before the water can reach to within 15 inches of the top of the separating tank, and thus adjusts itself to the supply of air from the compressor. From this valve a 6 in. pipe is carried to seven pairs of 8 in. x 12 in. engines, also to two singeing machines, a 9 in. x 12 in. single engine, and two Worthington pumps. A 1 in. steam radiating pipe passes through a portion of the air pipe and raises the temperature of the air to about 150 Fahr.

In the working of the compressor the water is carried through the penstock to the upper tank which it fills to about the same level as the fore bay. From thence it enters the opening between the two castings of the head piece passing among and in the same direction as the small air pipes. The water creates a partial vacuum at the end of these small pipes. So that the atmospheric pressure drives the air into the water in innumerable small bubbles, which are carried with the water down the compressing pipe. In their downward course the bubbles are compressed according to the depth and weight of return water sustained. When they reach the disperser their direction of motion is changed from the vertical to the horizontal. The disperser directs the mixed water and air towards the circumference of the tank. Its direction is again changed towards the centre by the apron, from whence it is again returned towards circumference of the tank. During this process of travel the air has been separating by rising in the tank and also under the disperser and apron. The water (almost free of air in this plant) escapes under the lower edge of the separating tank and returning up the shaft surrounding the compressing pipe, is carried off in the tail race. The air rising through the water to the top of the separating tank, displaces the water and is kept under nearly uniform pressure by the weight of the return water. The variation in pressure does not exceed three pounds per square inch.

The air bubbles are comparatively small, they are surrounded by a cold body of water, and compression takes place through the whole length of the compressing pipe. From this it will be readily inferred that this mode of compression is isothermal, a process which is not accomplished by any other compressor. More energy is consumed in compressing a body of air adiabatically than in compressing it isothermally. The rise in temperature acquired by air compressed adiabatically is generally lost in transmission. Hence by this system of compression a considerable saving of energy is effected. It is a well known fact that a given space will hold a weight of water vapor greater or less according as the temperature is high or low. If at any given temperature a space is saturated with vapor, when the vapor is compressed isothermally into smaller space a portion of it will be condensed Where air is compressed mechanically it is heated, and the water vapor contained is not condensed because of the rise in temperature. When, however, the air passes through the cool transmission pipe condensation

takes place. Should condensation not occur in the transmission pipe on account of insufficient cooling, it takes place at the exhaust of the motor because of the great fall in temperature due to the work done by the expanding air; thereby filling the exhaust with ice. Where compression of air is effected by water, as in the system considered in this paper, condensation takes place on the walls of the bubble and so can neither take place in the transmission pipe, nor at the exhaust, even when the temperature is very low. The compressed air delivered is of the same temperature as the water compressing it, and in the Magog plant its volume is about 2-9 of that at atmospheric pressure. Hence the air after its expansion in the motor will not contain sufficient vapor to saturate it at even the greatly reduced temperature.

By a test made on 50 cubic feet of air delivered by the compressor while in full operation, it was ascertained that the air when expanded to atmospheric pressure contained 1-5 of the amount of vapor usually found in the atmosphere during fine weather, or about 14 per cent. of saturation.

On the proposal of this method many engineers and others raised the objection that the air bubbles, after being carried down 34 ft. (the height giving a pressure equal to that of the atmosphere) would separate out by their buoyancy and fall no further. They thus predicted as a limit of pressure attainable about 30 lbs absolute.

Others predicted that the cold air entering and being diffused through the water would congeal the same. Others again promised us an efficiency of not more than ten per cent., from experience obtained about 200 years ago with the trompe used in the south of Spain.

I am pleased to say, however, that none of these predictions have been fulfilled.

In the maiden plant at Magog we have actually obtained an efficiency of over sixty-two per cent., and this was obtained in spite of the fact that we are wasting owing to the insufficient size of the air chamber about twenty per cent. of the air compressed.

This defect which can be easily remedied in future plants is accountable for a loss of about 15 per cent. in efficiency. So that it is safe to guarantee an efficiency of 75 per cent. as easily attainable in future installations.

The annexed table takes the results of a series of tests made on the Magog Compressor by Prof. C. H. McLeod of McGill University. The first three tests were made on the 7th of August, and the last three were made on the 13th of August, 1896.

Column 2 gives the quantity of water in cu. ft. per min. flowing through the compressor, column 3 the available head in feet during the trial. Column 4 gives the gross horse power in the fall under these conditions of flow. The fifth column gives the measured quantity of air discharged at atmospheric pressure, the actual pressure being given in the 6th column. The horse power required to compress this quantity of air to the pressure in column 6 is given in the 7th column. The ratio of the horse power in column 7 to that of column 4 is called the efficiency and is given in column 8. Columns 9, 10, and 11 give the temperatures of the air, water and compressed air.

RESULTS OF TRIALS OF THE TAYLOR HYDRAULIC AIR COMPRESSOR AT MAGOG, P.Q., ON AUGUST 7TH AND 13TH, 1896.

No. of trial.	Quantity of water discharged in cubic feet per minute.	Available head in feet.	Available horse power.	Quantity of air delivered in cubic feet per minute at Atmospheric Pressure.	Pressure of Air in Compressor.	Actual horse power of Compressor	Efficiency of Compressor.	Temperatures		
								External Air.	Water.	Compressed Air.
I	II	III	IV	V	VI	VII	VIII	IX	X	XI
1	6,122	21.4	247.7	1,377	52	132.5	53.5	79	75.2	75.2
2	5,504	21.9	228.0	1,363	52	131.0	57.5	83	75.5	75.5
3	4,005	22.3	168.9	1,095	52	105.3	62.4	80	75.6	75.6
4	7,662	21.1	305.9	1,616	52	155.4	50.8	75	80.0	80.0
5	6,312	21.7	260.0	1,506	52	144.8	55.7	77	80.0	80.0
6	7,494	21.2	299.8	1,560	52	150.2	50.1	75	80.0	80.0

From observations made in glass tubes, the rate of rise of the air bubbles due to their buoyancy is from 5 to 7 inches per second. To illustrate the effect of this slip take a 75 lb. pressure installation requiring a depth of 173 feet from tail water to separating chamber. The velocity of the water in the compressing pipe would be about 12 feet per second, so that the compression would be effected in 14.4 seconds. During this time the bubbles would have risen but 7 ft. 2 in., a comparatively unimportant loss, which is still more lessened when we bear in mind the fact that the volume of air is on the average one fifth of that of the water descending with it.

Regarding the freezing of the water by the entering air, it is only necessary to point out that the lowering of the temperature of 1 cu. ft. of water from 34 to 33 F. would raise the temperature of 277 cu. ft. of air at atmospheric pressure from 30 below zero Fah. to 33 above. As the proportion of the air to water by volume is only 1 to 5, it is manifest how small the actual cooling effect must be. This takes no account of the heat given out by the air while it is being compressed.

I have prepared a sketch which may be of interest to those members who wish to look more closely into the matter of the air compression.

The relative size of the bubbles as the air they contain is compressed, during their descent of 116 feet from atmospheric pressure to a pressure of 50 lbs. per square inch is shown diagrammatically in this. The diminution in the size of the air bubbles is seen to be quite appreciable, and their diminished size produces less retardation of the flowing water.

A large proportion of the whole power is spent in effecting the earlier part of the compression.

It is well known that as much work must be done to compress the air to about 25 lbs. as is required to complete the compression up to 75 lbs. Hence the advantage of using high pressures.

Asbestos Mining and Dressing at Thetford.

By H. Nelles Thompson, McGill University, Montreal.

Canadian asbestos, as is now pretty well known, is not the asbestos proper of the mineralogist, which is a variety of hornbende, but is a fibrous form of serpentine called chrysotile. It is an hydrated silicate of magnesia and is easily distinguished from the asbestos proper by its yielding water when heated in a closed tube.

It occurs in that part of the great serpentine belt of the Eastern Townships, which extends from the township of Broughton on the north east, to that of Ham on the south-west, and includes the townships of Thetford, Coleraine, Ireland and Wolfestown.

The asbestos-bearing serpentine is from 10 to 100 feet wide, and contains veins varying from a mere thread up to 4 inches in width, and which intersect the mass of rock in every conceivable direction.

Asbestos mining at Thetford is conducted wholly by quarrying. The quarries are in some cases from 70 to 120 feet deep.

Drilling is carried on by means of compressed air, the form of drill used being Rand's "Little Giant, No. 3," working at a pressure of about 80 lbs. to the square inch. The steel used is 1⅛ inch and has a x shaped bit. Holes are drilled from 8 to 12 feet in depth, and an average day's work of 10 hours is about 60 feet.

Dualin, which contains 40 per cent. nitroglycerine, is the explosive used for blasting. The holes are about one third filled with this and then tamped lightly with loose borings, by means of a wooden rod. The firing is done with a 25 hole "Pull Up" battery, several holes being connected in series and thus fired simultaneously. In block-holing, *i. e.* blasting detached blocks of rock which are too large to be conveniently handled, hand-drilling with ⅞ inch steel is employed, and the holes are fired by fuse.

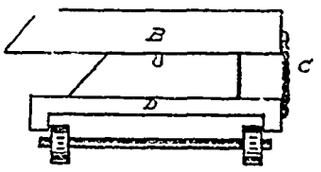
Pumping is a very small item in the expenses of the mine, as very few springs are met with, and the surface water which falls into the pit is quickly disposed of by steam pumps.

Hoisting from the pit is accomplished by boom-derricks, the boom being usually about 50 feet long. Copeland & Bacon hoists are used to operate the derricks. These are driven by compressed air conveyed from a Rand Duplex compressor by a 4 inch wrought iron pipe. This method of working the hoists is found to be much more convenient than steam, as work is kept up to some extent most of the winter.

Cable derricks are now being used by the Bell's Asbestos Co. in addition to the ordinary boom-derricks. These consist of a mast with a 2 to 3 inch steel cable stretched from it across the pit. A traveller runs on this cable, and hoisting may take place from any point of the pit directly below the cable. This system, although often slower than the boom-derrick, presents many advantages as the cable may be stretched a distance of over 400 feet, and its anchorage is easily moved.

The ropes used in hoisting are generally of ¾ inch steel, and last about two years when properly cared for. The cages or baskets are of wood, iron bound and with iron lined bottom. They measure about 4½ x 6 x 1 feet and are open at the front. They have a piece of metal rail fastened across the bottom on the outside, which fits into a grove when landed on the cars. A load for one of the baskets is from 1 to 2 tons.

A simple type of side-dumping car is used. This consists of a platform car with pieces of wood fastened across the top shaped as shown in Fig. 1. The loaded basket hoisted from the pit is landed on



the car. Fig. 1 is an end view of one of the cars with basket in position. B is the basket which is prevented from tipping over by the chain C. D is the platform car. Each car holds two baskets, which empty on opposite sides. A carload is thus from 2 to 4 tons, as each basket load is from 1 to 2 tons, as previously stated. When the car is to be emptied, the chain C has only to be undone, when the basket B overbalances and its contents are discharged.

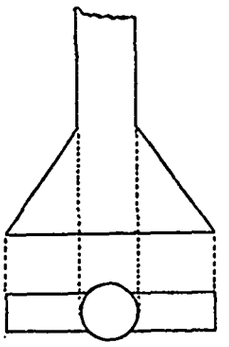
The car being loaded runs down a trestle, built on a grade of about 1 in 16, passes the dressing establishment, or "mill" as it is called, and empties at the dump. The loads containing asbestos veins are discharged upon the trestle in the rear of the mill. This material is then shovelled down a chute into an iron self-dumping skip. This, when loaded, is hoisted up an incline of about 45 degrees to the top story of the mill, by means of a small friction hoist, and dumped in front of the crusher. The empty cars are brought back to the quarry by horse.

At the dump several boys are employed hand-cobbing, as many pieces of the waste rock have asbestos still attached to them in small quantities.

Before describing the "dressing," a few words on grading are necessary. This is done in five qualities: 1. No. I, being the longest fibre from ¾ inch up, and especially valuable for spinning. 2. No. II. from ½ up to ¾ inch, also used for spinning. 3. No. III, shorter than No. II and used in the manufacture of mill board, etc. 4. "Waste" (not to be confounded with the term waste rock previously employed), consisting of still shorter pieces of fibre mixed with a large proportion of serpentine sand, and used in manufacture of bricks, cements, etc. 5. Fibre, a very soft variety almost free from rock, and used for purposes such as steam packing. The percentage of rock in the different grades is extremely variable, that in No. 7 sometimes varying as much as from 5 to 40 per cent.

The crude material is first put through a Blake crusher, the jaws of which are set at ¾ inch. From the crusher it goes on to an inclined 1-16 inch mesh preliminary screen. Thence it goes to a travelling picking table, which has a division along its centre. Here boys are busily engaged removing the barren rock to one side, and that containing asbestos to the other. At the end of the table the former drops into a chute, while the latter falls on to a carrier and is conveyed to the rolls. These are of the geared Cornish type. Their springs are adjusted so as not to exert too great a pressure between the faces of the rolls, as this would cause the rock passing through to cut the fibres. From the rolls the stuff passes over inclined screens shaken by an eccentric, this being arranged in the following order, viz: 1-16, ½ and ¾ inch. From the preceding remarks on grading, the object of this arrangement becomes apparent; the waste dropping through the 1-16 inch mesh, No. 3 through the ½ inch, No. 2 through the ¾, and No. 1 over the end. The waste from the 1-16 inch mesh screen is conveyed by a chain elevator to the waste box. No. 2 to ensure a more uniform product is screened a second time on a ¼ inch mesh screen and the screenings from this, consisting of pieces of serpentine with asbestos attached, are put through the process for obtaining the fibre.

The plant for this consists of a Cyclone mill opening on to a screen. This screen has 11 meshes to the inch, is covered for about two thirds of its length, and is suspended from the ceiling of an air tight room by four hickory rods. Over the lower end of it hangs a funnel, shaped as in Fig. 2, and connected by pipe with a circular blowing machine on the next floor. From the blower a pipe runs to a small room above, the window of which is covered by a fine screen.



The material being shovelled into the Cyclone which is run at the high speed of 2,300 revolutions per minute, is caught by two whirlwinds revolving in opposite directions, and the pieces of material thus become pulverized by attrition. The lumps of serpentine being broken up by this means, the fibre is freed and both pass together to the screen, where most of the pulverized rock is shaken out. The rest passes over the end of the screen, while the fibre is sucked up through the funnel by the blower, which makes 2,700 revolutions per minute, and is blown into the room above, the screen on window preventing it from being blown outside. About 35 per cent. of the material put through this process is obtained as fibre.

The different grades are put up in bags of 100 or 200 lbs. and shipped by the Q. C. R.

In closing, a few words on the manufacture and uses of asbestos may prove interesting.

The material from the dressing establishment is put through a machine for the purpose of separating the fibres from one another, and from the non-fibrous material, a quantity of which is still present.

One form of this machine consists of two rollers covered with teeth, revolving usually at equal peripheral speeds, and at the same time having a sideways motion in relation to one another. By the pressure the fibres are loosened, and being loosened are combed apart by the reciprocating motion. After this operation there is nothing special, the long fibre being spun and woven as any other textile, and the short fibre being treated like paper pulp.

All asbestos goods may thus be classed, as regards the process of manufacture, as paper or yarn.

In addition to the uses already stated in connection with grading, the following may be mentioned: Fire-proof paints, roofing, felt, covering for pipes and boilers, fire-proof clothing, rope and cord.

This paper has been written with the intention of giving a general idea of the method of mining and dressing asbestos at King Bros.' mines, Thetford.

The methods employed by the other companies working there, are very similar on the whole, differing, however, in such matters as the use of different makes of drills, steam instead of compressed air for drilling and hoisting cars of a different pattern, etc.

The Mechanics of Mining.

By D. W. Robb, M. E., Amherst.

Having been asked to present a paper before the Inter-Provincial Conference of Mining Engineers, I feel somewhat in the position of the lecturer of western reputation, who, having been invited to address a mining camp, stated that he had not given much attention to mining, but would deliver a lecture on farming, which he believed to be much the same thing, as both farmers and miners dig in the ground, and, in fact, the farmer has more chances of success in mining than the miner, because, in farming, he may find a mine, while the miner stands a very poor chance of finding a farm.

Although not professing to be either a mining engineer, an engineering miner or even a farmer looking for a mine, but as one who has had to do with mechanical operations, I believe mining to be, in many respects, similar to manufacturing or other kinds of business, which depend for success almost entirely upon skill and economy of operation.

The general public seem to regard mining much in the same light as a search for "Captain Kidd's Treasure," mysterious, difficult and uncertain; but, having discovered the mine, the fortune has only to be picked up.

This belief is, perhaps, unfortunate, since it leads to the loss of money and faith, and tends to produce distrust of all mining ventures. Yet this gambling spirit, which seems inherent to all humanity, the desire to acquire wealth with little labor, is perhaps not an unmixed evil, because, if all enterprise was limited to absolutely safe investment, very few mines would be discovered.

The mining engineer knows only too well that, notwithstanding the comparatively strong light that may be thrown upon, and even into, the bowels of the earth by geological science, and prospecting experience aided by the diamond drill, nature's secrets are so various and intricate that there is still much chance work.

However, the present paper is not intended to deal with the problem of finding a mine, but with the successful operation of it after it has been found.

While a few mining properties have been, and will be, developed which pay handsomely, in spite of bad management and crude mechanical appliances, by far the greater number of mines of all kinds depend for success or failure upon the method of operation, and even in those which will stand a certain amount of waste, there is no reason why they should not be made to pay better by good engineering.

While the mining engineer should be qualified to lay out and conduct purely mining operations, such as location and arrangement of pits, shafts, drainage, ventilation, etc., he is not usually an expert mechanic. He may understand the general principles of steam engines, pumps, air compressors, and electrical machines, but his calling does not require him to study the details of each of the numerous forms of these machines, and he has not the constant opportunity to become familiar with the peculiar advantages and disadvantages of each, so that he can readily choose the details of his plant, with a clear preception of how they may be combined to give the best results, with the highest economy in fuel, labor and repairs.

The mechanical part of mining consists in providing the best and cheapest methods of drilling and removing rock or ore, transporting, screening, crushing, milling, or otherwise preparing the mineral for further use, pumping, ventilating and other operations which may be accomplished by the use of machinery.

First of all comes the power necessary to drive this machinery, this must, in the present state of the mechanic's art, be obtained either by means of steam or water power. Whether steam or water will be used, must be determined by circumstances, where good water is not available, steam must be used, but in other cases there may be a choice. Where both water power and steam are available, care should be exercised in making the choice. To the superficial observer, water power may be attractive because the water is free of cost, whereas fuel costs money, but it should be kept in view that the cost of building and maintaining dams and other incidental expenditures is frequently so large that the interest on capital and cost of maintenance is equal to, or even greater in some cases than the cost of fuel, and if the stream of water is insufficient or irregular, steam may have to be used to supplement it, or the interruption of work would entail heavy loss.

Having decided upon the kind of power to be employed, the next question is the selection of apparatus. If water wheels, whether they shall be of the "Turbine" or "Re-action" type, if steam is to be used, whether the boilers are to be "Water Tube" or some other type, engines "Simple" or "Compound?" These are questions which should be decided by a competent and experienced mechanical engineer for each individual case, as they are governed by the conditions, e. g. whether the head of water is to be high or low, whether one large engine or a number of smaller ones must be employed, whether the steam is to be carried a long distance, or used near the boilers, and other circumstances too numerous to mention.

