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The Canadian Mining Review

Established 1882

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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 & Rentals moderate

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes, of Mines and Minerals Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six 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. Up to ten areas the cost is 50 cents per area, for every area in addition in same application 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 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 ease 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 $19.00 an ounce, and in smelted Gold valued at $18.00 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 th Province he may stake out the boundaries of the area he desires to obtain, and ths 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 twelve months are issued, at a cost of twenty dollars, for Minerals other than Gold and Silver, out of which one square mile can be selected or 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 free of charge, 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, 7½ cents on every ton sold.

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

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

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX

NOVA SCOTIA.

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Special Notice to Subscribers.

In response to the requests of many readers of the REVIEW, particularly from those resident in the mining districts, who find it very inconvenient to remit the odd amount of our present subscription price, we have to announce that henceforth the rate per annum per copy of the REVIEW will be two dollars instead of one dollar and fifty cents as heretofore. All subscriptions, therefore, falling due on and after the 1st August next will be charged at two dollars. This change will not affect members of clubs and associations subscribing to the REVIEW under agreement. In view of the permanent enlargement of the REVIEW, and the many new and improved features which have recently been made, and are still further contemplated, we trust that all our readers will heartily coincide with this arrangement.

The Ontario Mining Operations Act.

The people of Ontario are acting wisely on the principle that prevention is better than cure. Although as yet this province is not prominent for mining, there can be no doubt that its progress in this line will be rapid, as research opens newer and more valuable deposits. An Act of this nature introduced now will work the more easily in the future, when those investing in or working ores find that there is an Act regulating their mining, already cheerfully acquiesced in by their predecessors. The Report of the Commission recently published shows that there is a wide and varied mineral field, that Government aid is needed, and that every effort should be made to attract domestic and foreign capital.

The Act passed last Session, and relating to the working of mines, is based on the British Act of 1872. The new English Coal Mines Act, which came into force January 1st, 1888, would have afforded several valuable suggestions to those engaged in framing this Act. The definition of the term machinery, which is made to include tools, is, when taken in connection with the section in the general rules requiring the fencing of dangerous parts of machinery, rather cumbersome. The fixing of the age of first employment of boys at fifteen is a good plan in the case of metal mines, but there can be no valid reason why women should not be employed at the lighter surface work. Attempts were recently made in England to prohibit women's work above ground, and the matter was fully discussed, but the latest Act makes provision for their employment, the regulation of the conditions accompanying their work being, it is believed, subject to the Factories Act. In this connection it may be remarked that women would be precluded from undertakihg any clerical work about a mine.

Section 10, subsection 2, says that a mine owner may make return of the amounts and value of the mineral raised or sold every year. As under the census and other laws power is given to compel such returns it seems a pity that the rule adopted in some countries of making such returns compulsory could not have been adopted. Experience has shown that producers of raw or manufactured articles are ready to give details of their work if they find that they are legally required, and have an assurance that their returns will not appear, and will only form an unseen item in a total. The importance of exhaustive and correct mineral returns is nowhere better recognised than in the United States, whose Geological Survey has for the past eight years issued most valuable and interesting mineral statistical reports. If there were in Canada a law compelling such returns the Canadian Geological Survey statistical report would show an increase of twenty per cent. in a year—in amounts and values. The Ontario Government would find a greater profit in such returns than in compelling mine agents to keep registers of names, ages, residences, etc., of boys, when the crucial point, their ages, cannot be in many cases tested or proved.

Section 11 requires that a personal injury from "powder" should be reported. It would have been better in framing an Act for Ontario, where presumably high grade explosives would be largely used, to have adopted the wording of the latest English Act, and to have used the words "any explosive," as the 2nd sub-section would seem to point to the accidents not arising from explosions.

Section 12, subsection 1, would similarly have been improved by adding the words "or for a new deposit at such mine," and under the wording of the Act any mine not worked by a shaft is not required to give notices under subsections 1, 2, 3. The use of a sign board to warn people against abandoned shafts is a good one, but the alternative of "fencing" is better for cattle, and in the dark.

Under section 15 the inspector is given power when he considers any matter, thing, or practice about a mine dangerous or defective to require it to be remedied. In England the law on this point recognizes the fact that within the bounds of permissible mining there are wide divergencies of practice, and that custom, impelled by necessity or competition, had adopted systems of mining and of treating ores, which, if open to condemnation on broad principles, are safely carried on by the exercise of skill and attention. In order, therefore, to secure the skill of the individual operator, the English law allows him an arbitration whenever he is called upon by an inspector to make a change that appears unreasonable to him. It will probably not be long before the Ontario inspectors meet mining engineers, who will kick vigorously against the exercise of so potent an authority as this, which might often call for changes involving heavy expenditures.

Under section 2 of the general rules experience has shown that the storing of any quantity of explosive in the mine is objectionable, and impartial observers fail to see how the Minister of Agriculture can pronounce iron or steel prickers safe in one mine and dangerous in another, in view of the fact that even copper has been found to ignite charges. It would be advisable to forbid the unramming of high explosives as well as of powder, and in all cases it is better to leave a lost charge and drill a new hole close to it, as ordered in the English Act of 1888.

Apart from these criticisms which are offered in a friendly spirit, as the earth below is a common heritage as well as the sea, the Act is a good attempt at meeting the dangers which are often forced upon the miner by the greed or ignorance of his employer. The miners themselves should study the Act and bring to the notice of the Department any infringements, and when these charges are made clearly and properly and not maliciously, no doubt prompt attention will be given to them. The responsibility of the miner in regard to his own life and the safety of his comrades should be borne in mind, and it would not be amiss to have in the Act provision for special rules for the workmen and firemen so that they can clearly understand their liability and duties.

The Act is a much more creditable production than the first attempts at mining legislation in the United States, and the Ontario Government having made so good a start will no doubt see that it is carried out to the benefit of both miner and capitalist.

The Springhill Strike.

The collieries owned and operated by the Cumberland Railway and Coal Company at Springhill are at present idle, the men having gone out on strike during the latter end of last month. The men demand that the system of not counting a box with stone in it shall be discontinued, and that a certain scale of dockage should be laid down based on the percentage of stone in the coal. The statement of the men is submitted to the public as follows:

"In the month of January last there were 542 boxes of coal docked, about 450 boxes for February and the same number for March. This was at one slope alone. An equal number nearly was docked at each of the other two slopes, the value of which was $1,614. For those three months, or in one year at the above figures, the coal cutters of Springhill would be robbed of $6,556. Pioneer Lodge, representing a large majority of the workmen of Springhill, interviewed the manager and general manager and tried to have the matter adjusted.

After four or five weeks continuous running without any satisfaction, it was decided on the

17th of June to give the general manager until 21st June to make redress of the grievance. The committee waited on him on the latter date, and for his final answer were treated to the remark, 'The men have got all the satisfaction they ever will get." The committee reported the result of this interview to the Lodge on Saturday evening, 21st June. It was then decided that Mr. Cowans be notified that the men would suffer to be locked out until the grievance was redressed.

It may seem strange that coal should be sent up with stone in it, or boxes sent up not quite full, but when it is made known that, in some cases, men work places where the stone band is from 15 to 31 inches thick, get no consideration for cutting this stone, and only receive 27 cts. per box containing 1,700 to 1,900 pounds of coal, the public will say, surely, 'Little wonder if some small pieces escape detection in the dark mine.' The stone that escapes is composed of small pieces only. It can be proven that boxes have been docked because they contained a piece of stone no bigger than a man's hand. When the public further consider that a number of the worst places are worked with 'close' lights, they will conclude that the men have a substantial grievance and that something should be had for handling so much stone, which is among the coal. This stone, in many cases is not in one part of the seam only, but in four or five different places. For instance, there are 14 inches of stone in the middle of the seam; 3 to 9 inches about a foot above that, on the top about 7 inches, and a foot from the bottom there are from 2 to 6 inches more. All of this stone breaks up into minute pieces which the miner is expected to pick out and stow away for nothing, while digging and filling his coal for the small sum of 27 cts. per box said to hold 1,650 lbs., but actually holding 1,700 to 1,900 lbs. All that the men asked of the manager was that he would not dock boxes unless they contained, at least, 28 lbs. of stone. For that weight the men were willing to be fined 20 cts., and to forfeit the box wholly if 50 lbs. were found, but they were not willing to lose a box because one or two pounds of stone had been detected in it. In reference to docking for short weight, the men did not consider it right that a box should be docked without being weighed. If weighed and found to be short of the standard (1,650) they were willing to allow a deduction for shortage. To this as to the other, the general manager would not listen. He said he would do nothing other than he was doing. He reserved the right to dock at his good pleasure."

The claims of the men are, to a large extent, fair and reasonable, and a good deal of sympathy is expressed for them in their determined stand. The case seems to us to be a fit one for arbitration under the recent legislation of the Mines Department.

In the meantime the shortage in the deliveries of coal is causing some inconvenience to consumers in the Upper Provinces. Many of the miners have left Springhill and are finding employment at the other mines.

Our Iron Interests in Ontario; Another View of the Report.