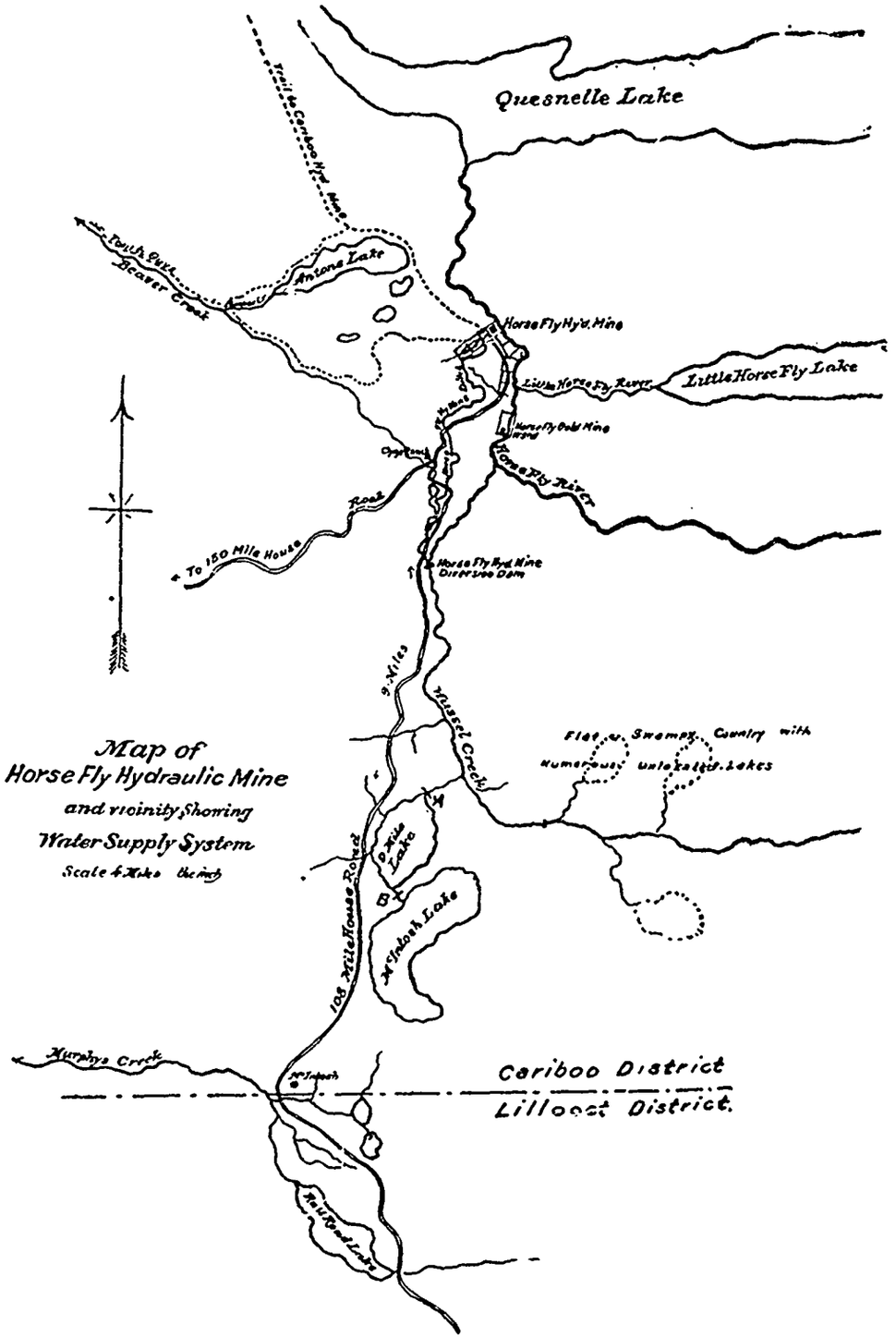
In small and medium size mining operations, a mistake is often made in using several separate engines for hoisting, pumping, milling, etc., involving five or six cylinders to be cooled and re-heated, causing a great waste of fuel, when, by a proper arrangement of gearing, one large engine, of the best and most economical type, could be made to do all the work. (I have frequently seen an enormous waste of fuel from this cause alone.)

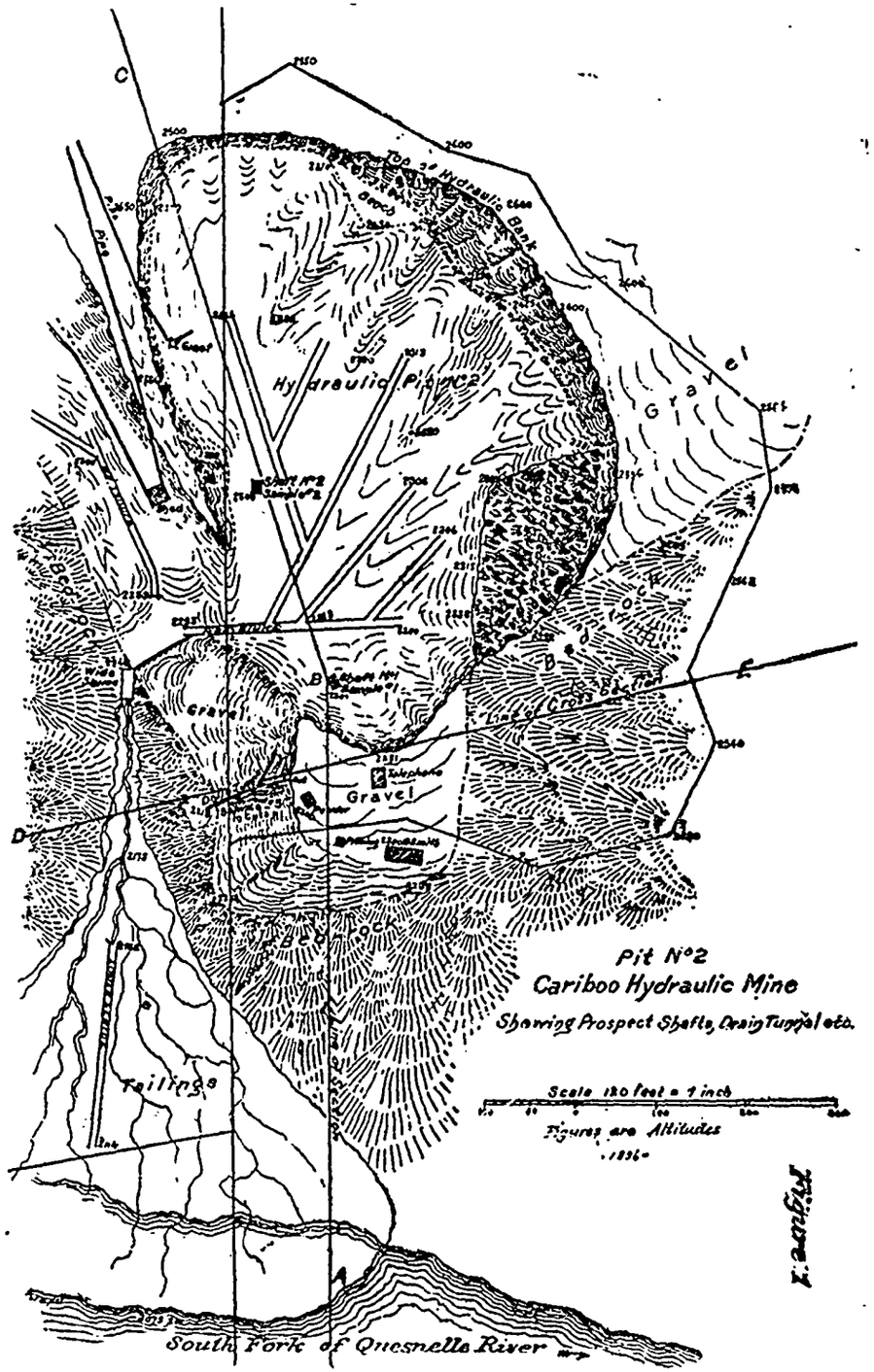
The next point to be decided is one which is so closely allied to the previous one that it must be considered with it, viz. that of transmission of power, one of the most important subjects in mining, because power must in every case be used for many purposes, and at many places, both above and underground. I find a tendency among mining men, and even mechanics, to advocate some one form of transmission as superior to others, while the truth is that each form (direct steam pressure, compressed air, electricity, rope driving, belt driving, shafting, etc.) has some special advantage, and is better suited to some particular case than any other. For instance, if a mine were so situated that only hoisting, pumping and perhaps a small amount of drilling, had to be done a short distance from the boilers, it would be more economical to use steam direct than compressed air, or electricity, each of which consumes power in the transformation by compressor or dynamo; if so situated that a Cornish pump may be driven direct from the main engine, or even by a separate engine with early cut off, and reasonable expansion, it would be much more economical than a steam pump, to which steam must be carried a long distance, and used without expansion, as is common with underground pumps.

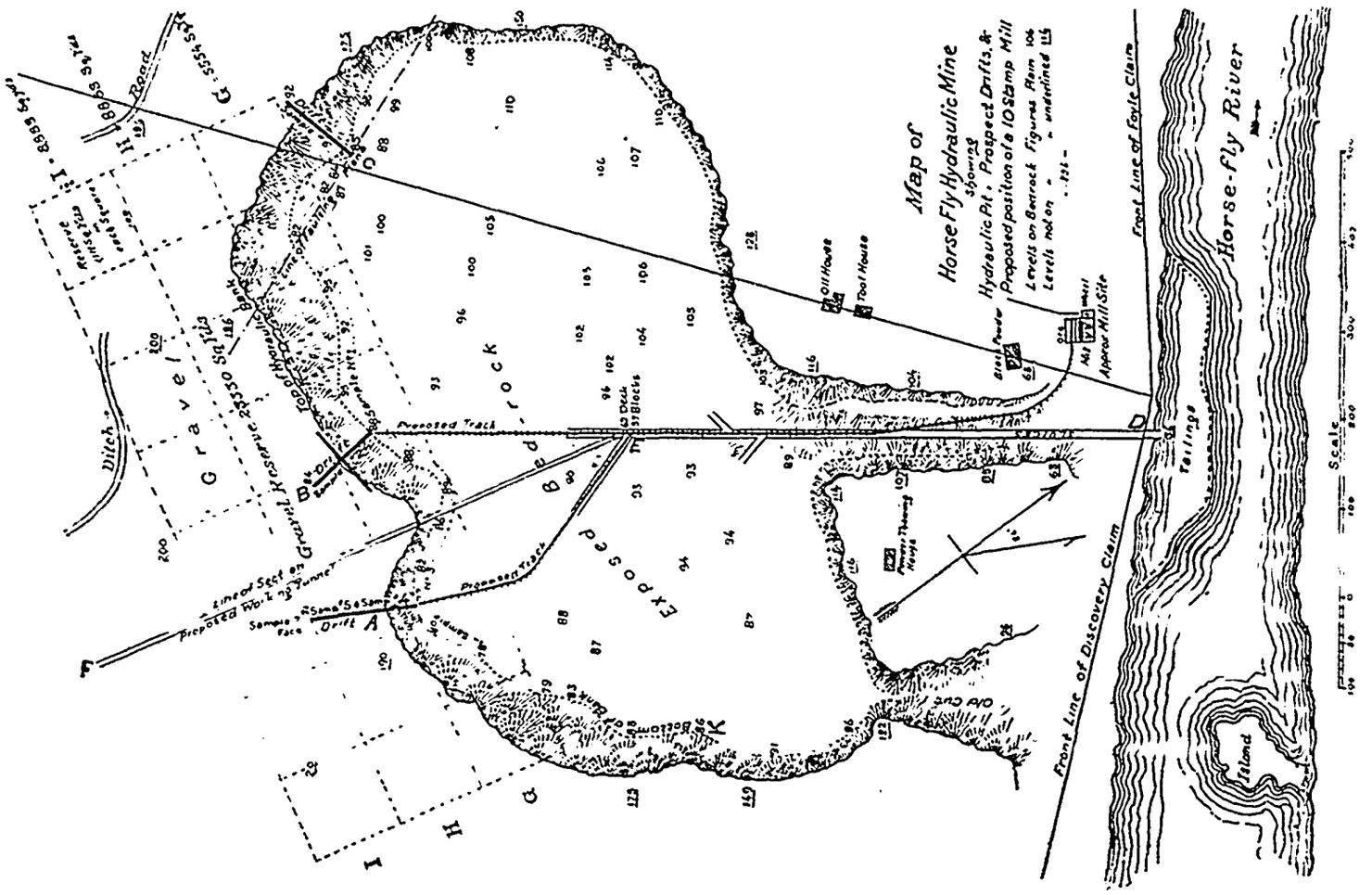
Compressed air is admirably suited to underground working. It may be transmitted in ordinary pipes having only the average capacity required, and the pressure maintained by means of receivers at almost any distance from the supply. It may be used in ordinary pumps, drills, or other simple apparatus which are easily managed by miners, and in use does not cause any inconvenience from discharge, on the contrary, aiding in ventilating to a small extent. On the other hand, it is attended by considerable loss from the accumulation of heat in compressor, and decrease of pressure by cooling. These losses may be overcome to some extent by compound cylinders, re-heating, etc., all of which adds to the complication of the machinery, and consequent additional expense and care. Electricity is perhaps the most flexible and convenient of all forms of transmission, because by a simple copper wire it may be conveyed long distances and furnish power for pumping, drilling, haulage, etc., or may be converted into light or heat. Since its use for these purposes is comparatively new, there is much room for improvement in the apparatus, and in the presence of gas in coal mines it may be dangerous from sparking or defective connections, but time will no doubt overcome these objections to a very great extent, and render its use as successful and popular for underground operations as it has become for street car propulsion and other uses above ground.

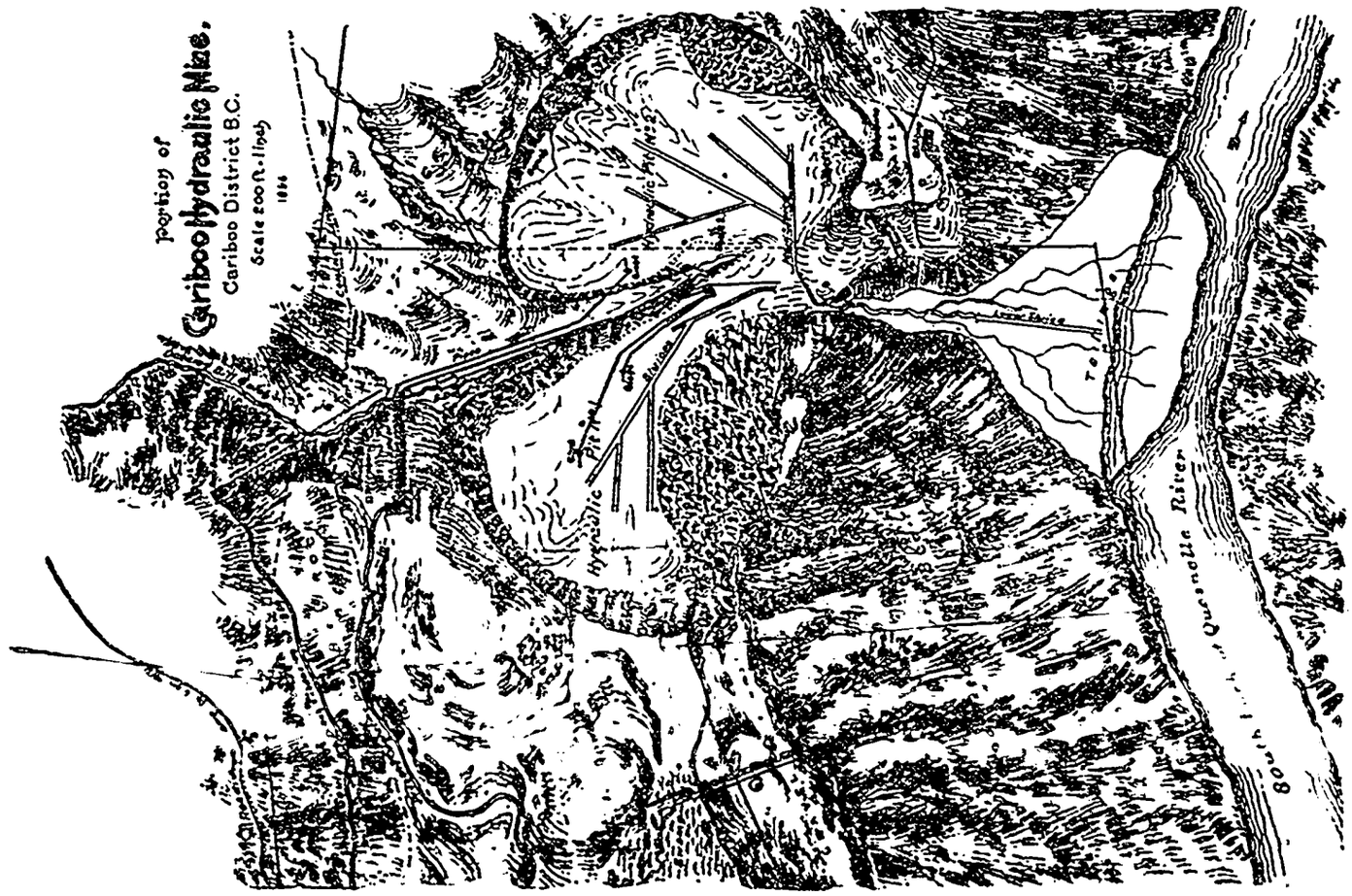
Although it may be necessary or expedient in some cases to use several forms of transmission for the surface and underground working of the same mine, there would be a great advantage in point of economy of fuel, attendance and repairs in using one source of power and one form of transmission for all purposes. For instance, if one or more large steam engines of the most economical type could be used to compress air, or generate electricity, for distant or underground work, and hoist directly, there would be a great saving of fuel over a number of small engines, pumps, compressors or dynamos. A large mine, to a greater extent than almost any other operation, presents constant opportunities for the mechanic's skill and invention, and since there is always a large amount of material to be moved and operated upon, economy is only to be obtained by performing every possible function by mechanical means. The conditions are so varied that the best mechanical knowledge and original invention is required, and the mechanic equally with the mining engineer has the power to make success or failure.

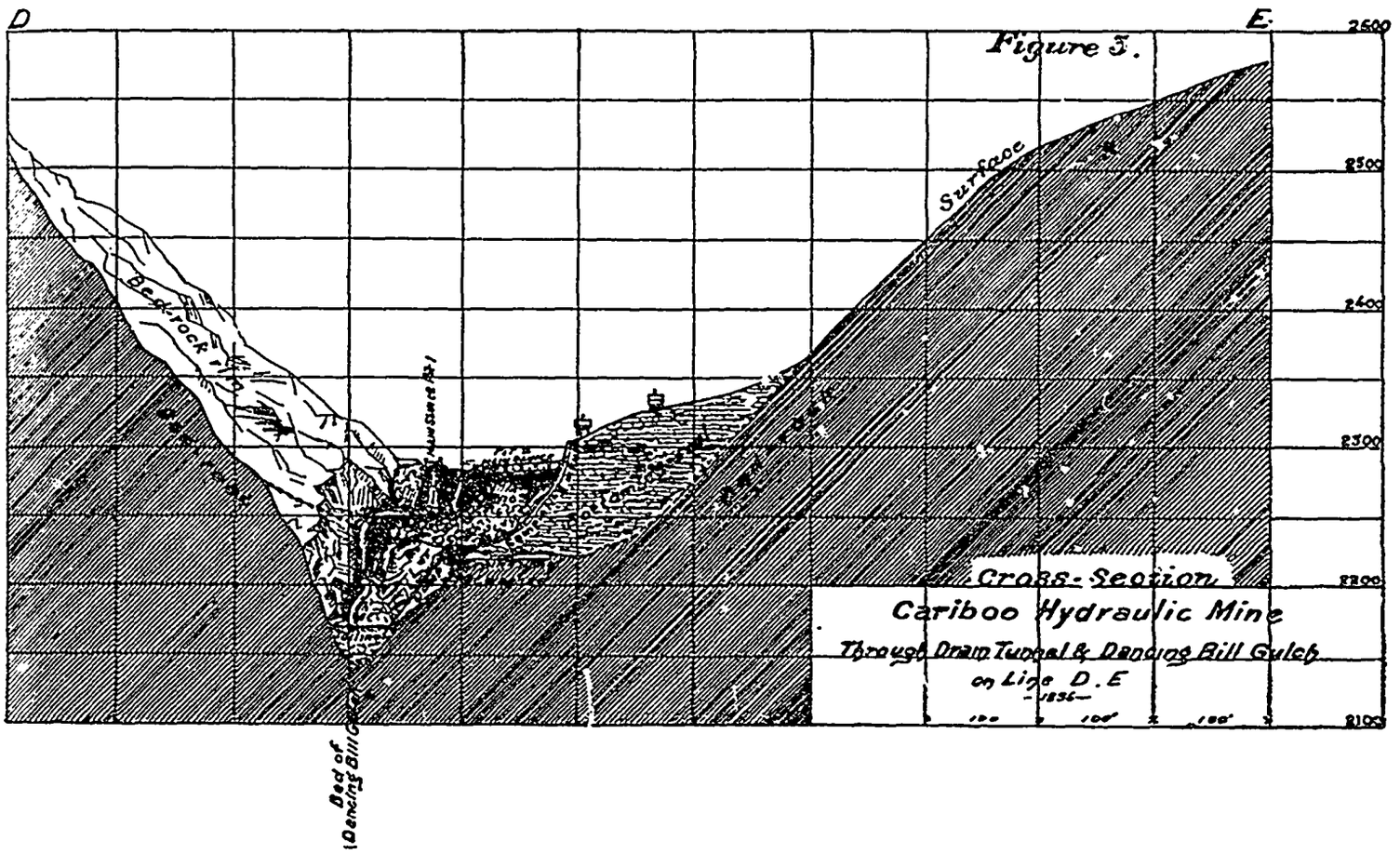
The moral to the investor in mining properties is, make sure of a good mine, under the management of a capable and experienced mining engineer, and to the mining engineer get good mechanical advice and assistance. I have nothing to say against the advice given gratis by manufacturing concerns, which is frequently honest and valuable, if it is not entirely disinterested—but an independent mechanical engineer, who has had experience in mining operations and who is employed directly by and for the mine, should be of great assistance, both in selecting and arranging the plant and in operating it.


Quesnelle Lake
Trail to Cariboo Hyd. Mine
Antone Lake
Beaver Creek
Horse Fly Hyd. Mine
Little Horse Fly River
Little Horse Fly Lake
Horse Fly Gold Mine
Horse Fly River
Road
To 150 Mile House
Horse Fly Hyd. Mine Diversion Dam
9 Miles
Mussel Creek
Flat, w. Swampy Country with Numerous unlocated Lakes
Map of
Horse Fly Hydraulic Mine
and vicinity, Showing
Water Supply System
Scale 4 Miles the inch
Duck Lake
McGibbon Lake
108 Mile House Road
Murphys Creek
Cariboo District
Lillooet District
Red Rock Lake

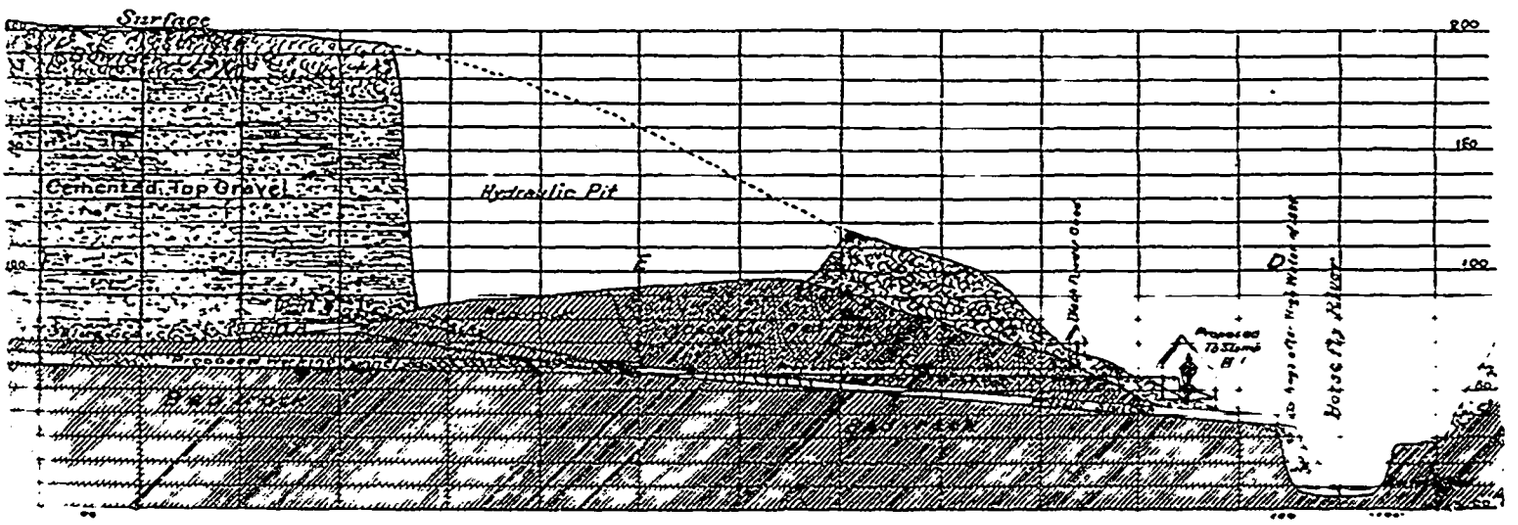

Top of Hydraulic Bank
Hydraulic Pit No. 2
Gravel
Bed Rock
Line of Cross Section
Gravel
Gravel
Bed Rock
Tailings
Pit No 2
Cariboo Hydraulic Mine
Showing Prospect Shafts, Drain Tunnel etc.
Scale 120 feet = 1 inch
Figures are Altitudes
1896
South Fork of Quesnelle River
Figure 1.


Map of
Horse Fly Hydraulic Mine
showing
Hydraulic Pit, Prospect Drifts, &
Proposed position of a 10 Stamp Mill
Levels on Bedrock figures Plain 104
Levels not on " " underlined 115
Front Line of Fayle Claim
Horse-Fly River
Front Line of Discovery Claim
Tailings
Island
Gravel
Bed Rock
Exposed
Proposed Track
Ditch
Old House
Tool House
Mill
Approx Mill Site
Scale


Portion of
Cariboo Hydraulic Mine.
Cariboo District B.C.
Scale 200 ft. = 1 Inch
1886
Hydraulic Pit
Quesnelle River



Horse Fly Hydraulic Mine, Section on Line of Sluices & proposed Drifting Tunnel.



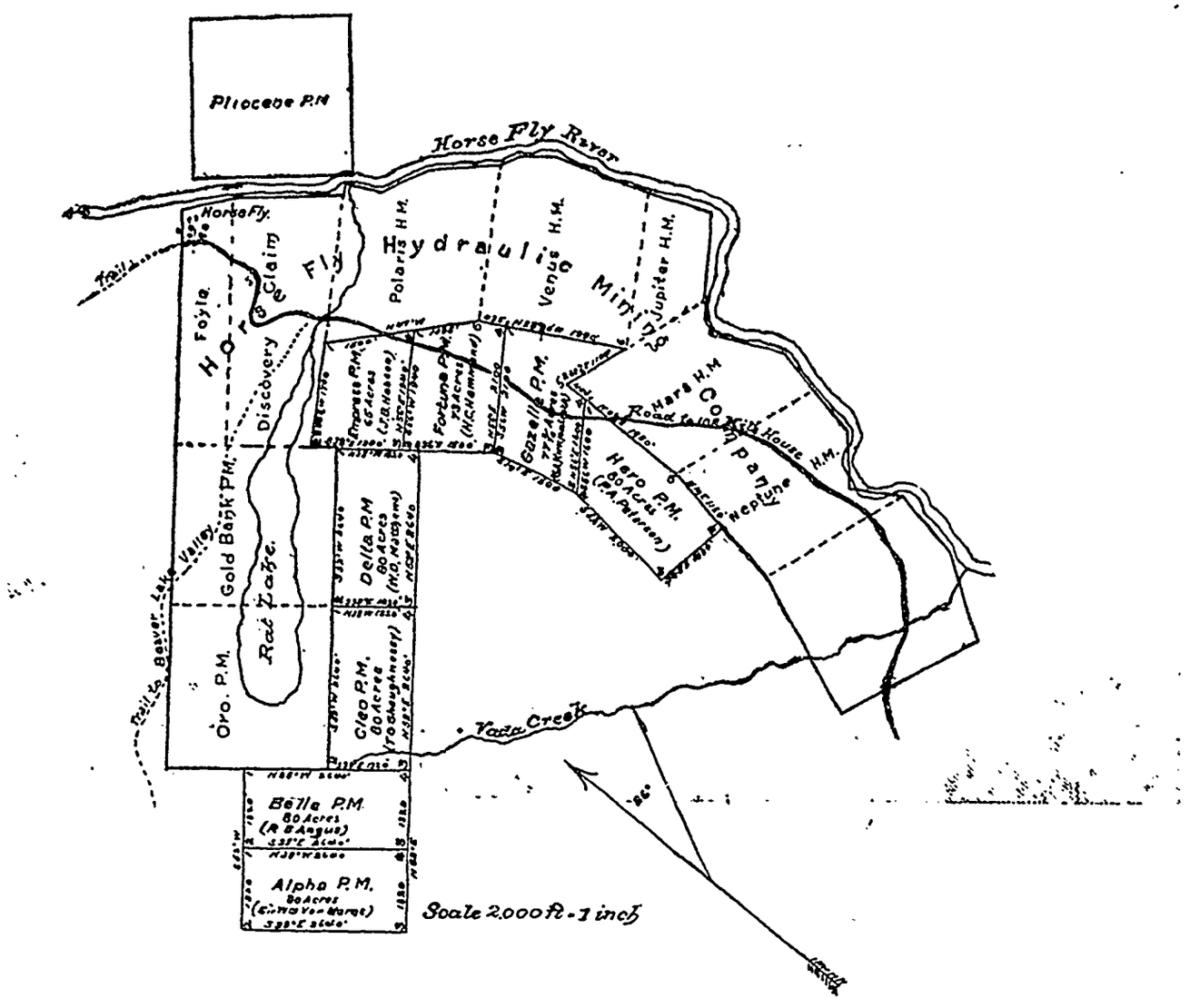
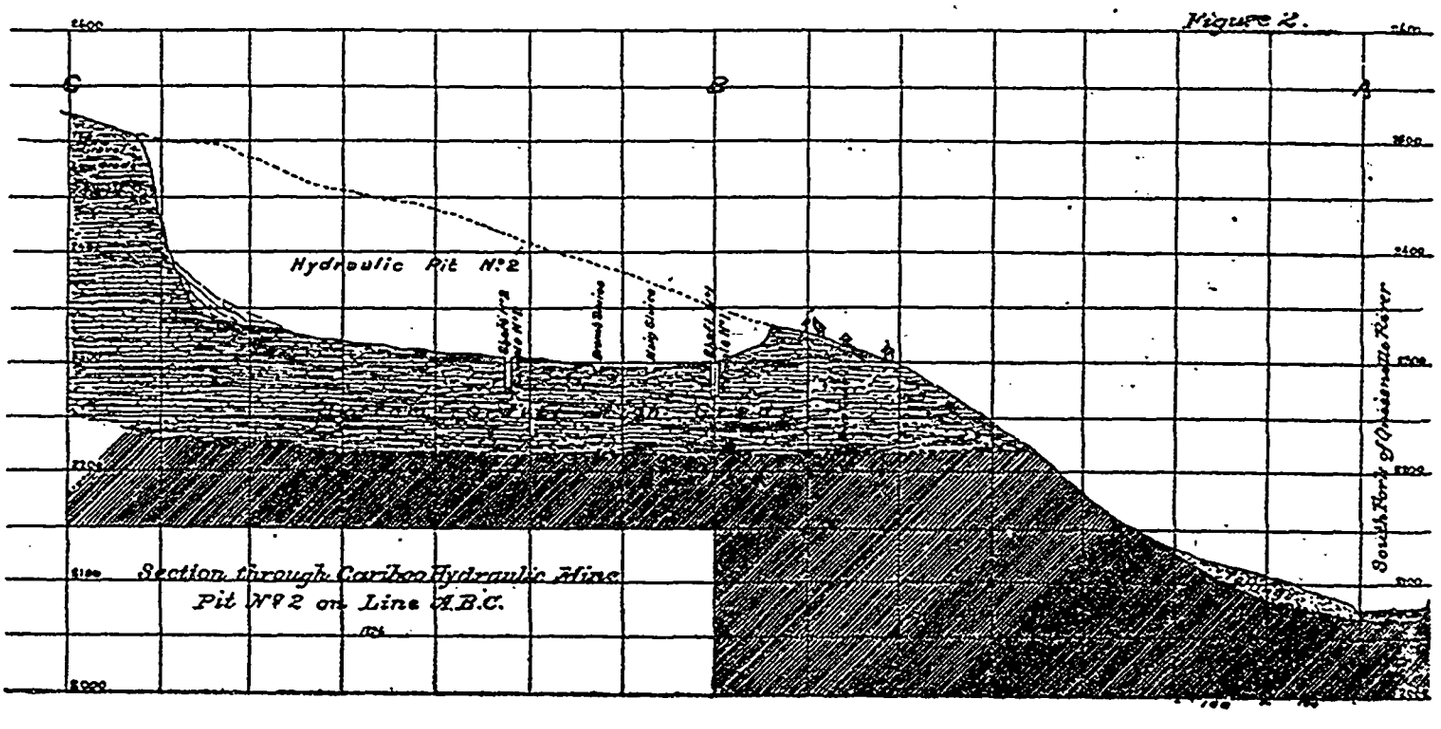


Figure 2.



Section through Cariboo Hydraulic Mine Pit N°2 on Line A.B.C.

COMPANIES.

Cariboo Mining, Milling and Smelting Co.—The following statement of accounts was issued by this company on 1st February:

Capital stock		$ 800,000 00
Water rights and mines	$ 800,000 00	
Dividends unpaid		34 00
Dividend account	124,964 76	
Expense account—General	12,780 17	
Mill account	17,352 62	
Labor account	81,630 73	
Mine and mill supply account	23,358 40	
Personal property	354 51	
Rent account		2,345 28
Mineral tax	491 96	
Bullion account		273,342 49
Building account	425 73	
Amelia mining claim		26,230 20
Profit and loss	8,700 00	
Treasurer's account	31,893 09	
	$1,101,951 97	$1,101,951 97

The Asbestos and Asbestic Company Ltd., was organised in London, England, last month, to acquire the asbestos mine, factory and lands of the Danville Asbestos and Slate Co., Ltd., at Danville, Que. Capital, £500,000 in £10 shares. Directors, Gilbert Bartholomew, Wilberforce Bryant, A. Naylor, Henry Hayman, Andrew Allan, R. H. Martin, Feodor Boas.

Mica Manufacturing Co., Ltd., has been formed in London, England, with an authorised capital of £80,000 in shares of £1, to acquire 1,700 acres of mica and phosphate lands in Quebec and Ontario formerly worked by the Lake Girard Mica System. Attested statements furnished by Mr. T. J. Watters, the vendor, show that there has been spent about £70,000 in selecting, acquiring, opening up the properties and establishing the business, and that there has been sold either in rough or prepared form, mica to the value of £40,000. The purchase money, under agreement with the Mines Contract Co., has been fixed at £65,000 of which £3,000 is payable in cash and the balance in fully paid shares, leaving 17,000 shares available for issue for the provision of working capital. The directors are: Sir Samuel Canning, C.E., London; Sir James Rivett Cormac, Bart., Weybridge; Sir Walter R. Olivey, Kent; John S. Green, London. Mr. T. J. Watters is to be resident managing director of the new company.

Horsefly Gold Mining Co.—The following report was submitted at the last meeting of the shareholders: "Beginning active operations about April 1st, 1896, we excavated a canal along the line of survey located in 1895, five miles in length, about one-half mile of which was principally rock; dimensions thereof: 8 feet top, 4 feet bottom and 3 feet deep; $5,643.35.

"Converted about 100,000 feet of fir logs into lumber requisite for the construction of flumes at depressions in our ditch and said flumes carried on trestles ranging from 12 to 35 feet high, which were computed at a cost of $3,814.35. Constructed a bridge across the Horsefly River for the purpose of carrying the necessary distributing pipes to the various parts of our claim.

"Purchased and shipped necessary mining machinery and tools (at a cost of $10,775.45) weighing approximately 460,000 pounds, including four hydraulic elevators, gates, giants, etc., and material for 14,525 feet of hydraulic steel pipe, which had to be hauled from the railroad station at Ashcroft in wagons 175 miles to the mine. The duties on material and freight to the mine amounted to $23,495.64. The pipe was manufactured at the mine, costing $5,515 for labor. In order to deliver material for our flumes and pipe line where required, we made ten miles of road; we erected two buildings necessary for our workmen; dammed Mussel Creek; made five waste flumes with gates on ditch line; made two large bulkheads and sand boxes, and all appurtenances necessary to complete a first-class ditch, and 30 inch steel pipe line for hydraulic mining.

"The pipe has been placed ready for active mining operations as quickly as climatic conditions will permit—probably by the first of April. Accomplishing the work necessitated the employment in the aggregate of 200 skilled mechanics and laborers, with a total expenditure in connection with the property of $100,985 23, as per following statement:—

Capital stock		100,000 shares
" " issued	90,890 shares	
" " on hand in treasury (9,000 subject to option)	9,110 "	
		100,000 "

Receipts.

Capital stock	$90,890 00	
Bills payable	54,799 19	
Assessment No. 1	20,436 25	
Gold dust and individual contributions	14,859 79	
		$180,985 23

Disbursements.

Purchase of mining property and lease	$80,000 00	
Mining machinery, tools and supplies	25,063 46	
Freight and duties	23,495 64	
Labor	22,285 68	
Transportation of mechanics	904 65	
General and legal expenses, rent and interest	25,565 31	
Animal account	1,597 10	
Sundries	1,120 71	
		$180,032 55
Cash on hand		$952 68

Horsefly Hydraulic Mining Co. Ltd.—The following is extracted from the report of Mr. John B. Hobson, M.E., General Manager of the Company, submitted at the last meeting of the shareholders:—

"During the first two months' operation of the Mine this season, no material change in the conditions, as reported at the close of the season of 1895, had taken place, excepting a slight increase in the quantity of cement in the bottom stratum of high grade lying on the bedrock.

Early in the month of July, while part of the workings were being carried southerly in advance of the Main Cut, the upper gravels changed gradually from free piping ground to extremely hard cement, which had to be bank blasted to facilitate its disintegration and removal.

The sum of $5,000 was recovered from 600 square yards of the bank blasted ground lying west of the Main Cut, an average of $8.33 per square yard.

As the workings were carried westerly, the cement increased and included the bottom stratum which became extremely hard, and while gold was abundantly visible and the cemented gravel rich, not to exceed one thousand dollars ($1,000), was recovered from 2,500 square yards of ground lying west of the Main Cut, which was uncovered and worked in addition to the 600 square yards of blasted ground worked from July 9th, to August 8th, 1896.