"The history of the iron industry in Great Britain," says the preface to the Report, "proves conclusively that its growth and prosperity have depended upon a knowledge of methods and processes." So much being known to the Commission, the assistance of practical knowledge of methods and processes should have been sought to aid in the preparation of useful information people will naturally turn to the Report for, and will seek in vain. While the book is evidence of great industry, the arrangement all that could be desired and the introductory geological portion clear and concise, it is to be regretted that straightforward dealing with the Report in the interests of iron mining and manufacture will very plainly expose a few important omissions. Something less of ancient history and of political criticism, and something more of scientific information would have been commendable. It is always well to remember that over past events the immortal gods have no control; and that criticism which ends in pointing to what should have been but has not been done is of little value to mortals in these worrying days when men need to direct all their minds to know what should be done and how best to do it. The geological member of the Commission tells us, in his part of the book, that "the iron mines of Eastern Ontario" are treated in "another part of the report," but search is fruitless for a comprehensive sketch of the geological features and lithological characteristics of Eastern Ontario. The Commission found but one iron mine in operation, but it would have been matter of easy exploration among the mines for samples, and of easy research among the American furnace records where Ontario ores have been used, to have obtained from these sources authoritative analyses of the iron ores of the province. Without this the estimates of working expenses and cost of production given in the report are crude and unsatisfactory. The computations of cost of iron smelting deal with the magnetic ores of the region between Hastings and Haliburton, and curiously differ very widely in the cost of ore :—

	Marmora.	Madoc.	Kinmount.	Snowdon (1).	Snowdon (2).	Howland.	Grhauser's estimate.
Tons of ore	2	2	2.25	1.75	2	2	1.66
Cost .....$	4	3	6.89	1.80	5	2.33	8.17

The English syndicate or American capitalists whom fancy sees likely to descend upon the country at any moment in quest of knowledge where they may best invest in iron smelting, will naturally be surprised to find that in the same ore region the cost of ore at the furnace will range from $1.16 to $5 a ton. If this should be matter of indifference to men usually so lavish of money and ignorant of business, it is reasonable to suppose they will be utterly unconcerned to know what and where ores may be found suitable for foundry iron, or for a car wheel mixture, or for special lines of steel. The report will not burden them with any information under this head. Lest it should be thought, however, that the criticism of the *Review* is altogether destructive, unstinted praise is accorded to the generous and faithful treatment of the subject of charcoal iron. A careful perusal of the Report should satisfy anybody that this manufacture should no longer await foreign capital for the enterprise. But the *Review* has not found in the Report any comment upon the preposterous misapplication of the bounty and protection offered the iron smelter which will happen if forty per cent. of the bonus be given to the American manufacturer of coke when a better native fuel is obtainable. The record of the Hinckle charcoal furnace at Ashland, built to smelt 80 tons a day and now giving on very moderate fuel consumption 125 tons a day, is proof that in the United States dense magnetite ores can be smelted as cheaply as with coke, while the iron brings a better price. The irregularities of fuel supply so often cited against the charcoal interest have been many times of late far exceeded through the operations of striking coke burners and the combination of coke syndicates. The advance in the price of coal the world over will also go far to reduce the advantage heretofore enjoyed by the foreign iron-maker.

On the preparation of magnetic ores for the furnace, the Commission remark that a quotation from Mr. Birkenbine recommending the "thorough roasting of magnetites" "applies more particularly to the mines on the Quebec side of the river." In Swedish practise all magnetites are roasted without exception. There is nothing in the report to warrant this comment of the Commission, nothing whatever to show that Ontario ores of this class should not be so treated. There was quite enough mention of sulphurous ore to the Commission to have prompted a more extended inquiry into the best treatment. The superior value of iron made from roasted ore and the wide extent of the practice in European metallurgy concur in recommending the roasting kiln. The oxydation attained in the kiln not only facilitates the reduction of the metal but the combinations in which sulphur is liberated. The Magnetic Separator may displace the jig in the concentration of lean ore, but will never serve the purpose attained by roasting, and it remains very doubtful if as a desulphurizer it is as economical. Magnetic separation is as yet a modern experiment: roasting iron ore has been advantageously followed for centuries.

On the subject of "the influence of commercial conditions upon mining industry" it would be strange indeed if the Commission had not a theory to offer. Their views on this subject, it may be premised without offence, are not likely to lead to any practical result. It takes a lot of talk and discussion to change commercial conditions. They are generally too organic in origin to yield to rhetoric. The largest users of iron ore in the United States are opposed to removal of the duty on foreign ore. Their interests in American mines, in making steel rails for mineral railways, in building steel ships for transporting ore, are greater than their interests in Canadian mines. The removal of the duty would not cheapen ore one cent a ton. Ore of uniform quality can be mined, shipped and brought across the Atlantic from Spain or Norway to Philadelphia or Baltimore for less money than it costs to put down Ontario ore in Cleveland. So far from commercial conditions having operated against the iron mining industry, it would seem they have been extraordinarily favourable. Thirty years ago very good ore was mined in Lanark and shipped to the United States. The existence of iron ore in various parts of Frontenac was known. The Lake Superior mines had not been opened. There was no fleet on that lake, but there was a considerable fleet on Lake Ontario. The demand for Canadian ore was met by supplies of waggon loads. The writer has a letter dated 25 years ago from a furnace owner asking for a cargo of ore from a mine from which a sample of 50 tons was taken. The mine was offered for sale in reply, and is for sale by the same owner to-day. A few years passed and Americans made some purchases of Ontario iron mines at prices which, in view of all the conditions, were simply enormous. Railroads were built, in certain instances largely with public money, but the miner paid the topmost charges for freight and shipment. The ores raised were of variable character, now excellent beyond all comparison, again carrying 1½ to 4 per cent. of sulphur, sometimes titaniferous. The miners were neither sparing of capital nor enterprise. In fact, in many cases had they gone slower and worked with more economy the outcome would have been different. But the result must be chronicled, that many American investors have lost large sums in Ontario iron mines from causes which have had no connection whatever with commercial conditions. The lack of native enterprise and lack of liberal dealing in providing facilities for cheap transportation, the extravagant prices at which ore properties have been held, the variable character of Ontario ores, and the inability of mining captains to reach a regular daily output, have all operated to hinder the progress of iron mining in Eastern Ontario. Add to all this that labour has been relatively high-priced for some years past, and it will be seen that the American tariff has had little effect upon the value of the few thousands of tons of iron ore sent to the United States.

The Commission do not appear to have realized that this low condition of the iron mining industry has been largely due to causes within the power of the business people concerned to remove; but owing to the lack of exertion at the proper time, while the development of mines elsewhere hastened on, the result has come about that from Eastern Ontario at least it is not likely there will be any remarkable demand for iron ore. The investments of American capital in this region have been profitless in the extreme, while the demand for capital for opening new mines in West Virginia and North Carolina is likely to be active for a long period. The large iron formation on the Canadian side of the boundary line in the Lake Superior region will no doubt bring in the usual speculative immigrant who will buy up valuable property at an insignificant price and then put forth every effort to get a railway built at the cost of the Province for the transportion of the ore. At this stage the property will be likely to find buyers among the class who have supplied the first comer with means, and the future course of the enterprise will depend on the quality and supply of the ore, cost of mining and transportation. It is difficult to see what benefit will accrue to the Province from this course of dealing, and in this connection the views of the Commission on mineral and laws come up for consideration. Every mineral calls for legislation suited to the exigencies of its natural conditions. A unform land law for gold and iron mines is as absurd a production as uniform leases of such property. A prospector with a ten dollar dipping needle and a polled pick travels a few days through a wild region and discovers a large iron deposit. His adventures have not been perilous or otherwise remarkable, save the encounter with black flies and mosquitos, to which the Commission do not fail to refer. He buys 80 acres at $1 an acre, and before getting his patent has expended for surveys, law fees and other expense as much more. He himself would not be able to earn at another business more than $100 to $200 during the time occupied in his discovery. The total cost of his discovery is about $400. It is talked of in bar rooms and whispered about in the offices of mineral land agents, and other lots on the same "lead" are speedily taken up by speculators. There is no demand in the Province or out of it for this iron ore. The supply offered by the great American mines is ample and apparently inexhaustible. The price is not considered excessive, although some of the companies have declared dividends ranging from 30 to 100 per cent. a year. Before a ton of the mineral, in the instance presented, can be sold the people of this Province must put their hands in their pockets and build railroad docks and chutes perhaps, or largely help to do so by a liberal bonus. If the ore is not smelted here who will get the benefit of all this liberality? If, with all the facilities we offer, ore is put down in an American port cheaper than American ores, the advantage is either to the American furnace owner or the American people at large. If we want a chance to work the dollars of our surplus into profit producing factors the common school arithmetic of the country is at fault if a better method cannot be found than that outlined, and for the maintenance of which the Commission are apologists. The case supposed as an illustration of the present law is an 80-acre location in which is a large iron mine. It may contain a million of tons of good magnetic ore. Let us suppose that to facilitate developments we offer iron bearing territory at 15 cents a ton royalty for any quantity up to half a million of tons, and 25 cents a ton beyond that. The property will yield the province $200,000, in return for which the Province may be properly called upon to aid in the development of this and similar sources of revenue. But that is not the American system, say the Commission. Well, if the American system is one of public spoliation, what then? The Michigan, Minnesota and Wisconsin mines are giving an output of ten millions tons a year. The history of their development proves that they should be yielding to these States a royalty of 25 cents a ton, or $2,500,000 a year. Here are some prices of North-Western Iron Company stocks in a dull market :—

	Par.	Buyer.
Ashland Iron Company	$25	$55
Champion "	25	90
Chandler "	25	37
Jackson "	25	110
Lake Superior "	25	67
Norrie "	25	70
Pittsburg Lake Angeline Co.	25	170
Republic "	25	43

The Commission have faithfully given the opinions of eminent experts in favour of an impartial system of education applied to popular needs, and have as faithfully reported in favour of a partial system of education adapted to a non-industrial class, and applied so as to further a theory of educational centralization, rather than the development of the mining and industrial interests of the country. The Commission quote the opinion of Sir J. Lowthian Bell, the greatest authority of the day on the metallurgy of iron and steel, and an "iron king" also, that "as in France and Belgium a much better purpose would be served by establishing technical schools throughout the country, and that every industrial district has a preferential claim to London." But, say the Commission, "the circumstances of England and Ontario are widely different." Certainly they are not different in the fact that there are industrial districts distant from the metropolitan centre, and the industry under consideration is mining and metullurgical industry, which should always work together under favouring natural conditions. The education necessary to further in dustry, says Sir Lowthian Bell, and all others

whose knowledge enables them to speak with authority, must be given where it is required. To this the Commission can only reply, in illogical phrase, "One school well equipped would serve our present need, and nowhere else could it be so economically established as in connection with the practical "science department of the State University." This conclusion immediately follows the statement that "we have few trained men to fill any place requiring superior skill, either in mining or smelting or metallurgical works." Here is precisely the defect in the industrial condition of this country. No man in his senses, no company having any regard for dividends, will commit an industrial enterprise in which special technical knowledge of methods and processes is requisite, to the management of the graduate of any technical or practical school. Further training is necessary, and the mere student of practical or applied science must seek this in another country, where, if he displays any special aptitude, he is very likely to remain, especially if his own interest lies in so doing. This is the state of things now going on, and which it is sought to perpetuate in a worse form than ever. The most expensive production in this country is its young men whose education at enormous expense to the community is brought up to a point where it is of no use to the public or the possessors unless supplemented by employment we cannot offer or further training we cannot give. The expatriation of such is constantly going on, and it is no figure of speech that it is a drain upon the resources of this country greater than the whole burthen of taxation. Now, what remedy do the Commission propose for this state of things? None whatever. In a lecture delivered at University College, London, in December last by Dr. Wright on the subject of scientific investigation as applied to the manufacture of iron and steel, he declares that "applied science must be learned in the factory," where the student must acquire "the faculty of reducing to manufacturing processes the small scale operations of the scientific laboratory; to devise means for utilizing waste products in other directions, and in short to solve the varied problems that are continually cropping up in every industrial factory (and especially so at a blast furnace) upon the successful solution of which depends the possibility of the commercial success of one works as compared with another, or of one country as compared with another." Lack of space forbids further extract from this important lecture. It remains only that reference be made to the foundation of the modern Belgian iron and steel industry, which was in a languishing condition until that the King in 1823 invited Mr. Cockerill, an English iron master, to settle near Liege, and assisted him in the erection of iron works on condition that the iron masters of the country should be permitted to learn from him the true principles and latest improvements in the art. The result was the foundation of the works of the great Cockerill company at Seraing, one of the most perfect establishments in all Europe. The evidence taken by the Commission together with this striking illustration of "the direct process" should have prompted them to recommend the construction by the government of a ten ton furnace in a locality where hydraulic power, charcoal fuel, and variety of iron ores would afford natural conditions favourable to success. A small Bessemer converter, open hearth furnace roasting kilns, magnetic separator and other plant for treating ores and manufacturing iron and steel by every approved process should accompany the blast furnace. The whole plant could be erected with a laboratory and necessary buildings for managers, lectures and workmen for $100,000. It could be run for five years at a cost within $100,000, with the result that we should have before the end of that period a trained body of furnace managers and a number of skilled workmen capable of applying in the language of the Commission, the "knowledge of methods and processes" to the reduction of the iron ores of Ontario and the manufacture of iron and steel. The works could then be sold, leased or maintained for the further education of young men as the experience gained would dictate. That any private concern entering into the untried field of iron and steel manufactures in this country will meet with problems it would be desirable to solve but which prudence will avoid, is evident; that the solution of others will be attempted to which experience worthless or profitable can only give the answer is also evident, but the result in any event will in all probability be concealed. What the country requires is knowledge and skill competent to guide its energies and develop its resources. The end can be attained only in the mode here suggested so far as the iron industry is concerned, but those interested in other lines of mineral development advance their particular views. It will be found that the industry whose interests are here advocated will lead, and if well directed largely assist the development of all others.

The Phosphate Corporation, Limited

The Phosphate Trust, to which some reference has been made in these columns, has at last materialized, and that, too, if we may judge from reports, in an eminently successful degree. From the prospectus we find on the Board of Directors the Rt. Hon. Lord Stalbridge, Sir James Whitehead, Bart., Sir Jacob Wilson, Sir George S. Baden-Powell, Hon. Cecil T. Parker, Sampson S. Lloyd, H. Mallaby-Deely, all men of high social status, of good commercial standing, and of excellent business capacity. The list of Founders is also a notable one. It is headed by the Duke ot Westminster, who is followed by the Duke of Richmond and Gordon, the Duke of Portland, the Duke of Sutherland, and the Duke of Fife. These five dukes are succeeded by a marquis, two earls, six barons, and the Prince Camille de Polignac. Then come a number of other familiar names such as that of Sir James Whitehead, Mr. Mundella, M.P., Mr. Sampson S. Lloyd, etc., etc. Among other prominent Canadians whose names appear on the list we observe that of the Hon. C. C. Colby, Hon. J. J. C. Abbott, and Mr. Sandford Fleming. The capital is £1,000,000 sterling in £10 shares, whereof 500 are founders' shares, the respective holders of which, in respect of each share, shall, in addition to paying up the nominal amount of such share, apply for and take at least fifty ordinary shares, and pay the sum of £20 in respect of each Founder's share taken by him towards expenses antecedent to allotment. The idea upon which the General Phosphate Corporation is based is an excellent one. It proposes to buy well-selected phosphate properties in Canada and elsewhere, and to work and develop them. There are in the Dominion immense areas of rich phosphate lands, which only await the well-directed infusion of capital, and capable experienced management to amply repay investment. There are, on the other hand, many worthless properties, and many fairly good ones which are offered to the public, and will probably be offered to the Corporation, at prices enormously in excess of their actual worth, and which at once preclude any chance of a profitable return. In the original draft prospectus of this Corporation were included a number of such properties, puffed up with inflated estimates by a few so-called experts. At the time we strongly condemned any such basis for the foundation of any important syndicate seeking a solid return for their money. If the Corporation is to be a success it must carefully discriminate and closely investigate the properties which will be submitted to it for purchase; and when good properties have been secured, it must see to it that they are capably worked by men experienced in the best and most economical methods of working the mineral. If this is done the success of the Corporation is assured, and its efforts will prove an immense boon to the country in promoting and stimulating the development of similar enterprises.

Algoma Iron Region.—A Winnipeg despatch says:—A number of St. Paul gentlemen who have been prospecting in Western Algoma are here, *en route* home. They state that the iron prospects along the Minnesota boundary on the Canada side were remarkably good. The district was recently visited by the Assistant State Geologist of Minnesota and a Philadelphia expert. They were immensely pleased with the whole iron district tributary to the Port Arthur, Duluth & Western Railway. An iron expert has examined some of the locations which the Kingston & Pembroke Mining Co. are said to contemplate buying, and was much impressed with the outcroppings on the Minnesota side. All the American mining companies contemplate active mining work as soon as the railway reaches the boundary. As their output has to be shipped in bond *via* Port Arthur, several strong companies have been organized. On the Atikokan range claims have recently been located, and exploratory work done. One bed of ore has been uncovered, and shows a width of 46 feet of ore, which is magnetic, free from sulphur, phosphorus or titanium, and will average 68 per cent. of metallic iron.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. IV.

Mr. Archibald Dick, of Nanaimo, B.C., Inspector of Mines of British Columbia.

Mr. Archibald Dick, the Inspector of Mines for British Columbia, resides in the City of Nanaimo, Vancouver Island, B.C.; he was born near Kilmarnock, Ayrshire, on the 25th December, 1841; his father was Mr. James Dick, of that place, his mother Sarah Muir, daughter of Mr. John Muir, of Quarter, near Hamilton, Lanarkshire, Scotland. Mr. Archibald Dick accompanied his parents and their family, who left in 1865, to Vancouver Island, where his mother's brother, Mr. John Muir, and his family had long been settled. As the Muir branch of the family is largely represented in Nova Scotia, as well as in British Columbia and other parts, it will be interesting to make a few characteristic quotations from the History of British Columbia, where the venerable historian, Bancroft, relates that in Vancouver Island "Fort "building was still in progress when the "Scotchman Muir, with wife, daughters "and sons, arrived at Fort Rupert. "Among them was Michael, born at Kil- "marnock in 1840. A shaft to the depth "of ninety feet (subsequently deepened "to 120 feet) was sunk by the Muirs, who "after further examination pronounced "the seam too small to be workable. "Troubles arose with the natives, who de- "manded pay for the land or its product; "and when the white men refused, the "savages surrounded the pit, threatening "to kill all present should they persist in "their robbery. Prospects were better at "Nanaimo, and thither, in the spring of "1851, Muir proceeded with all his men "and mining machinery, leaving Fort Ru- "pert in possession of the traders only. "Muir arrived at Nanaimo with the men and "machinery. The steamer 'Otter' brought "them thither, and Governor Douglas (after "wards Sir James Douglas) met them there. "The machinery was landed and set up, and "measures adopted for defence. Muir's force "was small, and should the natives grow jealous "or mercenary, as at Fort Rupert, they could "do but little that year; nevertheless they pro- "spected and dug heartily, wasting no time." Thus first opening and starting the coal mines at Vancouver Island which have been so successful and famous since.

Mr. Archibald Dick, on his arrival at Nanaimo, was an experienced and capable miner, in the true sense of the term; and at once found scope for his energies in the mines of the Vancouver Coal Mining and Land Co. (Ld.), then under the management of Mr. John Bryden (formerly of Ayrshire, now general manager of the Wellington Colliery, V.I.), where he was engaged for four years. In 1869 Mr. Dick thought he would try his luck at the gold fields of Cariboo, in British Columbia, whither he and many others resorted: meeting with but moderate success, he returned to Nanaimo in 1872, having however graduated in the higher branches of mining, to his complete satisfaction.

During the succeeding five years Mr. Dick was chiefly occupied in prospecting and exploring for coal on Vancouver Island, on his own account as well as for certain of the collieries.

The managership of the Baynes Sound Coal Company was in 1877 offered to Mr. Dick, who accepted the position and carried on the mine until the company were satisfied that operations could not be profitably continued without a large outlay of capital. By virtue of his position with this company he was entitled to and obtained, we believe, under the Coal Mines Regulation Act (when first passed in the Province), a certificate of service. Those persons who held situations as mine managers for a stated period previous to the passage of this Act were granted certificates without undergoing an examination.