The 528 square yards of bank blasted ground, lying east of Main Cut, and washed during the month of August, while some of the cuts were being cleared up, produced $3,850 an average of $7.29 per square yard.

The bottom stratum of high grade gravel under the bank blasted ground, varied from 3 feet to 6 feet in thickness and was only partially cemented, which accounts for the high percentage of recovery per square yard, from that block of ground.

The cement continued to increase until it included the whole working face, and became so hard that it would not and will not yield to the disintegrating power of bank blasting and water forced through the Hydraulic Giants. It is therefore, impossible to extract the gold from this cemented gravel by any but a milling process. For this reason operations were discontinued in Pits No. 1 and No. 2, but may be resumed later on some other part of the Company's extensive property, whenever on exploration the gravel deposits may be found free from cemented material, and more suitable for working by the hydraulic process.

The alteration of deposits of auriferous gravel from free washing hydraulic banks to masses and beds of cement or conglomerate, are geological conditions of common occurrence.

Such changes cannot be foreseen nor predicted, especially in unexplored regions, for there is usually nothing in the way of superficial conditions to indicate the presence of cement or conglomerate, and they are usually encountered where least expected.

Exploratory Work.

At the close of hydraulic work, three drifts, A. B. and C., were driven under the bank where shown on the accompanying plan, for the purpose of exploring the channel and proving the value of the cemented blue gravel beyond the face of the workings in Pit No. 1.

Drift A	120 feet.
" B	197 "
" C	100 "
Total lengths of drifts	417 feet.

By reference to the plan and profile it will be seen that the bedrock in Drift A. pitched off 7 feet, and Drift B. 4 feet, indicating a descent from the rim into the bed of the channel, both drifts passing through hard cemented gravel of high grade.

The rock in Drift C. raised 7 feet, indicating that the depression at the entrance to that drift is local, and caused by the fault in the bedrock (indicated by the dotted lines on plan). The drift passed through extremely hard cemented gravel, in which gold was visible as the work progressed.

In addition to the above work six (6) samples of the bottom gravel were taken for Mill tests.

Sample No. 1	43	Sacks	from bottom gravel West of B. Drift.
" No. 2	7	"	Drift B.
" No. 3	33	"	bottom gravel East of Main Cut.
" No. 4	14	"	first 60 feet of Draft A.
" No. 5	5	"	last 60 feet to face of Drift A.
" No. 6	4	"	Drift C.
Total	106	Sacks.	Total weight, 9,280 lbs.

Operating.

The following statement gives the details of Run No. 5, which commenced on 25th of April, and ended on the 10th day of September, 1896.

Run No. 5.

Dates.	No. of days Washing.	Quantity of water used.	Gold recovered.
April 25th to June 3rd	37 days	70,746 Miner's Ins.	470.13 ozs.
June 6th to July 6th	30 "	56,400 "	533.18 "
July 9th to August 8th	31 "	52,700 "	345.16 "
August 8th to Sept. 10th	25 "	35,500 "	478.32 "
Sept. 10th to Oct 30th Cleaning Rock			47.64 "
" " " "			6.00 "
Oct. 30th to Nov. 14th Cleaning Rock			10.90 "
Totals	125 days	215,346 Miner's Ins.	1891.79 ozs.

Platinum recovered from Sluice residues 7.5 ounces.

Summary of Run No. 5.

Time water was used in the mine	125 days.
Quantity of water used	215,346 Miners Inches.
Area of bedrock uncovered	12,000 square yards.
Average depth of bank	25 yards.
Quantity of gravel removed	300,000 cubic yards.
Duty of the water, per miners' inch	1.39 cubic yards.
Gross product of gold for season	1,891.79 ounces.
Gross value of gold	$32,786.64
Gold recovered per superficial yard of bedrock uncovered	$2.73.
Gold recovered per cubic yard	10 92-100 cents.

Value of deposits per cubic yard		40 cents.
Loss of gold in cement per cubic yard		29 8 10 cents.
Loss of gold inclosed in cement per superficial yard of bed-rock uncovered		$7.27.

Operating Account, Season 1896—Expenditures.

Management :—		
Salary and board		$3,038 50
Mining :—		
Labor	$22,748 59	
Explosives	9,975 36	
Stores	1,629 20	
Lumber	478 87	
		34,832 02
		$37,870 52
Buildings :—		
Labor	$390 70	
Stores	144 00	
Lumber	258 63	
		793 33
Maintenance of Dams :—		
Labor	$106 45	
Stores	10 40	
Lumber	84 93	
		201 78
Maintenance of Ditch		1,733 27
" Pipe line		506 10
" Sluices		254 36
" Portable Hydraulic Plant		8 00
" Tools and implements		337 00
" Camp		506 75
" Melting Plant		386 00
" Waggons, Harness, etc.		13 38
Prospecting		1,123 29
Lands and Leases		420 00
Roads and Trails		20 40
Stable expenses		481 98
Travelling "		1,197 55
Insurance		593 12
Stationery and Printing		69 00
Telegrams and Postage		126 35
		$47,222 03

Receipts.

Gold, June shipment		$8,073 27
July "		9,178 00
Aug. "		6,004 85
Sept. "		8,296 37
Oct. "		905 47
Nov. "		182 06
		32,640 02
Less freight, insurance, etc	977 72	
		31.662 30
Platinum 7½ ozs. at $4		30 00
Profit on stores		51 12
" boarding house		139 08
" saw mill and lumber		305 01
		$32,187 51

Condition of the Mine.

While the cement increased to such an extent as to make it impossible to attain success by hydraulic process, the conditions are extremely favorable for successful workings by the drift and milling process, and the mine never looked better since its opening in 1894.

The bottom stratum of blue gravel continued remarkably uniform in gold value as the workings were carried east and west, and while it became harder as the workings were carried south, the gold value increased. These conditions, together with the pitching off of the bed rock, indicate that the workings are probably on the north rim of an immense channel that promises to be the most extensive that was ever discovered on the Pacific Coast.

By reference to the map and profile, it will be seen that the bed rock has gone below the levels of the Drifts A and B, indicating that we have not reached the bed of the channel. This condition is considered a favorable indication that we will find richer ground as the workings approach the bottom of the channel.

The bottom stratum of blue gravel exposed in the face of the workings from the prospect Drift C to the point marked K, varies in thickness from two to six feet, and is of high grade.

The underlying bed rock is uniformly soft and can be bored with rock augers in most places. All the above conditions are as favorable as could be desired for operation by the drifting and milling process.

An average sample of 100 lbs. was taken from the lot of cemented gravel (106 sacks) sent for mill tests. The whole of the 100 lb. sample was crushed in a hand mortar and washed by panning. The gold recovered weighed 6·8 grains, valued 24·48 cents, or a yield of $4.99 6-10 per ton of 2,000 lbs.

The following certificate from the Nevada Metallurgical Works of San Franscisco gives the results of working the samples of cemented gravel sent for test by the free milling process. (Samples No. 5 and 6 were not worked by milling process).

Extract of Letter from C. A. Luckhardt & Co.

SAN FRANCISCO, CAL., Dec. 2nd, 1896.

DEAR SIR,— The 89 sacks of ore shipped by you received, and we gave it immediate treatment. Each lot was separately treated. The gravel was reduced to the proper size for the stamp mill, and reduced to pulp by the regular stamp mill process. A thirty mesh screen was used, the pulp passed over the usual silver plates, on to the vanner or concentrator, etc.

After the treatment of each lot, the mortar, stamps, dies, plates, etc., were thoroughly cleaned out, the amalgam carefully collected, retorted and refined. The vanner was treated in the same way, and the concentrates gathered and assayed. Final tailing samples were taken during the progress of the treatment and assayed.

The results you will best see by glancing at the report herewith :

San Francisco, Cal., Dec. 2nd, 1896.

Lot 37,215, marked Lot 1, 40 sacks, 2,854 lbs.—2,854 lbs. of the cement gravel were worked by the regular stamp mill process ; the amalgam was retorted, and yielded — grains of refined bullion.

This corresponds to a yield of :—

Gold 0·108 ozs	$3.76	per ton 2,000 lbs.
Silver 0·05 "	03	" "
	$3.79	" "

Lot 37,209, marked Lot 2, 6 sacks, 423 lbs.—423 lbs. of cemented gravel were worked by the regular stamp mill process ; the amalgam was retorted and yielded 36·5 grains of refined bullion.

This corresponds to a yield of : —

Gold 0·275 ozs	$5.67	per ton 2,000 lbs.
Silver 0·05 "	04	" "
	$5.71	" "

Lot 27,218, marked Lot 3, 30 sacks, 2,222 lbs.—1,222 lbs. of the cement gravel were worked by the regular stamp mill process ; the amalgam was retorted and yielded 177 grains of refined bullion.

This corresponds to a yield of :—

Gold 0·26 ozs	$5.41	per ton 2,000 tons.
Silver 0·075 ozs	05	" "
	$5.46	

Lot 37,212, marked Lot 4, 13 sacks, 967 lbs.—967 lbs. of the cement gravel were worked by the regular stamp mill process ; the amalgam was retorted and yielded 65 grains of refined bullion.

This corresponds to a yield of :—

Gold 0·215 ozs	$4.43	per ton 2,000 lbs.
Silver 0·06 "	04	" "
	$4.47	

Respectfully,

C. A. LUCKHARDT,

Nevada Metal Works,

(Sgd.) W. C. LUCKHARDT.

Average yield $4.85 per ton of 2,000 lbs.

The following gives the result of Mr. Anderson's samples, Nos. 1, 2 and 3, which cover all the ground including the Horsefly Hydraulic Co's. samples, Nos. 1, 2, 3, 4, 5 and 6 :—

Sample No. 1	865 lbs.	$4.32	per ton
" No. 2	851 "	5.94	"
" No. 3	835 "	6.42	"

Average yield $5.56 per ton of 2,000 lbs.

Estimated Value of Reserves.

Reserve "G." contains 5,554 sq. yds., 6 ft. deep	11,108 tons
" "H." " 8,888 " "	17,776 "
Total quantity in Blocks "G." and "H."	28,884 "
Estimated value in free gold per ton	$4 85
Total value	$137.887 40

These figures make it apparent that there is sufficient value in sight to warrant the installation of a water and steam power milling plant of ten stamps, having a capacity for crushing 120 tons of cemented gravel per day.

Estimated Cost of Mill.

10 stamp mill and 6-ft. Dodds water-wheel complete, f.o.b. at San Francisco	$2,175 00
Extra shoes, dies, etc., required for one year	640 00
Freight on 40,000 lbs. from San Francisco to Horse-fly Mine	2,000 00
Cost of construction of mill frame at mine	250 00
" " battery block at mine	250 00
Excavation of mill buildings	250 00
Erection of mill and machinery	1,000 00
Construction of mill buildings	1,000 00
Laying and connecting of pipe line	250 00
Travelling expenses of millwright	185 00
Horizontal tubular boilor, 42 x 14 with 9 x 14 engine, feed pump, stack and grate bars, complete	1,000 00
Freight on 10,000 lbs. at 5c	500 00
Total cost of 10 stamp mill	$9,500 00

Additional material, etc., will be required as follows :—

2,500 feet of rails, 17 lbs per yd., 14,000 lbs. at 2½c.	$ 350 00
Freight on 14,000 lbs. of rails at 5c	700 00
400 lbs. track spikes, including freight at 9c	36 00
600 feet of trestle and laying track at $1 per foot	600 00
400 feet of working tunnel E to end drift A	1,600 00
Enlarging and timbering drifts A and B 220 ft. at $2	440 00
4 mining cars at $100 each	400 00
Superintendance 2 months	500 00
	$ 4,626 00

Cost of 10 stamp mill	9,500 00
Cost of installation of plant	$14,126 00
Cash required to cover all contingencies, such as duty, extra freight, etc.	3,000 00
Total	$17,126 00

The milling plant can be installed and the mine got in readiness for production on or before July 1st, 1897.

Estimated Result of Operating the Mine with a 10 Stamp Mill.

10 stamp mill will crush 120 tons cemented gravel per day	120 tons
Estimated value, per ton	$ 4 85
Estimated daily output	582 00
Possible working days per month	26
Gross monthly product	15,132 00
Deduct cost of mining and milling 3,120 tons cemented gravel at $2 per ton	6,240 00
Monthly net profit	8,882 00
Possible number of working months in 1897 to Jan. 1st, 1898	6
Estimated profit for 1897	23,292 00
" " 1898	106,584 00

Water Supply.

The Company's system of ditches will furnish an abundant supply of water for power, seven months in the year leaving five months for operations by steam power.

The adjacent forests can be relied on for an ample supply of fuel at a reasonable cost.

The drifting and milling process of mining, if carried to the proper degree of perfection, will permit this mine to be worked to advantage both winter and summer, or continuously from year to year, subject only to such interruption as might be made necessary to make repairs, clean ups, etc. etc.

The benefits to be derived from such continuous work are many, and should not be disregarded, for the effect will soon be felt in the cutting down of previous yearly opening and closing expenses, so manifest in the tangible item of travelling expenses, and in other ways.

The continuous employment of miners and laborers will encourage the settlement in the district of a better and more reliable class of mining labor, and will tend to lessen its cost, besides doing away with the high premium heretofore paid under the hydraulic system of six month's work per season.

The full effect of such continuous work should be carefully and earnestly considered, when making plans for the working of this mine.

And further, the number of stamps in the mill can be increased whenever the developments warrant such action, without series interruption of the working of the mine, and the output increased in proportion to the increase in the capacity of the Milling plant.

This report deals with the revenue and expenditure attending the physical operation of mine, and does not include head office expenses and interest charges.

The accounts for the year as follows:—

Receipts.

Paid up Capital stock 15,000 shares at $10 each		$150,000 00
Balance carried to General Balance Sheet		36,191 40
		$186,191 40

Expenditure.

Mine Accounts:		
Mine Purchases and Leases	$26,915 00	
Prospecting	11,568 50	
Ditch and Pipe Line	82,241 44	
Dams	3,368 04	
Flumes, Sand Boxes, etc	1,079 07	
Sluices	8,344 04	
Buildings	7,944 01	
Mine labor, Explosives, etc.	21 453 39	
Mining Plant, Saw Mill, Lighting and Melting plant	10,379 59	
Road to 108 Mile House, etc.	4,166 64	
Farm	942 56	
Live stock, waggons, harness, etc	581 48	
Management	8,221 09	
Salaries, stationery and general expenses	3,284 72	
Travelling expenses, transportation of Miners, etc	1,331 14	
		$191,820 71
Head office and general expenses, 1895:		
Interest account	2,731 40	
Legal expenses	2,825 79	
Stationery and printing	164 84	
Telegrams and postage	66 78	
Travelling expenses	86 75	
General and incidental expenses	2,042 31	
		7,917 87
		199,738 58
Deduct:— Gold procured in 1894 during preliminary work in opening Mine		13,547 18
		$186,191 40

Operating Account—Season 1896.

Gold recovered during season	$31,662 30	
Platinum recovered during season	78 95	
		$31,741 25
Balance carried to general balance sheet.		15,399 78
		47,141 03
Management	$3,038 50	
Prospecting	1,123 29	
Mining expenses, labor and explosives	34,751 02	
Lands and Leases	420 00	
Maintenance of Ditch	1,733 27	
" Dams	579 85	
" Pipe	506 10	
" Sluices	254 36	
" Hydraulic plant	8 00	
" Tools and implements	337 00	
" Flumes, sand boxes, etc.	201 78	
" Melting plant	386 00	
Buildings	793 33	
Roads and trails	20 40	
Waggons, harness, etc., repairs	13 38	
Wages and general expenses of Camp.	506 75	
Stable expenses	481 98	
Travelling expenses	1,197 55	
Insurance	593 12	
Stationery and printing	69 00	
Telegrams and postage	126 35	
		47,141 03
		$47,141 03

General Balance Sheet—31st Dec., 1896.

Debenture Account, received on account		$52,640 00
Bank of British Columbia, balance due on Loan		17,500 00
Advances by certain Shareholders		17,000 00
Bills payable		5,000 00
Outstanding drafts from Mine and personal accounts.		397 88
Profit on Boarding House, 1896	$369 15	
" " " 1896	183 43	
		552 58
Profit on Lumber, 1895		305 01
" Stores, 1896		51 12
		$93,446 59
Balance from Capital Account		36,191 40
" Operating Account 1895.	$11,795 63	
Head office and general expenses 1896	7,894 81	
		14,690 44
Balance from Operating Account 1896	15,399 78	
Head office and general expenses, 1896	9,135 03	
		24,534 81
Stores on hand		11,214 88
Tools, etc., on hand		3,633 15
Lumber on hand		1,949 47
Live stock on hand		655 00
Waggons, harness, etc., on hand		560 00
Gold dust on hand		100 00
Bank of British Columbia, cash on hand at Dec. 31, 1896		517 44
		$93,446 59

Cariboo Hydraulic Mining Co., Ltd.—The following is extracted from the report of Mr. John B. Hobson, M.E., the company's manager, submitted at the last meeting of the shareholders. Results of the past season's work are tabulated as follows:

Run No. 5.

Commencing April 27th: ending August 19th, 1896.

Pit No. 1.

Water Used.			How Used.
Days.	Hours.	Quantity Miners' In.	
11	12	27,778·0	Washing ice, frozen gravel and clay from pit.
5	18	11,203·1	Washing out first bed-rock slide from north rim.
	18	6,665·6	Grading for extension of sluices.
26		52,771·3	Washing gravel and second slide from north rim.
44	00	93,419·0	

Quantity of Material Removed.

Ice, frozen gravel and clay barren	138,890	cub. yds.
First rock slide from north rim, barren	79,000	"
Second rock and earth slide from north rim, barren	109,000	"
Gravel from bank	105,000	"
Total quantity of material removed	431,890	"
Duty of water per miners' inch	4·62	"
Gold recovered	2,693	ounces
Value	$46,301 67	
Yield of gravel washed per cubic yard	44 1-10	cents
Average height of bank above head of sluice	250	feet

The slide material came from the north rim of the old Chinese workings and formed no part of the cross-section included in the working face of the gravel removed during the run.

Pit No. 2.

Water Used.			How Used.
Days.	Hours.	Quantity Miners' In.	
5		11,371·7	Washing ice frozen grazel from pit.
4	12	11,119·7	Grading for extension of sluices.
54	12	107,729·2	Washing gravel, sand and clay.
64	00	130,220·6	

Ice and frozen gravel, barren	56,858	cub. yds.
Gravel from the bank	880,060	"
Total quantity of material removed	936,918	"
Duty of water per miners' inch	7·19	"
Gold recovered	2,054	ounces
Value	$35,315 12	
Yield of the gravel washed per cubic yard	4·01	cents

Recapitulation, Run No. 5.

Quantity of water used during the run	223,693 6	m. in.
Gold recovered from both pits	4,747	ounces
Value	$81,616 79	
Time occupied in washing in both pits	108	days
Average yield per day	$755 70	

Run No. 6.

Commencing September 5th ; ending October 13th, 1896.

Pit No. 1.

Water Used.			How Used.
Days.	Hours.	Quantity Miners' In.	
4	3	8,250·0	Washing gravel from north rim of bank.
3	19	7,583·4	Bank blasted ground from north rim.
6	22	13,875·0	Gravel from bank.
14	20	29,708·4	

Quantity of Material Removed.

Top gravel and clay from north rim	114,000	cub. yds.
Gravel from bank, 250 feet high	52,000	"
Total quantity earth and gravel removed	166,000	"
Duty of water per miners' inch	5·59	"
Gold recovered	2,070·5	ounces
Value	$35,517 60	
Yield of gravel washed from bank per cub. yd.	68·3	cents
Average yield of whole mass removed per cub. yard	21·4	"
Time occupied in working	14 days 20½	hrs.
Average yield per day	$2,391 08	

Run No. 7.