In 1880 Mr. Archibald Dick was appointed the Inspector of Mines for the Province of British Columbia (succeeding Lieut.-Col. Edward Gawler Prior, M.P. for Victoria City, B.C.), and has since that time worthily fulfilled the arduous and onerous duties of that office, to the general satisfaction of the public.

Mr. Dick is Chairman of the Board of Examiners for granting certificates of competency to colliery managers under the Coal Mines Regulation Act of British Columbia.

In his official capacity Mr. Dick maintains a strict adherence to duty, and he has proved faithful always in the performance of it. On the occasion of a most disastrous explosion a few years ago at one of the Nanaimo collieries he exhibited that quiet bravery which, in a man in his position, is exactly calculated to inspire confidence. As a citizen he shows positiveness, zeal and purpose. Steady and reliable in all his undertakings, Mr. Dick possesses in an eminent degree those traits which, in the common parlance of Englishmen, come under the name of honor. He is one of those men who, if he gave his word, would feel as much bound as if he had given his bond. In a word, he is a man of high integrity and sterling worth.

Mr. Dick has made Nanaimo his home, and was married on 1st January, 1879, to Elizabeth Clara, third daughter of the late William Joseph Westwood and eldest daughter of Fanny Westwood, of East Wellington, near Nanaimo, and has six children, three boys and three girls.

The Cost of Charcoal Pig-Iron.

From the recent report of the United States' Commissioner of Labor it appears that the cost of making charcoal pig in the United States traverses a wide range of figures, not only for raw material but for labor. The latter evidently bears relation to the size of the furnace, being $1.46 at a 40-ton furnace in the south, $1.20 at a 75-ton Lake Superior furnace, and $3.59 at a 20-ton Maryland furnace, where ore at $10.29 and fue at $7.30 for the ton of pig, with other large charges in proportion to output, bring the cost of the metal produced up to $23.16½ a ton, and this without counting insurance, interest and depreciation of plant. The cost of Charcoal per ton of pig varies from $5.54 at the south on very low grade hematite ores to $9.05 at a Lake Superior furnace on the richest of magnetic ore. The cost of ore per ton of pig runs from $1.98 in Tennessee to $6.93 at Lake Superior. The total charges given for southern iron are $10.28; for Lake Superior from $14.45 at a 60-ton furnace to $18.78 at a 12-ton furnace. The low cost of southern coke and charcoal iron has resulted in an immense industrial development, not without serious disturbing influences upon northern and eastern enterprises; but the south is evidently not an ironmaster's Paradise yet, seeing that the last market reports state that "many furnaces are shut down owing to trouble with workmen in some instances, and lack of ore and coke in others.

LETTERS TO THE EDITOR.

Ontario Iron Ores.

The Editor:

SIR,—"The Mineral Resources of Ontario," lately published under the auspices of Mr. Archibald Blue, well deserves the favourable notices which it has been receiving from the press of the United States and Canada.

Mr. Blue has, with pains-taking care and judicious arrangement, put together facts most important both to prospectors and to miners in a practical manner that can be readily understood and used by all.

A good deal of space is devoted to our iron ores and the facilities for smelting them in Ontario.

No doubt one or two charcoal furnaces might find profitable employment in Ontario, but there is not much encouragement for capitalists to invest extensively in that line until we have a larger market.

Although the Dominion Government has imposed higher duties on imported iron and offers a bonus for domestic production, our iron manufactures, which are the most important of all industries, are growing very slowly.

It is time for our Government to recognize the fact that neither high import duties nor bonuses will give us customers for our iron or create a market, *and it is the customers and the market we want.*

We have abundance of excellent iron ores, and all that we can do with the greater part of them is to seek a market in the United States.

Unfortunately there is at present a prejudice in some parts of the States against Canadian ores. There is some reason for this, caused doubtless partly by the dishonesty or ignorance of those who have engaged in the business. But it is very unfair to condemn all Canadian ores because those from parts of one or two counties in Ontario have not proved satisfactory.

Many of our iron ores occur in the same geological formation in which the best Michigan and Minnesota iron mines are found, and there is no reason why some of our deposits should not be equally valuable when properly developed.

There are a dozen counties in Ontario in which iron ores are found, including the districts of Algoma and Thunder Bay, extending over several hundred miles, besides excellent ores in considerable variety in Nova Scotia, near the Atlantic coast, and in British Columbia near the Pacific.

Mr. W. J Rattle, M.E. and metallurgist, of Cleveland, Ohio, an expert of high standing, gave valuable evidence before the Mining Commission. Mr. Rattle said: "I am very well satisfied with the outlook in this "country (Eastern Ontario). I judge the iron ores to be "of good quality, and think the prospects are sufficient "to justify reasonable development, both of magnetites "and hematites.

"I believe you have a magnificent outlook for iron. I "think these Ontario ores would be easy to smelt, as "much so as our ores from Lake Superior. The ores "here carry lime largely, and you would require very "little flux. You have ample supplies of ores here to "make the best quality of steel rails, and in sufficient "quantities to start a blast furnace."

This opinion, given from his own observations by an expert of such wide experience as Mr. Rattle, should be a complete answer to those critics who question either the quantity or quality of our ores.

The following analyses of some ores from the Kingston and Pembroke District show them to be of excellent Bessemer quality, namely:—

Metallic Iron.	*Phosphorus.*	*Sulphur.*	*Silica.*
66·	Trace.	Trace.	2·14
65·33	0·017		
64·	0·025	Trace.	5·27
62·	0·006	Trace.	4·12
60·	0·009		6·31

With no titanium in any of them.

Yours, &c.,
T. D. LEDYARD.

Toronto, July 21st, 1890.

Messrs. Quigley & Hammond, of Fort William, located some iron lands last week 35 miles west of Port Arthur and 5 miles south of Finmark station on the Canadian Pacific Railway. The outcropping is 1½ miles in length, and has an average width of 50 feet; assays by F. Hille, M.E. & Ch., Port Arthur, gave 61% metallic iron. No titanium or appreciable quantities of phosphorus or sulphur.

The Miner in Relation to Mineralogy.

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

The rare elements are not nearly so rare as they are commonly supposed to be; if they were more frequently sought for they would be more frequently found. So read the writer in a treatise on chemistry some time ago, and since that time the statement has frequently been called to mind in connection with visits to some of our Canadian mining areas.

If the mining captains of our various mines be asked if they have any specimens of the minerals found associated with their ores, very probably the reply will be, "No; we have nothing here except ore and rock"; "ore" meaning whatever mineral is being mined, and "rock" including everything else. Not infrequently in such cases a few minutes' search over the dump leads one to say interesting mineral specimens are not nearly so rare as they are supposed to be; if sought for they would be found.

It is matter for regret that so many of the men in responsible positions in connection with our mines are so indifferent to the occurrence of minerals associated with their ores. Should one give utterance to this sentiment, very probably the reply of the miner will be, "What is the good? We have no time for anything else but getting out our ore. No money in that," etc., etc.

Now, the question is: Is the miner right in thinking it is vain and unprofitable for him to be on the look-out for minerals that may occur in association with the ore he is mining? Certainly I think he is very far wrong. We are told the discovery of the Florida phosphate deposits was made by a man who had his eyes open to see what could be seen, and was inquisitive concerning what he saw. The *Engineering and Mining Journal*, speaking of the discovery, says: "In the last fall some progressive orange grower, with a little more curiosity than his neighbors, sent to a chemist a sample of white sub-soil that occurred in his grove; the chemist reported that it was eighty per cent. phosphate of lime; the secret got out, and then the excitement began." The basis of this discovery, then, was in the fact that this orange grower observed that his sub-soil was peculiar and then imagined the cause of the peculiarity. Take another case: In the Sudbury district the valuable metal platinum has been discovered, as the result of examining the mineral associates of the ores of that district; and in the case of the Villeneuve mica mine interesting compounds of uranium have been found. Did the same intelligent inquiring spirit exist to a greater extent, it is altogether likely we would know of the occurrence of many more interesting mineral localities in Canada. There is yet room, abundant room, for the exercise of this intelligent enquiry in connection with our mines. Take, for instance, our asbestos mining region. It has long ago been pointed out, both by the Geological Survey and by Dr. T. Sterry Hunt, that nickel is seldom or never absent from the serpentines and associated rocks of this region; indeed, Dr. Hunt has predicted that the nickel so generally diffused through these rocks would in places be found in workable quantities, a prediction which as yet has found only a partial fulfilment in the operations of the Orford Company some years ago.

Still farther, the celebrated nickel ore of New Caledonia is a hydro-silicate of nickel and magnesia, and we are told the nickel ore is found associated with iron oxide and chromic iron ore, in beds of serpentine. Surely to those who know how frequently magnetic oxide and chrome iron cut the asbestos veins, no more need be said to show that it is worth while for the asbestos miner to keep an eye on any unusual looking mineral he may meet with in his mining operations.

Even if mining is being carried on in an area where there is no likelihood of finding any mineral or ore of commercial value, there is still no slight advantage to be derived from an intelligent inquiry into the nature of the various minerals there occurring. The finding of minerals or fossils in certain associations may be the key to the solution of the problem as to the origin of the deposits of economic value, and the solution of the problem may, in various ways, confer great benefits upon the industry in question as a whole.

But even in cases where no commercial advantage, either direct or indirect, can accrue from the lookout for associated minerals, we may not say that the quest has been in vain. The habits of observation and comparison induced by being on the lookout for minerals are of inestimable value to the miner himself, and cannot fail to render him more proficient in his calling, and, at the same time, add more or less to the sum total of knowledge. It may be urged by the miners that even though they could be on the watch for the occurrence of interesting minerals associated with their ores, they have not a sufficient knowledge of mineralogy to enable them to determine what are the minerals they may find, and therefore they would not know it they were finding anything of value or of interest. This objection need be no excuse, for the officers of the Geological Survey will gladly examine any mineral sent in to them, and in addition there are numerous chemists and mineralogists located here and there throughout the Dominion, and I am sure there is no one of these who has not sufficient love for science to be pleased to aid the inquiring miner by identifying any unusual looking specimen he may have met with.

Mine Maps.*

Among the primary necessities of every well-managed colliery is an accurate and complete map of the inside workings, showing not only the outside improvements, but the physical characteristics of the tract to be worked, as well. When we say an "accurate and complete map," we do not mean such apologies for maps as are in use at many collieries, and which are nothing more than approximate outline plans of the main workings. Such maps are regarded by some mine owners and superintendents as "good enough," and they cannot see the wisdom of going to the expense of employing competent engineers to make them maps that will in the course of a very short time, prove not only a source of great satisfaction to them, but will prove their economy as well. Such maps cannot be constructed by boys. Neither can they be constructed by the class of incompetent surveyors that call themselves "engineers," and are willing to work at their "profession" for $50 or $60 per month merely because this is more money than they can earn with the pick and shovel, or by tapping molasses and measuring tape.

The mining engineer is a professional man. His profession must have been acquired by years of work and study coupled with a good supply of that very necessary requisite in every profession—"brains." It takes more study and harder work for a young man to become a competent engineer than it does for him to pass the legal requirements which enable him to practice law or medicine. His profession is one of great responsibility. Thousands of dollars may be either lost or gained in a single decision or act of his. The lives of the workmen in the underground workings often depend on his skill and accuracy. Notwithstanding these facts there are hundreds of collieries at which the book-keeper is paid more salary than the mining engineer under whose direction the colliery should be worked, but often is not.

A mine map may be accurate, and still not be complete. Such maps can be constructed by good surveyors. They can make an accurate survey, and keep their instruments in adjustment, but as they only have a limited knowledge of the difficulties to be contended with in coal-mining, their maps are only outline maps, and are only of use in so far as they show the relation of the inside workings to land lines.

The complete mine map should be a complete history of the colliery, showing also, indirectly, what its future may reasonably be expected to be. It should be constructed by men who do not work to get done in the shortest time, but by men whose main idea is to see how much information they can put on a map.

We do not mean to decry the accurate outline map. It is very good as far as it goes, and is infinitely better than none. But we want to impress on our readers the advantages of maps so constructed that the superintendent can see at once all conditions existing in a mine at all times.

To make a complete map, the engineer should first make a survey around the tract to be worked, locating all the prominent physical features and improvements. If he can do so, he should make a topographical map of the tract at once; but, if time is limited, by running the vertical as well as the horizontal angle, he can carry the tidal elevation, or the elevation above some assumed datum, to every station, and mark it on the map at that point. Then as he makes subsequent surveys, he can gradually get data enough to make a fairly complete topographical map in course of time. Every ledge of rock in place, should be located, and the amount and direction of its dip, as well as the character of the rock, should be marked neatly on the map. The streams of water on the tract should be regarded as of primary importance, and should be located with exactness.

After the surface survey has been made and plotted, a survey should be carefully carried into the workings and the same care taken in reading the vertical angles. Mark the elevation carefully at every station. Take the dip of the vein at every station, and oftener if it changes between stations. If the vein worked is a thick one, note how far the station is above the bottom slate, if above it at all. Note the thickness of the vein, and take frequent sections of it. Locate the ribs of all pillars with accuracy. Don't attempt to make a pretty map by drawing the sides of openings parallel to each other; draw them as they are. Note all pillars that have been robbed out, and those that have been skipped. Designate such pillars by some standard mark to distinguish them from pillars that still remain intact. In running the survey through a tunnel, take a section of it, noting carefully the dips and character of each bench of rock. Do the same in shafts. Take advantage of every opportunity to "tie up" the survey by connecting with some other branch of it by running through crosscuts or any other openings. Take advan-

age of the second outlet to carry the survey to the surface by a route different from that by which the mine was entered, and tie up with the outside survey. "Don't shove," is a short and appropriate expression.

If the surveys don't tie, don't shove them so that they apparently will; re-run them until you find the error that has thrown you out. If you have tied up at every opportunity, the chances are you will not have far to look for the error. Use what good sense you have been blesed with. This will direct you in regard to noting other features not already mentioned. Always bear in mind that your notes cannot be too complete. Don't be afraid of filling your note-book. Note-books are cheap, and they were made to be filled. Keep your notes as neatly and in as condensed a form as is consistent with clearness.

Base all your work on one meridian. If you have a number of collieries in the same neighbourhood, don't have as many different meridians, or you will never know how they lie in their relation to each other, and the difference in meridians will be an endless source of annoyance.

Test your instruments frequently and see that they are in perfect adjustment. Don't trust the magnetic needle if you want to make an accurate survey and map. Test your chain or steel tape as frequently as you do your transit. An inaccurate chain and a poor chainman are as great sources of error as a transit that is out of adjustment and a careless transitman.

Let your mine map be the ventilating chart of the mine. Mark the upcast and downcast plainly on it, and show the course of the air-currents by arrows.

With mine maps constructed on these lines, collieries can be worked more economically and with greater safety. More coal can be taken out at less expense, and advantage can be taken of innumerable natural and other features that, without such a map, would be lost sight of.

If a cross section is desired on any line through the tract, the data to construct it can be taken directly from the map. If a change is desired in the method of ventilating it can readily be planned on the map. If mechanical haulage is desired the necessary data for the mechanics can be taken from the map. If it is desired to rob pillars in any portion of the colliery the superintendent can see at a glance whether it can be done with safety to the outside improvements and the inside workings or not. If there are any streams on the tract they can be readily kept from finding their way to the inside workings, and thus the duty of the pumping engines can be kept down to a minimum.

Millions of tons of the finest coal in the anthracite regions have been lost simply because there were no accurate maps to guide the officials to their work. The writer has frequently seen pillars many times larger than there was any necessity for, and he has just as frequently seen them so small as to be entirely worthless, and the only means that the inside foreman had of determining the thickness of these pillars was by putting a hole through them. The importance of knowing the exact size of all pillars and the exact thickness and character of the strata between the surface, and mine workings cannot be over-estimated. The colliery official or owner who cannot appreciate this is an incapable man, and is unfit to manage a colliery.

If accurate, complete maps meant greater safety only, they would possess advantages that should force them into use at every colliery. But in addition to greater safety they mean greater profits as well, and there is no excuse but obstinate ignorance that tolerates such apologies for maps as are to-day used at the majority of American collieries.

In the anthracite regions of Pennsylvania mine maps are made that will perhaps excel those made in any other portion of the world in point of completeness and accuracy. In the same regions there are maps in use that are simply botches, and are, in many respects, worse than useless. Their inaccuracy is frequently the indirect cause of many accidents and great unnecessary expense, and the users are men who either are handicapped by superior officers who expect to have good maps made by incompetent surveyors because they are cheap, or they themselves follow this narrow line of thought.

If good maps were not in use, and if accurate work was really unreasonably expensive, there would be some excuse other than obstinacy and ignorance to offer for the use of inaccurate and incomplete maps. But obstinate ignorance must be the verdict when such companies and firms as Coxe Brothers and Company, the Philadelphia and Reading Coal and Iron Company, the Lehigh Valley Coal Company and a few others have their mine maps as complete and accurate as it is possible for well-trained and competent engineers to make them. There are other firms and companies that are gradually getting to a higher standard, but the majority of operators—both anthracite and bituminous—still work on with maps that, instead of being consulted at any time, should be promptly consigned to the waste basket, and the engineer corps promptly told to either make their maps with some degree of accuracy and completeness or to get out.

In this connection a word for the competent mining engineer will not be amiss. Mineowners have no right to expect him to spend his time and talents for less compensation than they pay some members of their clerical force. If they want legal advice they pay a good lawyer a reasonable fee for it. If they happen to suffer from dyspepsia or any other ailment they pay a physician a reasonable fee, and the druggist a fat profit on his drugs, and never think of kicking. But if an engineer asks for a compensation considerably less than either the lawyer or doctor get, time and labour considered, they raise their hands in holy horror, and inform him that they can get men who will work for $50 or $60 a month. These latter are the parties that make the inaccurate and incomplete maps, and in the end always prove most expensive help.

* From the Colliery Engineer.

Phosphate Shipments.

The following have been the ocean shipments of Canadian phosphate from the port of Montreal to date :—

Date.	Name of Ship.	Destination.	Shippers.	Quantity.
June 17	SS. Fernside.....	Liverpool	Wilson & Green...	210
" 20	SS. Circe.....	Glasgow.	do ...	210
" 26	SS. Steinhoft.....	H'mburg	Millar & Co.....	300
" 26	do	do	Wilson & Green...	254
July 3	SS. Vedra	London .	Lomer, Rohr & Co.	150
" 4	SS. Amarynthia....	Glasgow.	do	200
" 5	SS. Michigan.....	Liverpool	Wilson & Green...	249
" 5	SS. Alava	do	Millar & Co	450
" 9	SS. Toronto	do	Lomer, Rohr & Co.	200
" 10	SS. Alcides.....	Glasgow.	do	100
" 12	SS. Altmore	London .	do	250
" 12	SS. Cassins.....	H'mburg	Millar & Co	185
" 14	SS. Galveston	London .	Lomer, Rohr & Co.	100
" 15	Brk. Churchiston...	Swansea.	Millar & Co	130
" 14	SS. Oxenholme.. ..	Liverpool	Wilson & Green...	554
" 16	SS. Sarnia.....	do	Lomer, Rohr & Co.	200
" 18	SS.St'ts of Magellan	do	Millar & Co	475
" 21	SS. City of Lincoln.	do	Wilson & Green...	655
" 21	SS. Circe.....	Glasgow.	Lomer, Rohr & Co.	250
" 22	SS. Plessey.....	London .	do	90
" 23	Ashburne.....	do	do	290
" 23	Oregon.....	Liverpool	do (in bags)	100
				5502.100

SHIPPER'S RECAPITULATION.