Commencing October 18th ; ending October 27th, 1896.

Water Used.			How Used.
Days.	Hours.	Quantity Miners' In.	
	19	1,583·3	Washing gravel from bank.
	6	541·7	Bank blasted gravel from north rim.
1	1	2,125·0	

Quantity of gravel removed	9,137	cub. yds.
Duty of water per miners' inch	4 3-10	"
Gold recovered	319	ounces
Value	$5,465 75	
Yield of gravel per cubic yard	$59 81	
Time occupied in washing	1 day 1½	hrs.
Average yield per day	$5,141 81	

Run No. 8.

Commencing October 29th ; ending November 5th 1896.

Pit No. 1.

Water Used.			How Used.
Days.	Hours.	Quantity Miners' In.	
	23	1,916·7	Washing gravel from bank.
	4	333·3	Top gravel from north rim.
1	3	2,250·0	

Quantity of gravel removed	9,225	cub. yds.
Duty of water per miners' inch	4 1-10	"
Gold recovered (partial clean-up)	283 67	ounces
Value	$4,855 10	
Yield of gravel, per cubic yard	$52 63	
Time occupied in washing	1 day 3 hrs.	
Aver ge yield per day	$4,315 65	

Summary of Season's Work.

Total time occupied in washing	125 days 1 hour
" quantity of water used	257,723 m. in.
Gold product for season	7,426·17 ounces
Value, gross	$127,455 24

Receipts for Season.

Gold product, less melting charges	$127,080 96
Profit on lumber	1,366 96
Profit on stores	3,206 18
Total	$131,654 10

A statement of the accounts for last year shows:—

Receipts.

Paid up Capital Stock, 100,000 shares at $5.00 each	$500,000.00

Expenditures.

Mine purchases and leases	$180,704 10	
Moorehead Ditch Survey	534 38	
Ditches and equipment of mine	163,258 70	
Dams, Sluices, Flumes, Sand Boxes, etc.	11,234 33	
Reservoirs	10,063 98	
Mine Labor, etc.	24,901 00	
Buildings	5,182 73	
Hydraulic Plant	3,753 99	
Melting and Lighting Plant	44 78	
Saw Mill	2,465 25	
Road and Trails	3,688 50	
Pasture lands	1,001 05	
Horses and wagons	2,531 67	
Transportation	2,485 96	
Furniture	553 70	
Operating	3,171 57	
Management	2,500 00	
		$418,165 69
Head Office and General Exp's. March, 1895		5,757 14
		$423,922 83
Deduct :—Gold procured in 1894 during preliminary work in opening mine		5,161 85
		$418,760 98
Balance carried to General Balance Sheet		$1,239 02
		$500,000 00

Permanent Improvements.—Season 1896.

To balance carried to General Balance Sheet		$58,132 09
Lands and Leases	$ 169 75	
Buildings	1,857 09	
Dams	2,849 58	
Flumes, Sand Boxes, etc	2,357 47	
South Fork Ditch Extention	22,075 75	
" " " Permanent Improvements	4,583 50	
Portable Hydraulic Plant	14,432 00	
Furniture	47 10	
Live Stock	3,309 30	
Wagons, Harness, etc	2,694 50	
Roads, Trails, etc	728 45	
Melting Utensils	1,124 90	
Telephone	1,902 70	$58,132 09
		$58,132 09

Operating Account.—Expenses Operating Mine, Season 1896.

To Gold recovered from mine during season 1896, after deducting transportation expenser, insurance and other charges		$124,026 86
Management	$ 3,150 25	
Prospecting	1,823 20	
Mining, Labor and Explosives	53,656 61	
Maintenance of Flumes	43 00	
" Ditch	7,327 42	
" Sluices	11,053 56	
" Hydraulic Plant	3,001 10	
" Lighting & Melting plant	627 90	
" Saw Mill	1,189 95	
" Wagons, Harness, etc	369 15	
" Roads and Trails	521 35	
" Tools and Implements	633 33	
" Camp	2,247 47	
Forest Fires	4,754 30	
Leases and Water Rights	450 00	
Quicksilver	717 00	
Stationery and Printing	151 12	
Telegrams and Postage	140 32	
Travelling Expenses	4,461 91	
Insurance	818 63	
		$ 97,145 57
Balance carried to General Balance Sheet		26,881 29
		$124,026 86

General Balance Sheet.—31st December, 1896.

Balance from Capital account		$81,239 02
" " Operating account 1895	$16,385 25	
" " " " 1896.	26,881 29	
		43,266 54
Outstanding drafts from Mine		4,673 93
Profit on Lumber, etc. 1895 and 1896		2,346 21
		$131,525 70
Head Office and General Expenses to December 1895	$1,674 85	
Head Office and General Expenses to December, 1896	8,505 42	
		10,241 83
Permanent Improvements Account to Dec. 1896		58,132 09
Personal Accounts outstanding		1,014 50
Stores on hand	$31,365 03	
Lumber on hand	5,358 60	
Tools, etc. on hand	4,701 50	
Quicksilver on hand	1,816 70	
		43,241 83
Bank of Montreal, Cash in Bank at Dec. 31, 1896		18,936 95
		$131,525 70

Annual Meeting of the Mining Society of Nova Scotia.

The annual meeting of the members of the Mining Society of Nova Scotia was held in the Halifax Hotel, Halifax, on Wednesday, 10th instant, the following among others being present :—

Graham Fraser (Nova Scotia Steel Co.) New Glasgow; H. S. Poole, M.A., A.R.S.M. (Acadia Coal Co.) Stellarton; R. H. Brown, M.E. (General Mining Association) Sydney Mines; Major R. G. Leckie, M.E. (Dufferin Gold Mining Co.) Torbrook; Major R. G. Leckie, B.A.Sc. (Torbrook Iron Co.) Torbrook; G. E. Francklyn (General Mining Association) Halifax; A. A. Hayward (Golden Lode Mining Co.) Halifax; Clarence Dimock (Wentworth Gypsum Co.) Wentworth; W. L. Libbey (Brookfield Mining Co.) North Brookfield; W. A. Saunders (Lake Lode Gold Mine) Caribou; C. F. Andrews (Richardson Mining Co.) Isedas Harbour; C. A. Meissner (Londonderry Iron Co.) Londonderry. Charles Archibald, M.E., Halifax; C. E. Willis, M.E. (Halifax Chrome Co.) Halifax; J. T. Burchell (Cape Breton Colliery) New Campbellton; T. R. Gue (Acadia Powder Co.) Halifax; E. C. Wilson (Acadia Powder Co.) Waverley; Geoffrey Morrow, Halifax; A. Dick, C. & M.E., Halifax; W. C. Brine, Halifax; C. C. Starr, Halifax; W. Blakemore, M.E. (Dominion Coal Co.) Glace Bay; Hon. David McKeen (Dominion Coal Co. Halifax; Joseph Austen (Austen Bros.) Halifax; J. E. Hampson (Ingersoll Rock Drill Co.) Halifax; H. M. Wylde, Halifax; *Secretary* B. T. A. Bell (Canadian Mining Review) *Hon.-Sec.* The meeting was called to order at half past ten o'clock in the forenoon, Major R. G. Leckie, President, in the chair. The Secretary submitted the minutes of the previous meetings, which were on motion adopted. Mr. J. B. Hampson was elected a member.

Financial Statement.

The Secretary submitted the following statement of the finances of the Society :—

Receipts.

Canadian Mining Review half Stenographer's, etc., 1895	$ 7.50
Sale of old furniture	8.85
Grant from Provincial Government	500.00
Interest	1.10
Subscriptions collected	830.00
Balance due Secretary-Treasurer, 1st March, 1897	88.44
	$1,435.89

Expenditures.

Balance due Secretary-Treasurer, 1st March, 1896	$ 240.41
Rooms, rent, etc	364.60
Canadian Federated Institute assessments	249.55
Canadian Mining Review subscription members	158.34
Meetings, guests, etc	121.15
Printing	11.75
Canadian Mining Iron and Steel subscription 1896	4.00
Postages, expressage, telegrams, etc	36.09
Secretary-Treasurer's salary, 1896	250.00
	$1,435.89

Audited and found correct.

(Signed),

H. S. POOLE, C. E. WILLIS, } *Auditors.*

The Canadian Society of Civil Engineer's Bill.

MR. B. T. A. BELL.—I daresay most of the members are aware by this time of an iniquitous and impertinent piece of legislation promoted by the Canadian Society of Civil Engineers, entitled "An Act Concerning Civil Engineers," a measure which had lately been submitted to the Provincial Legislature and which he was glad to learn had, on the representations of the society, been considerably modified, in so far as it related to the practice of the mining profession in the Province. There had been some correspondence in the local papers on the subject from Mr. Hardman, their late president and Mr Dodwell, and Mr. Hardman had asked him to read the following communication to the members :—

"As circumstances unavoi lably prevent me from attending your annual meeting, I am obliged to take this method of bringing before the society, a subject upon which I very much desire their consideration, viz: the bill recently introduced into the legislature to regulate the practice of the engineering profession.

In this connection it is extremely probable that most of the members have seen my letter upon the subject sent to the *Halifax Herald*, and also the letters on the same subject from a Mr. Dodwell and Prof. Butler of Queens College, and it is also most probable that the active members of the society have already given the matter much thought. I desire briefly to say that Mr. Dodwell's long article failed to point out the "illogical" part of my letter and that more than two years ago I was urged to join the Canadian Society of Civil Engineers by one of our own highly respected members, Dr. Martin Murphy, who prepared the necessary papers for me. Upon investigation of the published transactions of the society I declined the honor for the logical reason that the papers presented did not bear upon mining or metallurgical work and hence were not of a value of $20.00 per year to me.

Because the men who drafted the by-laws of the Canadian Society of Civil Engineers chose to define a civil engineer as a "mechanical, mining and electrical" engineer also, does not in the least make their definition binding nor authoritative, nor does it show in 1887 much knowledge of the relative status of the different engineering professions. The same by-law also includes "military" works, while a few paragraphs below, Mr. Dodwell says the "first and obvious meaning of a civil engineer was one who was not a military engineer." But passing by the personalities of Mr. Dodwell's letter, for personalities are not arguments, it is a manifest untruth to say that the "bill was pretty thoroughly discussed in committee of the House of Assembly," as no representative of the mining, mechanical or electrical end of the "civil engineering" profession was present, with the exception of Mr. Alexander Dick of Halifax, nor is it complimentary to Montreal to call that city "the highways and hedges," nor to allude to Messrs. Gue et al as having "scoured" therefrom.

The essence of the bill, as Mr. Dodwell states, is really to give a duly qualified engineer a recognized status, and if that were all no exception could be taken to it, but it is altogether a different matter to impose a tax of $20.00 a year solely for the benefit of the treasury of the Canadian Society of Civil Engineers. Let the tax, if one must be paid, be paid, in the case of mining men, into the treasury of the Nova Scotia Mining Society. Let the government appoint the examining committee from men in the province who are recognized as competent mining engineers, and let a degree in an engineering profession from a technical school of standing be accepted in lieu of an examination.

This bill (Sec. 5 par. E.) accepts only degrees from British or Canadian universities; why are American universities shut out, whose technical schools are admittedly ahead of any British or European schools?

In February, 1895, Mr. Wm. Mather, M.P., President of the Association of Technical Institutions in Great Britain, in his annual address in London, said of the Massachusetts Institute of Technology that it was the best model for scientific schools in his own country and that "the conspicuous practical knowledge of the students, their thoroughness, and power of adaptation and resource they possess in entering workshops and manufactories, railroads or mines, public works and constructive engineering, all these fruits of their training are, so far as I have seen, not equalled on the continent."

But coming down from this position, every capitalist, every man of business, every man of experience knows how frequently he has gotten his best advice, not from men with letters after their names, but from men who have learned their business practically, who have pounded the drill, have scratched with the awl and square, or have tapped the slag from the metal.

Yet any such competent practical man by this bill, is shut out from giving his advice when asked.

That a large number of totally incompetent men are advising, reporting and drawing fees as mining engineers is a fact to be deplored and corrected if possible, but it must not be forgotten that the mining engineer occupies a very different field to the civil, mechanical and electrical engineer.

To quote from an authority, "in many branches of engineering the engineer, while he has great responsibility is in a sense working in plain sight and with plain facts. Unless he is dishonest or utterly incompetent he is carried along by his work and his facts to what is, approximately at least, the proper solution of the problem at hand. With the mining engineer the case is different; the whole question of ore deposits is one of uncertainty. The science is yet in its infancy and at best can never be made the subject of exact laws like those of most other matters considered by engineering," and experience backed by training governs the skill and standing of the mining engineer with his clients.

Therefore in approaching this subject, as the engineers of both Great Britain and the United States have done, there has never as yet appeared a satisfactory solution, and the simile of the lawyer and the doctor becomes a false one. At the Montreal meeting of the Federated Canadian Mining Institute, one of the cleverest lawyers in the Dominion, a counsel for the C. P. R., stated that he did not see how it could be made practicable to have mining experts and engineers formed into an incorporated body and placed in such a position as to be responsible to the public.

Prof. Butler's letter needs no comment as he has himself, when president of a mining company, seen fit on several occasions to pay me a fee and ask my advice in mining matters.

Let me remove, however, from his mind one erroneous impression, viz., that Canadian mining engineers are going to hurry up to become members of the Canadian Society of Civil Engineers. Besides myself I can name several M. E's. who have declined membership; amongst others Mr. John B. Hobson of British Columbia who is doing work that no member of the Canadian Society of Civil Engineers has had the experience to do.

Furthermore, from the report of the January meeting of the Canadian Society of Civil Engineers it would appear that a very earnest discussion on the merits of this bill took place. It is to the credit of many of the members, foremost amongst whom was Mr. P. A. Paterson, Chief Engineer of the C.P.R., that exception was taken to

asking English or American engineers to pass an examination before practising in this country. It is note-worthy too, that the profession as represented by our chief technical school (McGill) took no part in the discussion.

I desire to submit to the Society a resolution to the effect that a committee of its members be appointed:—

(1.) To take this matter into consideration:—

(2.) To formulate a desirable bill without the objectionable features of revenue to an outside society:

(3.) To confer with the Nova Scotia representatives of the Canadian Society of Civil Engineers and so far as possible to co-operate with them in the matter insisting on the broad distinction that lies between a mining engineer and a civil engineer:

(4.) To confer, if necessary, with the Hon. Attorney General or other legal talent on the matter:

(5.) To confer with similar committees that may be appointed by the Mining Associations of Ontario and Quebec;

(6.) To submit a report at the next regular meeting of this Society;

I submit these resolutions in the hope that discussion will ensue and more for the purpose of arousing intelligent discussion than in the hope that these particular resolutions may be adopted. To those members who are interested in procuring foreign capital for our mines I need not point out the detrimental features of the Bill referred to in this letter. They are self evident upon perusal.

Regretting exceedingly that I am unable to be present to urge by my voice rather than by my written word, the importance of this subject,

I am, Yours truly,

JOHN E. HARDMAN.

It seems to me that such a resolution as that proposed by Mr. Hurdman should be endorsed by this Society. It is very likely that legislation of a similar character will be promoted in the other Provinces. and I need not say that any such will meet with a vigorous opposition from the Federated Canadian Mining Institute.

THE CHAIKMAN—When this matter was brought before the Legislature here, I had not returned from Montreal, but I believe a deputation interviewed the Attorney-General and the other members of the Legislature.

MR. GUE—It is quite safe to say that it will never become law while this Province has a Legislative Council.

MR. HAYWARD—I have received assurance from members of the Council that it will never pass.

MR. ARCHIBALD—In regard to any similar Bill being proposed in Ontario we could by passing the resolutions suggested give our friends thereour moral support.

MR. BLAKEMORE—The best thing to do is to support theaction of the Federated Institute, but I am in favor of a committee being appointed to look after such legislation in so far as it relates to our own Province. I would therefore move the appointment of a committee.

MR. T. R. GUE having seconded, the following committee was appointed, with power to add to their number: Major Leckie, C. E. Willis, H. S. Poole, C. F. Andrews, and A. A. Hayward.

The following resolution was also adopted:—That this Society condemns the clauses of the Bill promoted by the Canadian Society of Civil Engineers in so far as they relate to the practice of mining engineering; further that the Society endorses the action of the Federated Canadian Mining Institute in taking action to defeat the measure in Nova Scotia and the other Provinces of the Dominion.

The President's Address.

MAJOR LECKIE—The Geological Survey of Canada, has, with commendable promptness, issued its annual statement of the mineral production of the Dominion. In the year 1896 minerals to the value of $23,627,305 were mined or quarried. This is an increase of $11,627,305 over the year 1896, or an increase of one hundred per cent in ten years,—quite a satisfactory showing, and the probability is that the proportionate increase during the next decade will be fully as great.

In our own Province the report of the Department of Mines shows a gratifying increase in the production of coal and gold. The total quantity of coal mined was 2,235,472 tons, of which 2,047,133 were reported sold, an increase in ten years of 673,472 tons, or nearly fifty per cent. In coke an increase of fully forty per cent is reported, which will be still further added to by the new works just started on the North West Arm. These works our members had the privilege of visiting at the December meeting, but while yet in an incomplete condition. The plant represents a thoroughly up-to-date practice, in which every detail has been carefully worked out, with a view to securing the greatest efficiency and economy. The utilization of the gas and by-products, which must constitute a large source of income, will be watched with great interest both from a technical and financial standpoint.

The yield of gold was 25,596 oz. 14 dwt. 6 grs., which at $19.50 per oz. equals $499,156.00, to which should be added nuggets and mortared gold, which would bring the total production well over half a million dollars. The province has thus furnished enough gold, equal to the resources of all the Banks in Nova Scotia. To produce this quantity of gold 65,873 tons of ore were crushed, which yielded 7 dwts. 18½ grs. per ton; but taking into consideration the loss of gold by inferior milling practice, as well as that carried away in the tailings and capable of being recovered, the value may be reckoned as fully 10 dwts. per ton. In 1867, the year of the largest production, 31,386 tons yielded 27,314 oz. gold, or an average of nearly 17½ dwts. This marks a healthy progress towards working larger quantities of low grade ores at lower costs. It is well known that many large bodies of quartz, or quartz and slate forming interlaminated bands or belts, carrying from two dwts. to 5 dwts. or moro per ton. exist in several districts of this province. These are continuons for a considerable length and to unknown depths. They cannot be easily lost by faults, and can be mined very cheaply either by open-cast or underhand stoping. Improved mechanical appliances, together with the use of high explosives, have revolutionized quartz mining. Equal, if not greater improvements have been made in the milling, by the introduction of rock-breakers, self-feeders, belts or vanners for concentration of sulphurets, and improved chemical methods and apparatus for the extraction of the precious-metals from these sulphides.

A most interesting and valuable paper was read at the Montreal meeting of the Federated Canadian Mining Institute by one of our members, Mr. C. F. Audrews. In it he stated that at the Richardson Mine he had reduced the cost of mining, milling and general charges to $1.65 per ton. This, under conditions existing there, is equal to the best work done anywhere else in the world. Similar belts if carrying only $2.00 per ton, will leave a small margin for profit.

Although there are many rich leads, small and of varying size, which will pay well to work, yet it is the larger bodies of low grade ore, skillfully and economically worked, upon which the gold industry must depend for profits and permanency.