	Tons.	Bags.	Tons.	Bags
Lomer, Rohr & Co., (to 19th June) ..	2,715	100		
do (to 23rd July)...	1,830	100	4,545	200
Millar & Co. (to 18th June).....	1,475			
do (to 15th July).....	1,540		3,015	
Wilson & Green (to 16th June).....	823			
do (to 22nd July)	2,132		2,955	
Total European shipments to date			10,515	200

RECAPITULATION OF EXPORTS.

	Tons.	Bags.	Tons.	Bags
Liverpool, previously reported.....	2,823			
do reported to date.....	2,993	100	5,816	100
London, previously reported	1,265			
do reported to date	880		2,145	
Glasgow, previously reported	410	100		
do reported to date.....	760		1,170	100
Hamburg, previously reported	515			
do reported to date.....	739		1,254	
Swansea, reported to date.....	130		130	
Total tons exported to Europe since opening of navigation.....			10,515	200

The following have been the shipments of ground phosphate from the Ottawa Valley to the United States to date :—

To Holyoke, Mass. (previously reported)	647½ tons
To Chicago (to date).....	125
Total tons.....	772½

Notes on Quarrying.

(Wm. L. Saunders, in Stone).

An old quarryman when asked how much it would cost to start a marble quarry, replied: "You will have to run your hands down into your pockets clear up to the elbow before you get any return, but when the money begins to come back, it will come back faster than it went out." There is no doubt about the truth of this when applied to marble deposits, and it might also apply to frequent quarry openings in stone of less value. There seems to be a peculiar charm about the possession of a marble quarry which has induced many a successful business man to give up that occupation in which he had been trained, and which had proved profitable, in order that he might revel in the fascinations of a marble quarry. It is almost invariably true that when a man has once become fascinated with the marble business he is irretrievably lost and can do nothing else. He indulges his fond anticipations of dwelling in marble halls, and figures up the enormous profit which must follow a business which produces a stone at $1 per cubic foot and sells it at $5 or even $9. That there are millions in it seem to be perfectly evident. He gets his little specimens polished and carved in paper weights, horse-shoes, card receivers, &c., distributing them among his friends, and every one congratulates him on the possession of a property which contains such beautiful marble.

After organizing his company, or in many cases before such progress has been made, it is usual to write everybody who advertises himself as a manufacturer of drills to find out how much it will cost to do some prospecting on the property and produce a core. The value of this core drilling in a marble deposit is much over-estimated; though I do not share the opinion of many that it is entirely useless. It is certainly true that several instances may be cited where sound and beautiful cores have been taken out with a diamond drill, yet the quarry has produced little, if any, sound marble. A notable instance of this, and one frequently cited, is that on the Baker property in Central Rutland, Vt. Mr. Baker, sr., was in possession of a handsome piece of property at Central Rutland, and might have still been enjoying the mountain breezes of that beautiful locality had it not been his unfortunate lot to discover marble upon his property. Those who knew this genial old gentleman will remember his enthusiasm when talking to you about his marble, and how delighted he was to receive you at his house and show you his specimens. "We have marble all around us," he would say. "My property is full of marble, and the most beautiful marble in the world," yet in spite of the specimens, and in spite of a very strong financial backing, no profitable quarries have ever been worked on Mr. Baker's property, and Mr. Baker is now dead.

In starting a marble quarry do not depend too much upon the condition of the deposit as shown by the core. Get the judgment of an experienced quarryman, not one whose experieuce has been confined to one or two localities, but a man possessing general information on the subject, and whose experience has taken him to different deposits in different sections of the country. The judgment of such a man is of more value than a diamond drill, but it is very well to have both.

Do not spend money in the erection of a mill until you have demonstrated the fact that you have a quarry that will produce sound and profitable stone. In the Baker case hereinbefore cited, a handsome mill was erected in anticipation of the large business from the quarries, and though the mill has been operated almost since its erection, yet it has been supplied with marble from other localities, and is entirely out of place in its present situation. The prudent quarryman will send his product to the nearest mill, and pay for its sawing until he has proved that his quarry will produce sound material, and that he has located in the best place. When he decides to put up a mill he takes into consideration the most favourable point for power, for sand and water, endeavouring at the same time to keep the mill as near his quarry as possible.

Less than ten years ago it was the usual thing for men to spend from $50,000 to $75,000 on a quarry deposit before receiving returns. Recent improvements in quarrying machinery have largely reduced the cost of opening a quarry. It is a matter of record that a quarry opened within recent years at Gouverneur, N. Y., by Messrs. Davidson & Sons, of Chicago, paid for itself in about two months' time. The case was somewhat exceptional, though by no means extraordinary. Messrs. Davidson & Sons exercised prudence and discretion, not only in the selection of the site, but in the equipment. Instead of "plunging" into the quarry business with a sounding of trumpets and beating of drums, and buying an expensive plant of machinery, they took the sensible course to feel their way gradually. They purchased only such machinery as would be best suited for making an opening, having since gradually enlarged the plant.

A complete and thoroughly first-class plant of machinery for starting a dimension stone quarry, comprising derricks, hoisting machinery, channelling machines, rock drills, boilers, pumps, pipe, blacksmith's tools and fit-

tings, will cost about eight thousand dollars; but it is not necessary to spend even this sum of money unless the quarry has been operated before, or the proprietors are perfectly sure of the stone. If it is only a deposit which promises well, a first-class equipment can be procured for about thirty-five hundred dollars, one sufficient to do considerable work and serve every purpose for several months. Such a plant as this would comprise a channelling machine, drill mounted in a proper way to suit the work, boiler, pump, derrick and hoisting apparatus. The derrick should be erected with a view of using it for heavy lifting with a single line. In other words, it would be a derrick for power hoisting, though it is seldom necessary to do any power hoisting when starting a quarry. A great deal of work must be done in connection with stripping and general levelling off, then the channels must be cut, and in all this there is not much hoisting to be done in proportion to the other work. I have known quarries so situated on the side of a hill that practically no hoisting was done for at least a year, and in all that time the work was progressing favorably and profitably. A steam hoist is an expensive apparatus in the first cost, but a very valuable one, provided there is plenty of stone in the quarry to be lifted. In other words, it is an appliance which will only pay when there is enough work to keep it busy, otherwise it is cheaper to hoist by water power, or even hand power. A horse-power hoist is a useful apparatus in connection with quarry opening, and will usually serve the purpose of doing all the hoisting which is required until the quarry has progressed so far that the nature of the stone is well understood. A horse-power hoist is cheap in the first cost, and cheap in maintenance and operating expenses, and if properly constructed it will do a great deal of work. When the quarry begins to produce profitable stone a steam hoist may be put in and operated with the same derrick, while the horse-power hoist will always be useful, either at the loading station or at some other point about the quarry.

It is not good judgment to errect bricked-in or stationary boilers in starting a quarry, but those of the portable pattern mounted on skids are preferable. They may be placed near the work and can be moved about in case it is necessary. In other words, do not put in a bricked-in boiler until the steam hoist is put in, then it is best to put the boiler and hoist under one roof, and in this case a return flue tubular boiler is preferable. The boiler will serve to run the hoist and do other work about the quarry, while the portable boiler will remain in the quarry to run the channeling machines, drills, ect.

Florida Phosphates.

Messrs. Couper, Millar & Company, London, in a recent circular to the trade, give the following expression of their views on the question of Florida as a new phosphate producer :—

"There have been so many wild rumors scattered broadcast as to the newly discovered phosphate fields in Florida, that we feel it a pleasure to be able to give some definite information on this subject. We may mention that one of the members of our firm was in Florida last autumn, and since then we have been in constant communication with several reliable local correspondents. In addition to this we sent out a well-known phosphate expert, who spent two months in examining various tracts of land and, after his return, we had a further examination made of all the lands at present being worked. We may say at once that this is certainly the largest known deposit of phosphate, but there is nothing in this fact to substantiate the exaggerated reports as to analysis, etc. There are still many millions of tons of phosphate left in South Carolina, while the northern departments of France contain also quantities which can only be counted by millions. It is not the fact of the existence of so many millions of tons, but it is the rate of production and quality which really concerns the market. It may, therefore, be interesting to mention the following fact, viz., that shipments of Florida phosphate in January, February, March, April, 1889, amounted to 4,574 tons, and in the same four months of this year 5,745 tons were shipped, which does not show an extremely rapid rate of progress. It will take time, and more time than many people seem to think, to get these deposits into working order, as many of them have difficulties to contend with in the way of selection and separation of qualities and transport. Added to this, the rainy season has just commenced and will not give any assistance in the matter. Lands have been bought by the tens of thousands of acres, and in several instances as many as 10,000 acres have been bought in one section in order to secure 100 acres of good phosphate land. Many of the tracts acquired are 20 miles or more distant from the railway, and as the companies will not build branches unless guaranteed certain annual quantities the proprietors have been offering large quantities on the European market, so that if they manage to get a house here take such a contract they can then go to the railroad companies and get a branch built, and borrow money from bankers to commence operations upon.

"Speaking generally it appears that the whole of the West Coast of Florida, from Punta Gorda to Tallahassee, is more or less underlaid with phosphate, but the test of the great bulk of this rocky stratum is below 50 per cent. This fact was ascertained several years ago. Recent exploration, however, in Citrus, Marion and Polk Counties has proved the existence of beds of much higher test. There are two kinds of phosphate, *i.e.*, the Rock and the Nodule formation; and as far as we can judge it is the deposits that contain the Nodules that are likely to prove the most important, for the test varies between 65 and 78 per cent., whereas the Rock phosphate runs down from 80 per cent. to 20 per cent., is more difficult to extract, and when extracted is difficult to classify. When the first shipments were being made whole car-loads on which heavy railroad freight had been paid were thrown aside on arrival at the port as being valueless, and it is only picked cargoes that have been shipped so far. This points to the conclusion that cargoes of really high test will be few and far between, the bulk testing about 65 to 70 per cent. We know one large tract of land which has an inexhaustible supply of this test. Difficulties have also arisen as to the titles under which some of the American companies have been working.