Every mill, however small, should have a concentration plant, but few mines in the province have an output sufficient to jusify the erection of extraction works, for either the chlorination or cyanide process. It is rather highly desirable that suitable works be erected at some convenient and central point, where the smaller operators could send their concentrates for treatment or sale. Such a works the provincial government could well afford to subsidize liberally, as the result would be an increase in the royalty upon gold, which is at present entirely lost in the tailings.

The enterprise and courage of Mr. Libbey and his associates displayed in the erection and operation of a complete concentration and chlorination plant, have been rewarded, I am delighted to learn, with complete sucess. This is a most important step in the gold mining industry of the Province, and we may look forward to a most interesting paper from Mr. Libbey at our next meeting.

The meetings in Montreal of the Federated Canadian Mining Institute on the 3rd, 4th and 5th of last month were highly successful from every point of view. The atten lance was large and representative. From the Universities and Mining Schools came men of the highest scientific attainments; the late Director and the presnt Chief of the Geological Survey, with members of the staff, contributed valuable and interesting information by papers and discussions. Our mining engineers ano those interested in the industry displayed the greatest interest in the proceedings, and by their practical knowledge and aid made the meetings an unqualified success. The contingent from our own Society was much in evidnce and creditably represented the province. The aid which the able representative of the Department of Mines gave us was of the greatest value. Our thanks are due to the government for its liberality in sending a marvellous exhibit of nuggets and goldbearing quartz which excited the greatest interest, and called attention in an unmistakable manner to the great resources of Nova Scotia.

In view of the marked interest being taken in mining matters, and more especially in gold mining, the report of the Department of Mines for 1896 is very disappointing. That portion referring to the metalliferous mines, especially gold, is crude, badly arranged, and in every way defective. It is not such a Blue Book as one would feel like sending abroad to either a professional or business man. It has not even an index.

The Assistant Commissioner of Mines, although eminently qualified for the position, has too much to do, and is not provided with a qualified efficient staff. It is highly necessary that a thoroughly educated and trained engineer be appointed as inspector of metalliferout mines. He should have some knowledge of chemistry and metallurgy as well as surveying and mining. A new or revised description of our gold districts is required, and an up-to-date report on the gold mines and progress of the gold mining industry. The competition for capital capital is keen, and it behooves the government of the province to arouse itself and be up and doing, even for the prospect of increasing its own revenues.

It may be worth while for this Society to consider the expediency of appointing a committee of its members to consider a Bureau of Information. A monthly bulletin might be issued, giving the latest information regarding the operations of mines, new discoveries, and other items likely to attract attention to the mineral resources of the Province. Great care would have to be exercised in verifying statements and reports. This might take the place of the Chamber of Mines, which in other mining countries publishes statistical information and interesting facts regarding the mining industry. (Applause).

MR. B. T. A. BELL—The President's remarks call for some discussion. The suggestion of the publication by the Provincial Government of a series of bulletins dealing with special districts is a particularly happy one. British Coiumbia has adopted this practice with much benefit to the expansion of knowledge of her mineral resources.

MR. DIMOCK heartily endorsed the remarks of the President in so far as they related to the Mine's Report. His own mine at Central Rawdon, although labour and other returns had been furnished to the Department, did not appear in the report at all. On bringing the matter to the notice of Dr. Gilpin, that gentleman had written to the effect that the Deputy had not visited the mine as he was under the impression that it was not being worked. He further stated there was no obligation to mention a mine in the Report except for infringement of the law, but that it had been customary for notices to be inserted; that Central Rawdon had been unintentionaliy omitted, and if I would give him a brief memorandum of the work done it could be embodied in the next annual report. The Society should enquire into the working of the Mine's Department and get it into a more perfect condition as soon as possible.

MR. DICK—Any committee appointed should ask the government to do more to interest outside capitalists in our gold mines. The Annual Report was a miserable, incomplete affair in comparison with those published by other Governments.

MR. B. T. A. BELL—It appears to me that Dr. Gilpin's hands should be strengthened by the appointment of a first-class metalliferous mining engineer, whose duty it will be to look particularly after the gold mining industries. The reports of Dr. Hind dealing with the districts of Sherbrooke, Wine Harbor, and other gold mining sections of the province had demonstrated the utility of special reports of this character, and it should be the duty of such a mining engineer to continue the work so ably begun by Dr. Hind. Reports of this character if properly illustrated with maps and views of the mines in operation will do much to dispel the lamentable ignorance of the outside public respecting the present condition of the gold mining industry in Nova Scotia.

Mr. C. E. WILLIS endorsed the idea of illustrating the reports of the Department. The equipments of the Collieries, Furnaces, and many of their gold mines were unsurpassed, and photos of these undertakings should be shown.

MR. A. DICK—The whole inspection of the gold mines last year occupied thirty-five days, twenty of which were consumed in driving from one to another, and fifteen in making enquiries from the manager at the pit head.

MR. ANDREWS—I think the inspection of the mines by the Deputy Inspector simply a farce. At the Richardson he simply drove in and had a talk with the superintendent and drove out again.

MR. BELL moved that the Society interview the Hon. Mr. Murray in a body on Thursday morning and impress him with the urgent necessity of the improvements indicated on the lines of the discussion. The motion carried, and the Secretary was accordingly instructed to arrange for the interview.

Election of Officers and Council.

President :

Major R. G. Leckie (Dufferin Gold Mining Co.) Torbrook.

Vice-Presidents :

Graham Fraser (Nova Scotia Steel Co.) New Glasgow.
Wm. Blakemore (Dominion Coal Co.) Glace Bay.
Chas. Fergie, M.E. (Intercolonial Coal Co.) Westville, N.S.

Hon. Secretary :

B. T. A. Bell (Editor Canadian Mining Review) Ottawa.

Secretary-Treasurer :

H. M. Wylde, Halifax.

Council :

F. H. Mason, F.C.S., Halifax. — Chas. Archibald, M.E., Halifax.
G. W. Stuart, M.E., Truro. — Geoff. Morrow, Halifax.
W. G. Matheson, New Glasgow. — J. T. Burchell, N. Campbellton.
W. L. Libbey, N. Brookfield. — B. F. Pearson, Halifax.
C. E. Willis, M.E., Halifax.

Unsystematic Methods of Gold Mining.

MR. C. F. ANDREWS—I should like to occupy your attention for a few moments with some remarks on the systematic, or rather lack of systematic, mining of gold ores. We see too often the proverbial "hole in the ground," the hastily constructed shanty dignified by the term "shaft-house," the trap of a plant consisting of an engine, boiler and hoisting-gear, which so far as its location and adaptability are concerned, might easily have been placed there by a whirl-wind. All this has cost the company money and is likely to continue to do so, under the circumstances.

If the mine is of stout heart, and persists in refusing to be killed by its greedy and expectant owners, it may pay its way through the numerous changes of plant, the many stages of additions, the final demolition of its parts above ground, and the expense of re-building them. It may even stand having the particular mill, under the disadvantages of which it has to labour, erected upon it, from motives of false economy, its first cost being considered rather than its adaptability to the requirements of the mine. In this I do not refer to any one mine in particular, but to the history of many mines, and, judging from the past, history which is still likely to repeat itself. And the cause of this,—well in most instances, the cause may be found in the fact that the mine is not governed by a set of men who understand its requirements.

Its management, individually, in their own particular lines of trade or profession, may be the smartest and most successful men in the country. Too often their mining energy is displayed in attempting to kill the goose which they expect to lay for them the golden egg,—by squeezing it. Yet it is hard to make them believe this. They have put their hands in their pockets and put up their money for a "plant," too often saying in their minds, like the old maid who was praying for a husband, "any old thing" will do. They have also given instructions to put up a "plant" and hurry along the gold. Nor is it always the fault of the owners—managers have been known to be as premature in their hurry for a "plant," as owners for their returns. However, the results have the same drawbacks in each case.

Meanwhile, let us take a look at the conditions below-ground. If it is a new mine, we too often see a single shaft down a few feet, generally far enough to get enough solid rock to drive a tunnel on the load or belt, which may be showing considerable gold. We may also find that the lode has been exposed in a few places on the surface for a hundred feet or so. Perhaps a tunnel has been driven both ways from the shaft from twenty to one hundred feet on the lode. As likely as not, if the shaft is deep enough, you will find a drill already following up the men working in the face of the tunnel, perhaps close against them, taking out a stope. It is of no consequence that they are in each other's way: there must be some quartz on hand when the new plant is ready for it and the "plant" must start on time no matter what may happen afterward.

Every one connected with the property (who is not obliged to go below too often) is happy. Things are being pushed, a big crowd working, and the manager is able from day to day to plan his construction work so that none of the carpenters are idle. He has not had time to get out, study, and correct his plans before the construction work was started, but he must have a place for his machinery when it arrives.

The directors, if they visit the place at all, see every thing on the hum; even see the miners who are driving the tunnel and sinking the shaft hurrying on deck along with the stopers to avoid the shots the stopers have just set off. But presidents and directors are seldom supposed to know anything about this, they are satisfied,—"things are humming." And if the mine is fortunate enough to hold out, they are in a fair way to keep things humming rather than paying. With great luck—and expense—they manage to keep things working along this way for a couple of years or so.

Yes, "it is paying," and they are congratulating themselves; they always "knew that it would pay." They have made considerable additions to the plant, which was a little overtaxed; and the fuel bill is rather heavy for the amount of work accomplished. The strike of gold is found to be working away from the main shaft; it did not remain where first found. But the hoister and pump are, unfortunately, not endowed with the same power of apparent locomotion that has taken possession of the strike—they are left behind. After spending some three or four thousand dollars more to patch up the plant, it is finally considered inadequate, and a new one is decided upon and erected.

With the first plant it was costing four dollars a ton for mining and milling, and twenty-five thousand tons of ore have been crushed. With the improved plant, installed in a rush in order to avoid keeping the mine closed down any longer than the time set by the management, who have failed to profit by their previous experience, it is found that the cost has been reduced by one-half. But the plant, put in under these conditions, is yet far from perfect.

What better appeal than this can we make for a more systematic method of mining? In this supposed case, (instances of which are not confined to this Province alone, or to this Dominion, for we can find them all over this continent, particularly in some of the Southern States*) we can see the great saving which would have been effected had the last plant been adopted on the first instance. If with this hastily constructed plant, the cost was reduced from four to two dollars per ton, the saving on the first lot of ore mentioned would have amounted to over fifty thousand dollars. Had that property been properly developed before any plant was erected, when the time came to work the mine the proper machinery could have been put in and located at the proper place, thereby, also, saving the cost of the first plant.

This is but one of the many cases which could be brought to illustrate the necessity of thoroughly developing and understanding a property before attempting to equip it. Unfortnately, many blunders in this line do not result so favourably as in the case which I have supposed, which I am sure you will not for a moment think is an overdrawn one. Nor would I have it supposed for a moment that I intended it as an illustration of an average case in mining,—I simply maintain that it does happen, and that too often; and many good properties, to-day closed down, are without doubt, idle owing to a similar occurrence.

MR. CHAIRMAN—I listened with great pleasure to the paper which Mr. Andrews read in Montreal. What he has added to-day I think is pretty much the experience of most of us having to do with joint stock companies. As a rule when persons purchase a property they imagine they have a mine and that all that must be done is to get out the ore, but a mine has to be constructed quite as much as a cotton factory. It requires time a money and very few of our gold mines that I know of have started in with either one or the other. The prospectors have had to develop and equip mines out of their own earnings which means a hand to mouth policy and a starvation one at that. It has already been a question of expediency and as Mr. Andrews stated, "any old thing will do," the result being that very few of our mines are really properly equipped. The great advantages of starting with sufficient capital and with the investors understanding the clear conditions of the case are that the property can be properly prospected before any permanent work is done and when the shaft is put down it is in its proper place.

MR. LIBBEY—I would like to say a few words perhaps in criticism and somewhat in friendly advice too. In my experience around the Province I found that men built mills almost as soon as they discovered boulders. We all know the gold mill. It has a long slanting roof on one side and is generally placed at an inconvenient distance from the shaft. The mine I am working is a conspicuous example of the lack of common sense in the placing of the mill, which is flat on the ground, without a foundation under it. If the man who built that mill had exercised the same amount of common sense as he would in any other business he would have placed it over the main shaft, instead of fifty feet away. This is not an isolated case. With the exception of the mill at the Lincoln mine at Chester basin our new one is the only one I have seen placed over the shaft. Our new mill takes the ore from two leads. Some of the old gold miners said that it would be impossible to run two leads at the one shaft, but we are doing it. All these things conduce to cheap working.

MR. ANDREWS—We may find circumstances under which it would be impossible to place the mill at the deck head. Sometimes there is a lack of water, and again, if the location is low you can't get rid of the sand without putting in an elevator.

MR. LIBBEY—I can pump water with a steam pump cheaper than they can haul the ore with an ox and one man to drive it.

Mr. FRASER,—I think that Mr. Libbey has thrown out a very practical suggestion in regard to putting the mill close to the shaft. While people may think it does not cost much to haul ore half a mile, if accounts were kept properly, it would be found that there was considerable wear and tear. Of course there is one thing to be considered in putting the mill at the head of the shaft, you must know that you have enough ore to last for a considerable time, and in some cases it may be better to select a place for the mill a little distance away from the shaft. I think it does not make much difference what the buisness is you will find the directors want dividends. When I started in business it was with the suggestive name "steel and forge," making iron and steel for a living. (Laughter.)

MR. WILLIS—I know two or three instances in which Mr. Libbey's idea was carried out. At Oxford sixteen years ago the ore was hoisted to the top floor, also at the Parker Donglas mine and at another mine in Oldham.

MR. SAUNDERS—I have noticed in other countries failures in gold mining have occurred from too much haste to get out gold on the start. I believe that the first point is to raise money enough to open yonr mine, then your mine will guarantee further capilal for putting in plant.

MR. HAMPSON—My opinion is that a small good development plant should be erected at first in place of the large plants we usually see. I have seen plant which originally cost $82,000 standing idle for lack of material. It would be far better if the miners found out what they had underground before erecting such a costly plant. You can always carry water cheaper than you can carry ore, and I think Mr. Libbey is right to have the mill as close to the shaft as possible.

Delegates to the Federated Institute.

The following were elected delegates to the Federated Canadian Mining Institute :—

Major R. G. Leckie, Torbrook.
R. H. Brown, Sydney Mines.
John Hardman, Sc.B., M.E., Montreal.
Charles Fergie, M.E., Westville.

The meeting then adjourned.

Afternoon Session.

The members reassembled at three o'clock, the President in the chair.

The following papers, reproduced elsewhere in this month's REVIEW, were read :—

"The Gold Bearing Tailings of Nova Scotia," by Mr. F. H. Mason, F.C.S., Halifax.

"A Review of the Commission on Mine Fires in Pictou County. N.S.," by Henry S. Poole, M.E., A.R.S.M., Stellarton.

"The Mechanics of Mining," by D. W. Robb, M.E., Amherst.

"Mines and Mine Management," by Robt. Archibald, C.M.E., Joggins, N.S.

The meeting adjourned at half-past five o'clock.

Annual Dinner.

In the evening about thirty members sat down to an excellent dinner in the Halifax Hotel. The proceeding were entirely informal, only two toasts being given, viz, 'the Queen' and 'the health of the President,' both of which were loyally honored. Thereafter the evening was enjoyably spent, a number of excellent songs and instrumental selections being given. An amusing feature of the programme was

*See Gold Mining in the Southern Appalachian States. Vol. XXV Trans. Amer, inst. of M. E., also, pages 1024 and 1025 same vol.

the topical song by Mr. Ernie Wylde, containing the following verses relating to the Bill of the Canadian Society of Civil Engineers, and entitled:

"IN THE SWEET BYE-AND-BYE."

There's a certain affair the C. S. of C. E.,
May it roast in the sweet bye-and-bye,
They were after our dollars through a local M.P.,
And they'll wait till the sweet bye-and-bye;
Their recent bold effort to gobble us in
And make us all C.E's. was rather too thin,
I tell you they never will survey *our* tin,
Neither now, nor the sweet bye-and-bye!

And if they attempt to persist in their game,
Some day in the sweet bye and bye,
The C. I. of M. E. will attend to the same,
You bet, in the sweet bye-and-bye!
I just wonder how things would look in this light,
If we brought in a Bill to absorb them outright,
And arranged an exam. that would knock them out quite,
Would they kick—in the sweet bye and bye?

With all due respect to our Government here,
Both now and the sweet bye and bye,
We humbly suggest that they don't lend an ear
To such schemes in the sweet bye-and-bye;
For although a C.E. is all right, we admit,
And in planning a sewer may make quite a hit,
That his knowledge of mining is certainly *nil*
He will know in the sweet bye and bye.

British Columbia Association of Mining Engineers.

Elect Officers at their Annual Meeting and Desire Federation with the Canadian Mining Institute.

The adjourned annual general meeting of the members of the British Columbia Association of Mining Engineers was held in the Hotel Vancouver, Vancouver, on Saturday, 13th instant. There was a large attendance. Mr. J. F. Bledsoe, of Alberni, in the absence of the President, being called to the chair. After the transaction of routine business the following officers were elected for the ensuing year:—

President

Mr. S. M. Robins (New Vancouver C. M. & Land Co.) Nanaimo.

Vice-President:

A. H. Holdich (Hall Mines, Ltd.) Nelson.

Secretary.

G. F. Moncton, F.G.S., Vancouver.

Treasurer:

Col. T. H. Tracey, Vancouver.

Council.

Howard West, A.R.S.M., New Denver.
A. J. Colquhoun, M.E., Vancouver.
R. C. Campbell Johnston, Shoean Lake.
W. A. Carlyle, M.E., Victoria
W. A. McGregor, Nanaimo.
L. F. Warner, M.E., Quesnelle Forks.
John B. Hobson, M.E., Quesnelle Forks.
J. F. Bledsoe, Alberni.

A large number of new members, associates and students were elected.

An important resolution was moved by A. J. Colquhoun and carried unanimously to the effect that the Government be requested to open a mining record office for Burrard electorial district at Vancouver, to be bounded northward by a line to be selected by the Government, for which the north side of Queen Charlotte Sound was suggested. A strong feeling in favor of affiliation to the Federated Canadian Mining Institute was shown, it having been proposed by the latter body. New Denver was decided upon as the next place of meeting, on or about June 1st. The Association has now 65 members and is in a highly flourishing condition

MINING NOTES.

(FROM OUR OWN CORRESPONDENTS.)

Nova Scotia.

The month of February, during which our shores are generally ice-bound, has been quite an exception this year, the weather being fine and open and temperature higher than for many years. As a consequence there has been little hindrance to surface work and shipping has been an easy matter. The Dominion Coal Company shipped 25,000 tons from Louisburg which is fully vindicating its claim to be considered a winter port. So far the regularity of the shipments has enabled all the mines to keep going on narrow work without banking and in the interests of all concerned it is to be devoutly hoped that the last has been seen of this wasteful and costly system

Unfortunately the General Mining Association are not yet in a position to follow suit and they are busy piling up their usual winter's heap, but it is not likely that this will continue for long as nothing stands in the way of hoisting all the coal they require during the shipping season except a re-arrangement of their gear. We understand it is their intention to bank 50,000 tons, about the same as last year.

Rumours as to the closing of Victoria Mines are again ripe but probabilities seem to point the other way as instructions have been given to commence banking coal on the 1st March and to continue for two months. This does not indicate any disposition on the part of the Company to depart from their recent decision not to bank, but is understood to be a concession to the men who suffered so much last season in consequence of the break-down of the pumping appliances. As this is the only coal with which the Company can face the competition of their powerful neighbours—The G. M. A.—in certain markets where the Sydney Mines Coal is always asked for, we can hardly imagine that they will take the extreme course predicted and tamely surrender these markets.