"Our conclusion, therefore, is that though Florida will be the largest producer of phosphate in the future, the quantities likely to be shipped for some time to come will not be large enough to affect the market, and manufacturers who rely upon these supplies for this year or early next year, are likely to be disappointed, everything pointing to present prices being maintatned for some time to come."

A New Method of Preparing Manganese.

A new method of preparing manganese, by which the metal can be obtained in a few minutes in tolerably large quantities, and almost perfectly pure, is described by Dr. Glatzel, of Breslau, in the current number of the *Berichte*. A quantity of manganous chloride is dehydrated by ignition in a porcelain dish, and the pulverized anhydrous salt afterwards, intimately mixed with twice its weight of well dried potassium chloride. The mixture is then closely packed into a hessian crucible, and fused in a furnace at the lowest possible temperature, not sufficient to volatilize either of the chlorides. A quantity of metallic magnesium is then introduced in small portions at a time, the total quantity necessary being about a sixth of the weight of the manganous chloride employed. Provided that the crucible has not been heated too much above the melting point of the mixture of chlorides, the action is regular, the magnesium dissolving with merely a slight hissing. If, however, the mixture has been heated till vapors have begun to make their appearance, the reaction is extremely violent. It is, therefore, best to allow the contents of the crucible, after fusion, to cool down to a low, red heat, when the introduction of the magnesium is perfectly safe. When all the action has ceased, the contents of the crucible are again heated strongly, and afterwards allowed to cool until the furnace has become quite cold. On breaking the crucible, all the potassium chloride is found to have been volatilized, leaving a regulus of metallic manganese, fused together in a solid block, about three parts of weight being obtained for every two parts of magnesium added. The metal, as thus obtained, is readily broken up by hammering into fragments of a whitish-gray color, possessing a bright metallic lustre. The lustre may be preserved for months in stoppered glass vessels; but when exposed to air the fresh surface becomes rapidly brown. The metal is so hard that the best files are incapable of making any impression upon it. It is so freely magnetic that a powerful horse-shoe magnet, capable of readily lifting a kilogramme of iron, has no appreciable effect upon the smallest fragment. It was noticed that the introduction of a small quantity of silica rendered the manganese still more brittle, and caused it to present a conchoidal fracture, that of pure manganese being uneven. The specific gravity of the metal, former determinations of which have been very varied, was found to be 7-3921 at 22° C. This number, which was obtained with a very pure preparation, is about the mean of the previous determinations. Dilute mineral acids readily dissolve the pulverized metal, leaving a mere trace of insoluble impurity. It is also satisfactory that practically no magnesium is retained alloyed with the manganese, and the introduction of carbon is altogether avoided by the use of this convenient method.—*Kuhlow.*

The property of the Ontario Mining Company, near Rat Portage, now being worked under an agreement with the Canadian Pacific Mining and Prospecting Company, is being developed under the superintendence of an English expert. Shaft-houses and other buildings are being erected, machinery introduced, and mining operations will be pushed to the fullest extent.

MINING NOTES.

Nova Scotia.

(From Our Own Correspondent.)

Pictou County.

At the Vale colliery the McBean seam is still shut down from the effects of the fire last December. The six-foot seam re-opened in January has been working fairly steady. The management has, we understand, secured a contract to supply 40,000 tons of coal to the I.C.R.

Mr. John Muir, who has leased what is known as the Kirby area, situated at a point between New Glasgow and the Vale colliery, is working on a four-foot seam of very fine coal. The situation of his property, however, places him at some disadvantage, as he has to haul his coal by road into New Glasgow at a cost of something like 50 cents per ton.

Under the able direction of Mr. Poole and Mr. J. G. Rutherford the old Foord pit, which has been idle since the disastrous explosion in 1873, is slowly being re-opened, and it is expected that early next year will be producing coal in quantity again. The seam here is the largest in the province, and of excellent quality for coking purposes. The Douglas slope, which is in the third seam, has been re-timbered and cleaned up, and drifts are being driven across the measures to catch the second seam which overlies them. The management will then be able to take the Cage pit seam out through the Douglas seam.

The MacGregor pit is working steadily. Some difficult pillar work along the creep has been successfully accomplished. The slants have been sunk to a depth of some 600 feet, and levels are being extended east and west. This seam gives a very good coking coal. There has been a great deal of repairing and fixing up done at this mine for the last couple of years, but it is now evident that all difficulties will soon be overcome, and that a large quantity of coal will be raised.

The Drummond colliery, under the direction of Mr. C. Fergie, is making steady and satisfactory progress. I am informed that they are raising 1,225 boxes per day (of 9h. 25 min.). These boxes hold from 14 to 15 cwt. of coal. Work has been resumed on the Scott pit seam. Altogether it may be safely stated that the output from this mine will be largely in excess of former years.

The main slope at the Acadia colliery is now down to a depth of 3,600 feet. These extensive workings entail constant care and watchfulness on the part of the management, and a large amount of time and labor is expended in looking after the roof and sides. Mr. Maxwell is introducing a new system of winning coal in the deep workings.

The Black Diamond, under the management of Mr. J. W. Sutherland is now raising about 175 tons per day. The coal is mainly used for local consumption. With a view to proving the underlying measures, a portion of this property is being prospected with the diamond drill, under direction of Mr. John Douglas, formerly underground manager of the Albion mines. The drill is now down to a depth of 240 feet, having passed through the Scott pit seam at 100 feet, and it is expected to cut the third seam at 360 feet, and the fourth, or McGregor seam, at a depth of 640 feet.

Cumberland County.

Steady work is being done at the Joggins mines, about 260 tons being the average daily output at present.

The Minudie mine is idle.

Mr. Hall, formerly underground manager at Springhill, is reported to have discovered a promising four-foot seam at Salt Springs, Cumberland County, on which, with a small force, he is at present working.

The Lawson mine continues to turn out a small output for local trade.

(From Press Committee Gold Miner's Association.)

Central Rawdon District.

The June yield of the Central Rawdon Company, Mr. Gould Northup, Manager, was 543 ozs. The tons crushed were 100 of alluvial and 80 of quartz.

The yield of the Northup Mining Company, Mr. C. E. Willis, was 132 ounces from 155 tons.

Rawdon District.

Mr. Robert McNaughton has repurchased the property formerly sold by him to the English Company, and has commenced to pump out the water in the eastern end of the property. It is his intention to re-open the mine as soon as practicable and put it on a producing basis.

Waverley District.

Mr. MacDuft, Manager of the Nova Scotia Syndicate, Ltd., has about completed the work of straightening the shaft on the Union Lode and of getting the underground workings into proper shape for overhand stoping. A new gallows frame has been erected at the pithead, and systematic work has fairly been inaugurated.

The Lake View Mining Company are pushing the work on their stamp mill, and hope to have it stamping quartz before the 1st September. The company have from 1,000 to 2,000 tons of quartz stacked on the surface, and it is not intended to resume mining work until this accumulated quartz shall have been crushed and tested.

Oldham District.

Mr. T. P. Putman, on the 18th June, transferred the property of the Oldham Gold Company, bid in by him at public sale on the 10th June, to Messrs. Hardman & Taylor. Work was begun at once upon the Baker Vein, and No. 3 shaft is now sinking. It is calculated that intersections will be reached about 300 feet in depth, the shaft is now 268 feet. The June yield of the Standard Gold Company was 875½ ounces from 30½ tons.

Renfrew District.

The owners of the "Free Claim" property are rebuilding their stamp mill and water wheel gear. The old mill had been in use a long time, and was badly out of repair.

The Empress Company are working a few men only. The prospects are reported brighter than for some time past, but Manager Turnbull is wise in making haste slowly.

Killag District.

Mr. George W. Stuart started his mill on the 17th inst. on quartz coming from the new lode found last fall. Reports from this find are most encouraging, the width of the lode running from 8 to 16 inches in rolls, and is judged worth 2 ounces per ton.

Stormont District.

Mr. H. K. Fisher has about completed the organization of the North Star Company, operating the North Star group of mines on the west side of Isaac's Harbour. Mining is being vigorously carried on and the lode looks well. Early in July a prospecting drift from the main incline cut the rich streak worked years ago by former owners, and the quartz is variously estimated as worth from $60 to $100 per ton. The erection of a mill on the west side of the harbour is now under consideration.

In General.

The next regular meeting of the Gold Miners' Association will be held in the Halifax Hotel, Halifax, on Saturday afternoon the 2nd curt. at 2:30 P.M. A large attendance of members is particularly requested, important business being before this meeting

Quebec.

We regret to learn of the death of Mr. S. B. Jenckes, President of the Jenckes Machine Company, of Sherbrooke. Mr. Jenckes was one of the early pioneers of our manufacturing interests in this province, having emigrated to Sherbrooke from Rhode Island in 1845.

Eastern Townships District.

From the pits of the United Asbestos Company. under the direction of Mr. John J. Penhale, a very nice quality of asbestos, of which a goodly portion was No. 1 quality, was turned out last month.

The Anglo Canadian has the crusher at work, and find it giving good satisfaction. By means of this machine they are now enabled to work up and utilize at a small cost, rock containing small veins, which formerly it did not pay to cobb by hand. The system adopted is similar to that formerly carried on by the Scottish-Canadian Company; 143 tons were dressed by the machine last month. Mr. Hopper is well pleased with the turn-out from all his pits.

The output from the asbestos mines in the Black Lake district for the month of June exceeded previous records for any one month's work since operations were begun here. All the mines did very well, and the production from some was exceptionally good.