Prospectors are preparing for a busy season as soon as the winter breaks up in the back-lands where recent discoveries and the proving of the Mullens seam have given quite an impetus to this class of work. Pressure has been brought to bear on the Provincial Government to purchase a Diamond drill and hire it out on reasonable terms to those who hold licenses to search. It is thought this will be done shortly.

The attitude of the N. S. Government on the tariff question is the topic of the hour which effectually dwarfs all others in interest for the coal mining community of this Province. The decision of the Republican Committee to support a 75c. duty comes as no surprise except to those who were fatuous enough to believe that a nation proverbial for "cuteness" were going to admit us free to a market which consumes 60,000,000 tons of bituminous coal a year in exchange for a roving commission over one that consumes less than 1,000,000 tons of soft Canadian Coal and already imports all its requirements of hard coal from the States. We are as anxious as anyone to see Nova Scotia coal capture the New England market and are satisfied that on its merits, and having regard to the geographical position of the mines, it is the natural market but as long as consumers are content to pay a tax in order to enrich the producers of their own country and appear to be indifferent as to the amount, the capture seems rather remote. Instead of preaching reciprocity it would be better to practice retaliation.

The success which has attended the use of Cape Breton coal at the works of the Light and Heat Co., Halifax, augurs well for future shipments of culm to the States, even under the non-prohibitive duty of 30c. Most excellent coke has been produced and when the whole of the plant is in operation the valuable bi-products will be recovered This will prelude the inauguration of Mr. H. M. Whitney's gigantic gas scheme in the State of Massachusetts.

Among the practical coal mining men the subject of explosives is exciting a great deal of attention just now, especially since the last Explosives Act was passed in Great Britain. This gives arbitrary power to the Secretary of State to exclude whatever explosives he thinks fit from a gaseous mine. It is evident that the trend of public and scientific opinion is in the direction of the total abolition of explosives from mines and although it may take a few years to effect this there is little doubt that it will come. Meanwhile "to be forewarned is to be fore armed" and every step voluntarily taken in that direction is a commendable one. Safety must be the first and last consideration.

Rossland District.

There has been considerable talk of various deals within the last month and it appears that the Rossland district is becoming very popular with the capitalists; especially English capitalists who now hold options on several of the well known properties. The Le Roi is under bond for a figure somewhere in the neighborhood of $4,000,000. An option was held on the Monita by James F. Wardner for a Montreal syndicate but was allowed to lapse. There is another deal pending on the same property and whether this sale will go through or not the next thirty days will show.

The Monita has a very fine showing of shipping ore. The rich War Eagle chute has been stoped out close to the Monita line.

There is an option on the Jumbo to run until April 1st. The purchase price is $502,000 The Jumbo is not shipping at present as no ore is taken out except that which is broken in the development work. A winze is now being sunk from the upper level and in this winze the ore is changing from a siliceous to a very basic one. However, siliceous ore has been found right from the surface as has the basic ore, so there is nothing peculiar in this change of character.

The Commander and Gertrude are under bond till Apoil 1st, the purchase price being $250.000 and $125,000 respectively. The Commander has a compressor and machinery plant and has sunk something over two hundred feet with a very favorable showing of ore in several places. The Gertrude has not been so extensively developed but is in a very good neighorhood,

The White Bear, an extension of the Black Bear, through which the Le Roi lead is supposed to run, has a very fine showing of ore at the bottom of the shaft at a depth of one hundred feet. There is a steam hoist at the shaft and two steam drills are being worked cross-cutting the vein.

The big forty drill compressor of the Le Roi has finally been built and put together; and on the 23rd February the great fly wheel revolved for the first time, amidst the blowing of the whistles. It is a very fine piece of machinery built by the Rand Drill Co. Canadian. The compressor valves are opened and closed mechanically, thus ensuring air at atmospheric pressure. The engine is a compound Corliss. The plant is situated on Black Bear ground somewhere about one thousand feet from the Le Roi shaft, and a tunnel is being driven from a point somewhere near the plant to meet this shaft. The compressor is not running any drills at present as several pipe connections have yet to be made.

Several towns of West Kootenay, grown weary of the paternal government apron strings have applied for incorporation as cities. Here-to-fore Kaslo alone possessed a mayor. Nelson and Rossland will now have this pleasure. The system of private and partial subscription, together with a lift from the Provincial Government, keeps places like Sandon in fairly presentable condition. But in no town in the District is the sanitation of much account. A heavy freshet from Cody Creek would very effectually scour out this latter town, which is another victim of townsite troubles.

During the first two months of this year the output of ore and matte from West Kootenay amounted in value to $1,410,913.

The mines shipped 4570 tons of ore worth $301,452, and 631 tons of copper matte worth $261,401, a total value of $562,853 during February, by port of Nelson. The value of January shipments was $675,506 by Port of Nelson, and $172,554 by Port of Revelstoke. At present the ore of the Slocan goes out by way of Kaslo, Kootenay Lake and the Nelson & Fort Shephard railway or by way of Nakusp and the main C. P. R. at Revelstoke. Approximately two to one in favour of the former route.

A discovery of metallic tin in granite is reported from the Nelson Division. This is prospector's testimony. The tin was a fact, where it came from remains to be proved, but the story appears probable enough.

The Exchange group has again been transferred by R. Campbell Johnston, to Sir James A. Grant. Cabins were built upon this group of claims last fall and some shaft sinking done. The Exchange has shipped a few tons of ore.

Many deals are mentioned in the papers. Several of them however fail to show up in the records, and so have not materialized.

The Arlington is again to be operated. This time probably as a joint stock company, in which Frank Watson of Rossland is interested. This property is six miles up Springer Creek, two miles N.W. of the Two Friends, two miles east of the Howard fraction group, and half a mile east of the Lilly-B. recently taken over principally by Evans Coleman and Evans of Vancouver, who are heavily interested in Slocan Lake properties.

A grand rush for the joint stocking of companies is taking place, in order to forestall limiting legislation, no less than 15 Vancouver companies being formed in one week in the latter part of February. Many of these have properties as fanciful as their names. They will relieve these people of cash, to whom money is useless. One good feature of the Slocan news papers is their conservativeness. There may be a radiant hue once in a while, but most of the statements are fairly true. There is not the weary repetition of "strikes" of ore in these papers. The Slocan ore has been struck and has stayed with us.

The rate at which professional men are coming into the country fully bears out the fact of over crowded professions. Doctors and lawyers are in on the "ground floor" hoping to earn a living and to speculate for a fortune. Hotels are crowded, they are by far the most numerous of any institutions, yet there are not enough. Nearly every place licensed to sell liquor has sleeping rooms for a good many people. The rates are not high for a mining country, usually $2,00 a day.

The Payne mine is making a high record of late, even excelling the Slocan Star in shipments. This is no fault of the latter mine, in which, by the way, there was a big cave-in the other day, above level No. 3. There is plenty of ore, but the mill and water capacities limit the daily output of concentrates.

The Hon. the late Minister of Finance is reported to have bought heavily in the Reco stock. This stock is held at $1.35, par value being $1 one million shares. A $100,000 dividend was declared recently. The mass of the stock is still held by Messrs. Harris, Kelly and the Whartons.

Campbell & McRae, brokers of Rossland, will probably put in an office at Slocan city this season, and become identified with Springer and Lemon Creek properties. There is a rush to this part of the country, and the usual town site tangle.

The charter mongers, water right sharks, and robbers generally, are being watched down at Victoria this session. One can hardly cut a stick in some parts now without an injunction being out against one. And they say down at the Coast, "we mustn't frighten capital away" and so obey the scriptural mandate "to him that hath (capital) shall be given" even half of this province.

Slocan City, 15th March, 1897. J. C. G.

New Denver.

A general feeling of relief passed over every one here when it was known that the United States' Alien Labor Bill had made its final exit from the stage of politics at the instance of Mr. Cleveland. It had been a serious bone of contention among mining men in the Kootenay from the date of its inception, and, generally speaking, the advocates of retaliation found themselves in the minority, However, since the burial, people have other and more congenial subjects to converse upon, and it is to be hoped that its silly provisions and the motives which prompted them, will be speedily forgotten amid the cosmopolitan character of everyday life in the West.

One of the troublesome things which almost all in the Kootenay have to contend with more or lsss, is the question of lawful right to town lots. Hardly a single town-site is free from difficulties in regard to absolute title ; first one and then another lays claim to the land, until the original ownership is entirely lost in the maze of conflicting interests. Such a state of affairs does much, of course, to retard settlement in the regions so affected, and respective claimants would in many cases show more foresight and business ability by compromising matters among themselves, instead of having recourse to tedious court proceedings, which I suppose in the long run may prove very effective, but are very often delayed until there is no further occasion for dispute. The Sandon trouble appears to have reached an acute stage, and pending final settlement in the matter, each individual is appropriating the right to such town lots as may suit his fancy.

Slocan City, although not quite in the same predicament, has yet been hampered in its growth by the unbusiness-like methods adopted by the owners of the town-site. Their want of discernment in the first instance led to the establishment of a rival own within half a mile of them, and at the present time lots are held at a figure so ridiculously out of all proportion to their value that it is bound to exert a most potent influence in the wrong direction on the future of the place.

Matters pertaining to legislation move only by degrees, but it is tolerably certain that something will be done, and that almost immediately, to check the absurd over-capitalization of stock companies in the Province. Company promoters die hard, and while Rossland appears to have reached its zenith in this respect, the Slocan is as yet in its infancy and offers an unsurpassed field tor the manipulating operations of these gentry. The excuse that the claims require from thirty to fifty thousand dollars expended on them before they can be expected to ship, is inapplicable here, because many, if not the majority, of claims that ever turn out to be worth anything at all, pay almost direct from the grass roots. The Slocan, unlike Trail Creek, is quite capable of getting along without the existence of stock companies, and it would certainly be better in the end to do so, than open the way to unscrupulous trading on its reputation.

We heartily endorse in this section any restrictive measures the Government may be pleased to consider in this matter, as the talk about retarding the development of the country by these means is sheer nonsense when applied to the silver producing districts.

The sum total of shipments continues to increase, as would naturally be expected with the Noble Five concentrator running to its full capacity. The Payne is worthily upholding its reputation of the last few months, and I can state authoritively that the owners recently refused an offer of a million dollars for the property, stating that it was not for sale.

While so much talking is being done regarding the erection of a smelter and refiner at Vancouver, private parties are not overlooking the possibilities of a paying concern of that kind being operated somewhere in the Slocan itself ; and it is stated that on account of its central location and admirable natural advantages, New Denver will probably be the spot selected. We shall be very pleased to see Vancouver blossom in the garb of a smelting centre, but we cannot afford to wait until the mines are worked out for them to come to our rescue. A lead furnace is being added to the smelter at Trail, which will undoubtedly capture a large portion of the Slocan output. It is rumored also that the establishment at Pilot Bay will in all probability soon be re-started. Let us hope so, it has been idle long enough, while thousands of tons of ore have been leaving the country for treatment. The more the merrier, says everyone here in regard to smelters.

The astonishing developments and continued shipments from the Payne have almost succeeded for the moment in relegating the famous Slocan Star to second place ; yet this great mine is as active as ever. The concentrator is working to perfection with the limited water available, although it is claimed that a considerable value is still lost in the tailings, which one would judge could be readily obviated by the introduction of more jigs. The immense size of the lead shows no diminuation, as is evidenced by the fact that a recent cave-in afforded 130 tons of clean ore and probably 300 tons more suitable for the mill. Another $50,000 dividend is announced to be paid at the end of the month, and with a plentiful water supply to run the concentrator, this will be further augumented at intervals during the year.

The Two Friends will declare a two and a-half per cent dividend on March 31st. Considering that this claim was bonded less than a year ago and that it was the merest prospect at the time, it speaks well for the care exercised in its management and the richness of the property.

The Rambler, in entering the list of dividend-payers, announces a disbursement of $20,000 to the fortunate shareholders some time this month. The condition of the mine would indicate a continuance on these same lines, which will do much for the other claims in that neighborhood.

The Arlington, famous for its native silver, is again to the fore and will be worked on very liberal lines. Since Mr. Finch relinquished the bond last October, steady development has been going on and now a Spokane company intend to introduce the requisite machinery and work it systematically, While very uncertain, it is likely to prove a veritable bonanza in the end.

Snow-slides and waggon-roads seem to be the order of the day at the present time. The former have not reached what may be termed their very busy season, but come down in a desultory sort of way at intervals, just to impress one with the unpleasant thought that they may be expected at any time. A little warmer weather and rawhiding will have to be discontinued from the mines situated low down, and the output will suffer correspondingly. It is to be hoped that mail facilities will not be interfered with to any great extent on account of slides, although it is too much to expect complete immunity from snch occurrences at this time of year.

The Goverment will have their hands full attending to all the requests for waggon-roads from this section, but substantial aid has already been promised towards the construction of one up Four-mile to tap the many rich properties in that vicinity, notably, the Fisher Maiden and Thompson group ; and it is probable that the claim owners on Springer Creek will be similarly favored ; but what is most urgently needed and what the people of the Slocan are determined to have is a connecting link in addition to the railway, between the two great divisions, the Sandon and Lake districts.

Petitions are now being circulated among the inhabitants praying for Government assistance in this matter, and considering the utility of such a road and the fact that private subscriptions to a considerable amount have already been collected, there can be nothing unreasonable in their demand.

Mr. Bostock was here a short while before returning to Ottawa, and became duly impressed with the needs and requirements of the district. He is looked upon as the right man in the right place and so far has done for his constituency all that could be expected since his return to Parliament.

The bonding of the California for over $60,000, referred to last month, was declared off at the last moment on account of disagreement among the owners, so that each retain their original interest,

Two days after the machinery was started, or in other words, on February 25th the Le Roi directors declared another dividend of $25,000.

The Centre Star tunnel is now over fifteen hundred feet long and is in very good ore near the Le Roi line. Connection will probably be made with the Le Roi. In fact such a connection should be compulsory, facilitating as it would the escape of miners in either mine in case of accident and at the same time materially assisting the ventilation. This tunnel at the face gains a depth of about 225 feet and runs about east and west. A cross-country tunnel has been driven from this main tunnel in a northerly direction and several ore bodies were encountered. On the largest of these north veins drifts were run both east and west and now a tunnel has been started from the surface to make connection with this east drift which will give the mine another working tunnel in Centre Star Gulch.

The Centre Star will probably never ship any ore from the camp and for the following reasons : the mine is a fine property and has several very large chutes of ores of different character. Some of this ore is very high grade ; some is very low grade ; some of it is very siliceous and some of it is very basic ; some of it runs very high in copper and some of it runs very high in iron. Then again there is considerable calcium in the ore both as calcite and as a silicate. Now, all this goes to show that the mine can produce a smelting mixture and it has always been the plan of the company to do its own smelting. Consequently no stopting has been done, all work being purely exploitation so that the large ore bodies when called upon will be able to produce steadily. The owners being men of ample means can afford to do this development work and large amount of dead work without looking for immediate returns ; but if their expectations are realized so that ore can be smelted the Centre Star is destined to be a great and wealthy mine ; as by building their own smelter the owners will have no freight and treatment charges to pay ; they will be able to make the high grade stuff help out the low grade and *vice versa* ; and the cost of treatment will probably not amount to more than three or four dollars. This with an output of 800 tons a day would mean a bonanza. Manager Durant expects to begin sinking a shaft very soon. This shaft will be put down five hundred feet.

The Deer Park after sinking one hundred feet and cross-cutting in a large body of pay ore suspended active development in order to thoroughly timber the shaft and install the hoisting plant. This work now being finished active development is ready to begin again and we should hear good news of the Deer Park before very long.

By far the most important discovery ever made in the camp was the result of the test on the low grade siliceous ore of the Le Roi. This ore contains a small percentage of iron and copper sulphides, the gaugue being a silicate of iron, alumina, magnesia and calcium with some free silica or quartz. Being too low in grade to ship, ten and one half tons were taken to the O. K. mill on March 5th to be treated for concentration. The ore was supposed to run $10, but a little sorting was evidently done in making up the load, for the mill samples taken from the feeders showed a value of $16.00. A thorough clean-up was made of the battery and plates, the rock was stamped and run over the plates before going to the vanners. The concentrates looked well and the tailings seemed fairly clean for such a brittle ore as pyrrhotite, but to the surprise of everybody, the plates began to frost and when at the end of the run a clean-up was made it was found that $6.40 per ton had been caught by amalgamation. This was truly remarkable as no one had dreamed of there being free milling gold in the rock and it will be difficult to over-estimate the importance of suce a discovery. The degree of concentration was six into one and the concentrates assayed 1·08 oz. gold, 2·98 oz. silver and 2·5 per cent copper, or a total value of about $25.00 per ton at smelter prices. There were $45.00 lost in the tailings or about $4.50 per ton of ore crushed. Even at this rate there opens up enormous possibilities for the camp as there are thousands of tons of such ore here ; but the test was made imperfectly for it takes a good millman and amalagmator to get a high extraction out of such heavy stuff in which the gold is very fine ; and in this test the vanners were much over-loaded showing that ten stamps were too many. The Le Roi people intended making another test very soon on a a lot of one hundred tons. This with the knowledge gained from the first test will prove conclusively exactly what can be done. The Le Roi already has 10,000 tons of this ore on its dump while the War Eagle has large quantities as well as the Centre Star, Monte Cristo, St. Elmo, Deer Park, and so on, by the dozen. All of this rock has heretofore been rejected as too low in value to pay for treatment, but now that we know it can be milled the possibilities of the camp are wide indeed.

The bill for the incorporation of Rossland has been passed, and provides that voters in all matters must be British subjects and for the first election, must have resided here at least three months. C. O. La Londe has been nominated for mayor. The exclusion of Americans from voting on municipal affairs seems hardly fair considering the large amount of property which they hold in and about town, still the Canadians can not be blamed for such a slight evidence of retaliation after the far from neighborly spirit evinced by the United States.

The Nest Egg has started work again and this time with air drills. The compressor arrived a short time ago and was lately put in place.

The I X L is continuing its cross cut tunnel. A pipe was lately laid from the O. K. compressor and now with two drills in the face rapid progress is being made. A shipment was made from the first vein cut and it is expected that the smelter returns will be above shipping value.

The Copper Queen, an extension of the Mayflower, has been bonded by the Eastern Mining Syndicate who are now sinking a shaft on the property under the direction of Mr. Fred Oliver, superintendent of the Monte Cristo and Mayflower. The showing ie good and very promising assays have been returned, the values lying mostly in silver and lead.

The region around Sophie Mt. has lately been coming to the front. This district is about one mile this side of the boundary line and from eight to ten miles from Rossland on Big Sheep Creek. Up to within the last few months no work had been done there. The best known claims are the Victory and the Triumph with a fraction between. This group is now owned and being developed by the Victory-Triumph Co. A shaft has been sunk on one of the claims and a drift tunnel is being driven on the other. The surface showing is very large and strong on the principal ledge, which may be traced over a thousand feet on the outcrop. The values lie principally in copper and silver. There is a cross ledge to this which carries no silver whatever the values being in gold and copper. The property is looking promising and if the ore can be concentrated will prove a rich property.

The Morning Star is ready to begin operations again which were suspended some time ago, because of the inflow of surface water. A shaft has been sunk 100 ft. and cross cut at the bottom with a handsome showing of ore though of low grade. This property has a very large ore body which is siliceous and otherwise similar to the Le Roi rock that was milled. If this proves to be a milling and concentrating proposition we will have another large mine in camp.

The Iron Horse has an air pipe from the Kootenay compressor and is running two drills and a hoist. The shaft is still sinking.

The Great Western has a force of men at work sinking on a large showing of low grade rock.

The Palo Alto is installing a pumping plant and as soon as the shaft is pumped out work will be resumed. Some very nice ore was exposed before work was suspended some two months ago.—G. O.

Boundary Creek.

The steam hoist recently purchased from the Jenckes Machine Co. has been installed at the Jewel, the shaft on which is now down over 100 feet. A Deane pump is being put in.

The Mother Lode tunnel is now in a little over 200 feet in good ore.

The Republic Mining Co. have started work again under the management of W. T. Smith. The work will be confined, until spring opens, to the Last Chance, the shaft on which will be continued to 100 feet.

A working bond has been given on the 'Ruby' for $12,000 to a Mr. Elliott of Ellensburg, Wash. It is an undeveloped deposit of copper pyrites.

A considerable quantity of coarse native silver is being encountered in the adit and the Boundary Creek M. & M. Co. are driving on the "D. A." vein.

The block of stock which the Brandon & Golden Crown Co. have put on the market is being rapidly taken up at 10 cents. Work will be started and vigorously pushed directly Spring opens.

At Camp McKinney a 4-drill compressor plant is being put in by the Cariboo M., M. & S. Co. It was manufactured by the Canadian Rand Drill Co. The ore they are now milling is rather richer in sulphurets than formerly, the concentrates being about 4 per cent.

At Fairview on the Morning Star the water has been taken out of the shafts and drifts, pending an examination by Messrs. Towers and Kendall, who it is said are representatives of the London and B. C. Gold Fields Co.

Work is proceeding regularly on the 'Joe Dandy' with 25 men.

We have received a prospectus of the International Co-operative Mining Co. of Portland, Oregon. capitalization $10,000,000, par value of shares $2,50, and shares sold only at par.

It is really worth the price of a small block of their stock just to read all the remarkable things they are going to do. They are so elaborately explicit too in explaining how and when and where the dividends are to be paid, that the pleasure of anticipation is something fine. They also give a dessertation on things in general, including a whole lot of gratuituous information about Rossland and Boundary Creek, incidentally mentioning the absolute certainty with which you can bank on your ore getting richer as it goes down. In addition to the prospectus, the company own, so they say, two extremely promising properties in Boundary Creek, out of which they probably intend to pay those dividends. Through some oversight no mention was made of the amount paid for these famous properties, which was, we happen to know ; $100 for one, and for the other a *bond* of $100, a few dollars down and the rest in 6 months. A descriptive report of the claims, furnished by an engineer here, after their purchase, was returned by this company as not being quite in keeping with the magnificent scale on which they intended to proceed, and the outline of another one suggested as 'sounding better.' Failing in this they were, in the description of their properties, thrown on their own resources, which are apparently ample.

Greenwood city, 15th March, 1897. H. A. G.

Slocan District.

At the present time of writing winter still holds the Slocan snow covered. Yet the summer visitors are pouring in from all over the Dominion, many of them coming to make their first start in business or prospecting, and many a fine wreck drifted in here to repair or sink out of sight. Most of the people now coming in are Canadians. These come by way of the main C. P. R. to Revelstoke. Revelstoke is the one gate way from the north into the Slocan. It should become an important place, if the eternal Townsite squabbles of this West Kootenay District don't paralyse it.

The whole interior branch system of the C. P. R. joins at Arrow Head on the Arrow Lakes and passes up the Columbia Valley to Revelstoke. And the C. P. R. system is reaching out in a most masterly style to capture the trade of Southern West Kootenay. Their fine line of steam boats travel up and down the Columbia and Arrow Lakes, the Kootenay Lake and Slocan Lake, whilst over land they have, the Arrow Head branch line from Revelstoke to Arrow Lakes, the Nakusp and Slocan railway from Arrow Lakes to Slocan Lakes and Sandon ; the Kootenay and Columbia railway from Robson on the Columbia to Nelson on Kootenay Lake, and the Slocan & Kootenay River railway from Slocan Lake, south to Nelson to Robson. This latter line will be soon built. Tenders for grading are to be in by 15th March.

If the same company get hold of the Lardo Trout Lake county, and the Crows Nest Pass railway, they will be pretty nearly almighty in this District. Yet the Northport & Rossland railway taps Rossland from the States. So also does the Nelson & Fort Shephard reach Nelson from Spokane.

Rossland people may boast of their gold, but what would they think of a recent sample from the Lemon Creek country in which no gold was visible on the exterior, but which was literally plastered inside and gave returns of over $5,500 to the ton. It would be good policy to keep our eye on that neighborhood, because in the light of recent developments it is more than probable that considerable gold is destined to be recovered from claims there located.

The Canadian Pacific Railway, although not always fully alive to the requirements of the district, have made a popular move in reducing the freight rates into the Kootenay and also lowering local passenger fares. That from New Denver to Sandon has recently been reduced from 60 cents to 45, and so on.

Although the winters are by no means severe around Slocan Lake, an unfortunate prospector, named Kerr, was detained in the mountains through the loss of his boat, until both of his feet were badly frozen and had to be partially amputated. This affords singularly convincing testimony of the unexpected dangers to which prospectors are exposed. What with snow-slides, falls of rock and the other dangers incidental to the calling, it is by no means all beer and skittles, and farmers in the east will do well not to envy too much those who are fortunate enough to make a stake under these disadvantages.

HOWARD WEST.

Nelson District.

Notwithstanding that we are now in the middle of March, the snow shows little sign of vanishing. If by accident one fine warm day makes a visible difference in the aspect of the ground, another snowfall will probably dash all our hopes of an early spring and leave us as far off any chances of prospecting as ever. And when it snows down in the valley and on the flat shores of the lake, we know very well what is going on in the hills, and can only sit down to curb our impatient spirits with the best grace we are able to find.

In spite, however, of all the inconveniences attending a British Columbia winter in the hills, an astonishing amount of work is being steadily performed in developing claims, and even in staking new ones. Many of these latter are undoubtedly nothing but guess work, and it is a little difficult to see how the locator can swear he found 'mineral in place' under 6 or 8 feet of snow, as the Act requires him to do; but it is possible that some men possess a happy elasticity of conscience to which their less favoured fellow men are strangers.

The most important discovery, if such it really proves to be, of the past month, has been finding metallic tin. The small shots of metal brought to your correspondent were without any doubt metallic tin, and the question naturally arises as to their origin. It is right to say that the prospector who brought the stuff in knew nothing of its character, but thought it was probably some compound of silver and gold or of mercury and gold as it was so soft, and was immensely astonished when informed it was tin. He claimed to have picked it out of some rotten granite on the surface of the ground, which is a very probable story, as tin (in the form of *tin stone* however) usually is found in such a matrix, but it does not seem quite easy to explain how it occurred in the metallic state. One quite possible theory is that the tin stone (which may be in very small quantity; I am waiting for further information) was reduced by the action of one of the innumerable forest fires so prevalent in this country, as there is certainly no great difficulty in obtaining the metal from its ore by means of carbonaceous matter. Again it may be possible that the metal actually exists as such, though that fact will require very careful investigation before mineralogists will accept it, the text books being unanimous in saying that tin does not occur in the native state. In any case it is a most interesting discovery and, if at all extensive, a very valuable one.

It may here be added to quell the doubts of scoffers, that the tin was not derived from the common or garden tin can, as there was absolutely no trace of head in it, though there seemed to be slight indications of arsenic. Your correspondent is most anxiously awaiting samples of the rock itself, and will certainly refer to the matter again when anything further is surely known.

The locality in which it was found is in the vicinity of the north fork of the Salmon, to which district reference was made last month, the name of the camp being the "Feeney Harrison Camp," on or close to Erie Mt. A great deal of work has been done all the winter in this district (North Fork) and it will be no cause for surprise if we hear of very rich finds being made; already there are well defined reports of good placer diggings there in some of the old creek beds now filled up with gravel and other debris.

Up to the end of February the total exports from themines of the district amounted to nearly $1,500,000, which may be considered at least a fair showing for two months' work, and may well induce the thoughtful capitalists to consider whether after all gold is the only thing that pays.

The Ainsworth camp is still improving; neglected prospects are being neglected no longer, and the town is once more attracting the attention of capitalists. Without detracting for a moment from the good character of other mines, it seems the Dellie is shewing very marked improvement, while the No. 1 is shipping a little ore regularly. As an additional proof of the interest lately awakened in this, one of the oldest camps on Kootenay Lake, we may say that it is proposed to build a large new hotel there, possibly in connection with the well known Hot Springs; as the accommodation now provided for travellers and visitors is barely sufficient.

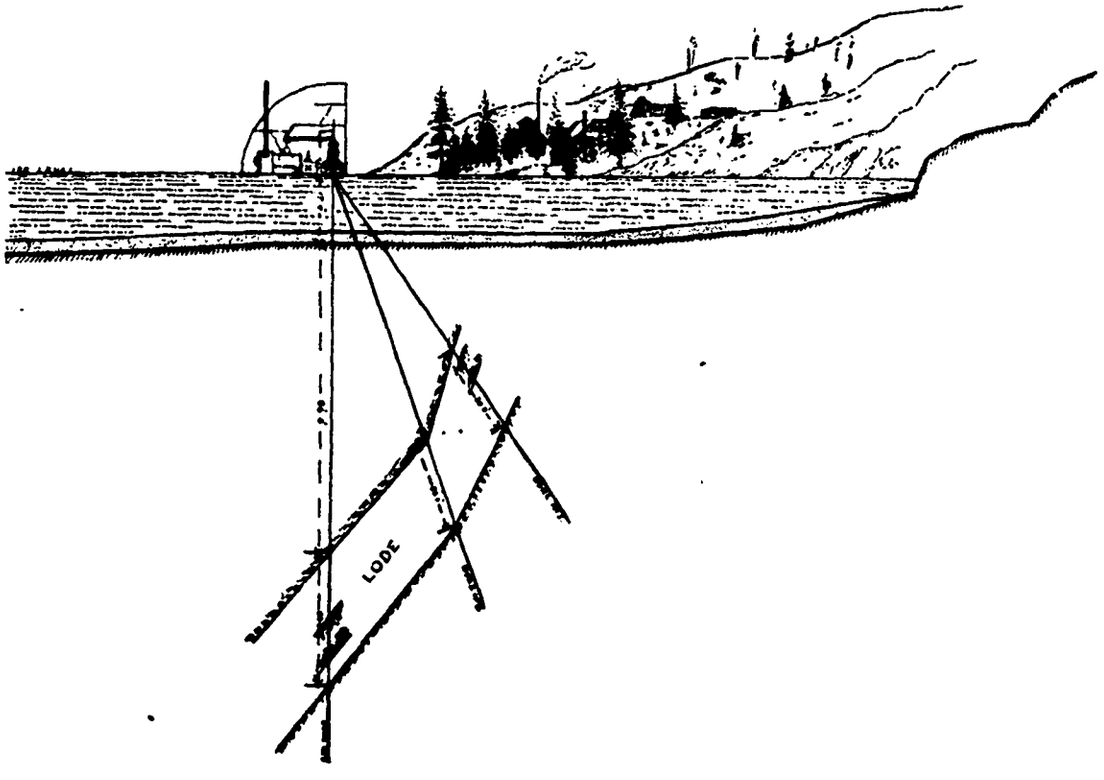
The great event in Nelson itself during the past month has been her incorporation, the Bill for which received the assent of Lieut. Gov. Dewdney on March 4th, Rossland and Grand Forks being incorporated also at the same time. The only noteworthy feature of the discussion in the House on the matter was the earnest but futile attempt of certain parties to secure the whole of the water that might be available for supplying the city in the immediate future, the present supply being totally inadequate, but this very laudable idea of making money easily was not permitted to become an accomplished fact, although the Provincial Government have been notoriously liberal in the grants of land and water that they have made to people full of promises to build wonderful railroads, etc.

Some properties on Toad Mt. and the vicinity have changed hands lately at good prices; we may mention the Ruby and Goodenough bonded by the locator G. H. Andrews to A. Rand for some $10,000 and another group known as the Delight group has been bonded by Messrs. McLeod to F. McLaughlin for some $45,000. A great deal of work has been done on both properties which have been held by the locators for some years.

Golden Lode Mining Co.—The Annual Meeting of the Golden Lode Mining Company was held on 30th instant at Halifax, when the following report on the year's operrtions was presented and adopted:

"Your direciors beg to lay before you the third annual report of the workings of yonr mine during the year 1896, and also the treasurer's financial statement for the year 1896, together with recommendations made by the manager for the future workings of the mine. This report, though brief, will, we trust, be sufficient to cover all points of interest to the shareholders.

"During the year the mine has been worked continuously and in a most satisfactory manner. Nothing has happened during that time to interfere with the work. The plant has given perfect satisfaction in all particulars. The men have, with a few exceptions, all worked for the best interests of the company, and by consulting the



Sketch showing position of the Sultana Lode under the Bay (Lake of the Woods, Ont.) as located by 3 Diamond Drill borings. The water location under which the above lode occurs is the property of the Barley Gold Mining Co., Ltd., of Ottawa.

time book it will be found that they have been the most industrious class of workmen. This fact no doubt is due somewhat to the confidence the men have in the company's ability to pay their wages when due.

During the year there has been added to the plant a new hoisting engine, which cost, set up and ready to run, about $1,200; also a new steam pump and a few other additions in the way of piping, tools, cables, cars, ore buckets, etc. During the year there has been mined and milled 376 tons of ore, from which 2,163¼ ounces of gold have been won, an average of about 5⅔ ounces per ton. Roughly speaking the total expenditure for mining, milling, increase of plant and all other charges for the year has been $21,640.81, while the receipts from the sale of gold amounted to $40,292.59, leaving us a profit on the year's operation of $18,649.78, or about 65 per cent. on the entire capital of the company. We are therefore quite confident that this most satisfactory showing will be fully appreciated by the shareholders.

During the year there have been declared ten monthly dividends of five dollars each per share. In November last the directors decided to cease paying dividends, carrying out the expression of the shareholders at the last annual meeting, which was that when the shareholders had each received in dividends the full par value of their shares, monthly dividends should be suspended. By this procedure much doubt had been created in the minds of some of the shareholders, as well as the public.

"The conditions now found in the mine are entirely changed. Instead of having a small vein of exceeding rich ore, which in the past has only been mined in small quantities, we have a large vein of ore, yielding from one to three ounces per ton. As a comparison, the pay streak formerly being only 45 feet in depth, while the top streak was from 12 to 14 feet; to-day the two streaks have come together and, increasing in depth as the work is prosecuted in the easterly direction, we find the ore body to be 125 feet in depth. In order therefore to work the mine in the future under the new conditions found it will be necessary to change the mode of operation if the same degree of success is expected. It will be necessary to drive a drift east from the bottom of the present incline a distance of about 200 feet, and at each 100 feet to drive upraises about 100 to 125 feet, also to carry down the incline 180 feet and drive another level from this point east, and to connect this level with the upper one with an other upraise of 100 feet. To do this work it will require from four to five months and an outlay of about $8,000. The value of ore to be won by this undertaking, based upon the present quality of the ore, would be about $100,000. The manager is confident that if this work is continued as outlined, richer and larger ore bodies will be found than have yet been encountered. He therefore strongly recommends the carrying on of this work along the lines laid down."

All the old officers of the company were re-elected.

BOUNDARY CREEK MINING AND MILLING COMPANY.

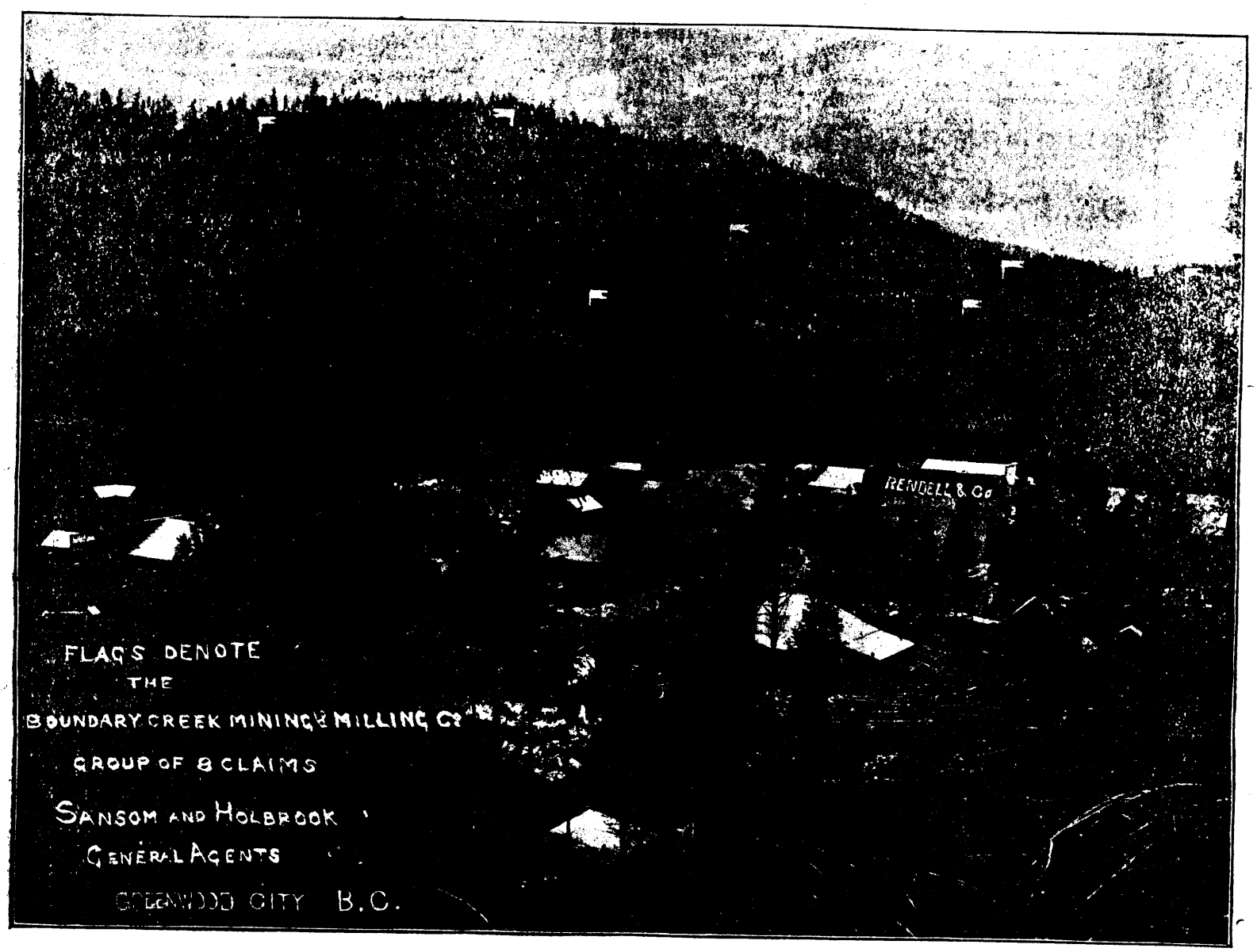
INCORPORATED OCTOBER 21st, 1896.

CAPITAL, $1,500,000. - - - - 1,500,000 Shares at $1.00 Per Share.

. . 700,000 Shares in the Treasury for Development. . .

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

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



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

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

A small shipment of 8,653 lbs. was made to the Everett Smelter in 1894, yielding per ton, gold $103.15; Silver 74-7-10 ozs.; Lead 2 per. cent. and a considerable amount of shipping ore is at present on the dumps of the different claims.

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

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

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

BOUNDARY CREEK MINING AND MILLING COMPANY,

SANSOM & HOLBROOK, - - - - Greenwood City, B C