The American Asbestos Company, under the able management of Mr. Klein, contiunes to push work with customary vigor. The new hoisting plant is in position on the top of the hill, and is run by compressed air from the compressor at bottom, the air being conveyed in pipes, a distance of some 1,800 feet or more; there is not an elbow in the entire line, thus lessening friction, there being only a difference of about 2 lbs. in the pressure on the hill and in the engine-room. The productiveness of the property is evidenced by the excellence of their last month's output.

Dr. James Reed is working on his Lot adjoining the Bell, or Hayden property. Several pits yielding good quality have been opened, and give excellent promise for the future.

The Laurier Mining Company has suspended work on the Lot adjoining the Anglo-Canadian property. Operations are entirely confined to some prospecting on the old Johnston & Loomis property.

The St. Julie Company has also been compelled to suspend operations; the quantity and quality of asbestos found was insufficient to meet prospecting expenses or to warrant a continuance of work.

The D'Israeli Company has shared a similar fate.

Good reports occasionally reach your correspondent from the Central Company, operating a property across the Lake.

Since writing the above, this district has been pretty well shaken up with an explosion of dualin. During a very severe thunderstorm the powder house of the Anglo-Canadian Company was struck by lightning, exploding with terrific force, some 30 cases of dualin and a number of kegs of black powder. Fortunately only one person was seriously injured, but the buildings in and about the place were all more or less damaged—but not to the extent of $40,000 as reported by some Montreal papers.

Mr. A. M. Evans, M.E., of the firm of Blakemore & Evans, Cardiff, Wales, has been spending a few days in this district.

Messrs. King Bros. have at present about 180 men, under charge of Mr. Wm. King, operating some 6 pits south of the railway. Mr. King estimates that the production from his property will show a satisfactory increase over the excellent outputs of former years. Several openings on their property near Black Lake station have proved sufficiently encouraging to cause the erection o sheds and the construction of a road into the works.

The output from the Bell's Asbestos Company's properties continues up to the average, indeed Mr. Sheridan is confident that his output of 1,600 tons for last year, will be exceeded this season by close upon a thousand tons About 200 men are employed.

Work is also going on briskly at the properties of the Johnson's Company, the Thetford Mining Company, and other Thetford mines.

The White's Asbestos Company has a force of men under Mr. L. Boyd working at Coleraine under agreement with the Megantic Mining Company.

Ottawa Valley.

The output of phosphate from the pits of the Phosphate of Lime Company at High Rock shows a slight lead over the production for the same period last year.

Mr. O. M. Harris reports that all the pits of the Canadian Phosphate Company are turning out satisfactorily. Through a typographical error Messrs. Millar & Company's ocean shipments were credited to Messrs. Wilson & Green and *vice versa*.

The North Star, Central Lake, Emerald, Ætna Hill and other phosphate mines on the Lievres River are steadily working and producing in good quantity.

Recent developments made in Lots 27 and 28 in the 4th Range of Portland West have proved extremely gratifying to the owners, extensive bodies of red and green apatite of high grade having been uncovered. Mr. John Haycock and a small force are at present engaged in the work. The property was recently visited by Mr. O. Ladureau, Directeur du Laboratoire, Central Agricole, Paris, in company with Mr. J. Obalski, M.E. Inspector of Mines for the Province. These gentlemen are unstinted in their praise of the extent and richness of the deposits revealed in these recent workings.

Mr. Robert Dollar, Fort Cologne, has a number of men prospecting over his property in the 4th and 5th Ranges of the Township of Wakefield.

All the Templeton mines are also doing well.

Messrs. Lomer, Rohr & Co., Montreal, made on 23rd inst. an additional shipment of 100 tons of felspar from the mines of the B. & C. Mica and Mining Company at Villeneuve.

From returns kindly furnished by Col. Lay, United States Consul General at Ottawa, we find that the exports of iron ore from 1st January to date, from the Bristol Iron Mines, have been 6,537 tons. The points to which the ore has been shipped are :—

To Catasqua, Penn. (previously reported)	4,197 tons
" " " (reported to date)	2,202
" Philadelphia, Pa	138
Iron ore, tons	6,537

Ontario.

The Silver Center Mining Company of Ontario is the name of a new mining company incorporated by S. C. Duncan-Clark, John Flett, Henry Lowndes, Robert McClain, Richard Chaddick, Thomas Claxton, George Dunstan, O. A. Shaw, O. A. Howland, S. J. Dawson, M.P., and Ed. Gordon, to acquire, hold, lease, exchange and sell mining lands, consisting of mining location "R64," in the Township of Lybster, District of Thunder Bay, and other locations in the district, and to develop the said lands by working mines, smelters, stamping mills and other necessary works. The capital stock is $300,000.

The Frontenac Phosphate Company (Limited) has been registered with a capital of £10,000, in £1 shares, to acquire phosphate and other lands and mines in Canada or elsewhere, and for such purpose to adopt an unregistered agreement with the Stirling Phosphate and Mining Company of Kingston (Limited), and with C. J. R. Stirling.

An important meeting of the Provincial Natural Gas and Fuel Company of Ontario took place in Toronto a few days ago, at which all the stock of the company was represented. The general manager reported that a new well of a capacity of 3,000,000 cubic feet per day had been added very recently to the already long list of successful wells of the company, the total production of these wells being now about 12,000,000 cubic feet per day more than what will be required to supply St. Catharines, Thorold, Merritton, Welland and adjacent places. It was decided to at once proceed to pipe these towns, as well as to run a pipe line to Buffalo to dispose of the surplus of gas. Offers from the best and largest pipe firms in the United States were submitted in person by their representatives to the directors, who have these various tenders under consideration. No doubt now that the first natural gas pipe line in this country will be an accomplished fact within the next few months.

The Imperial Oil Company and the American Company are steadily getting ready for the fall trade, which, by the way, will soon be upon us. The former company (the Imperial) are making some very extensive additions to their paraffin plant in the shape of three large brick buildings intended for the manufacture of paraffine candles, etc. The American Company have the brickwork about ready for their new stills, and are having a general all-round clean-up about their premises, especially noticeable is the new system of drainage they are putting through their yard.

The Kingston Board of Trade are making efforts to obtain a display of the minerals of Frontenac, Leeds, Renfrew and adjacent counties at the Midland Fair, 1st to 6th September next.

The proposed cement industry at Kingston under Mr. Linderoth has not materialized. He claims, by means of his patented invention of the mixture of sawdust with the raw material before calcination, that he secures more perfect formation of silicates, less free lime, and consequently strong cement. A new project is promoted in the limestone city by Mr. Strathy for the manufacture of builders' plaster, the plant for which, with little additional cost will, it is said, turn out Portland cement. A large cement plant at Marlbank on the Nuban and Tamworth railroad is talked of. The extent of the marl deposits of Ontario is beyond estimate, and it is not unlikely they may yet be explorted to a considerable extent in the manufacture of lime as well as cement. Meanwhile the inventors, who are turning blast-furnace slag to every conceivable use, are likely to seek a market in this country for their cheap slag cement. It is a problem whether the leading brands of the best English Portland cement will be displaced by the weaker and cheaper cements now pressing on the market. The room for new competitors seems to be "at the top."

Port Arthur District.

(From Our Own Correspondent.)

THE BADGER SILVER MINING CO.—An exceedingly rich vein was discovered on the 2nd June running parallel with the old vein and situated about 350 feet south-west. It was exposed by running a cross-cut on bed rock across a break in the hill under about 20 feet of clay and boulders. It was about one foot wide at the surface of the trap, carrying galena, pyrites and zinc blende; the gangue was composed of calc spar quartz and fluor spar. At a depth of about 1 foot, leaf silver in considerable quantities came in; at 10 feet it carried about 100 ounces of silver, and has steadily increased in width and richness as depth is attained. The shaft is now down 76 feet, 56 of which is on the vein. Seven and a half barrels of high grade shipping ore, averaging 3,500 ounces of silver to the ton, has been taken out, besides 40 tons of mill rock that averages 100 ounces to the ton. Two-thirds of the vein has been left standing in the shaft. The width of the vein for the last 35 feet is five feet; the silver is in the form of native and argentite, with some zinc blende carrying very high in silver. The silver is quite regularly disseminated throughout the vein, but the richest portion is on the foot wall. Drifts have been started both ways from the bottom of the shaft, besides an adit level has been started in to strike the shaft at that depth. This same vein has also been found on the south-west side of the hill, a distance of 1,650 feet from the discovery shaft carrying the same gaugue and an equal amount of silver with the surface of the vein at the discovery shaft. This is believed to be the richest and best discovery ever made in the Port Arthur silver region, and when it is opened up it is expected that it will exceed in richness, size and grade of ore anything in the history of silver mining on this shore, as it is now known to extend for such a great length through the hill and is apparently quite uniform, and in all probability extends into the low lands, down over the slope towards Silver Creek. It will be thoroughly prospected throughout its entire length by Capt. Shear. The force of miners has been increased to 135. The mill is running full blast, and the output of the Badger may be expected to surpass anything in its already remarkable history as a producer. This company has bought the adjoining property (Porcupine) for $50,000 cash, on which there are three strong veins, one of which is partially developed; about $10,000 was spent on it and 20,000 ounces taken out. Three shafts are now at work on the bottom level of No. 3 vein, and its development will be vigorously pushed

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THE BEAVER MINING AND MILLING CO.—The owners of this property must be congratulated on the present condition of the mine. For the past two years they have devoted their entire energy to development work, and have not sought to take out any silver excepting what was encountered in the drifts and levels, everything else being left standing, and it may be safely said that thousands of tons of high grade ore is now in sight in the mine. Your correspondent had the pleasure of going through all the workings a short time ago. Ten slopes are now working, and fifteen more are ready for commencement as soon as the mills demand. They have 2,000 tons of mill rock on the dump that will average 100 ounces to the ton. The mill is running night and day and giving entire satisfaction. It started up on June 16th, and has been running on an old refuser dump, left since 1887, that has averaged 30 ounces to the ton. Capt. Hooper invented an improved slow motion vanner, over which he is running this low grade ore. The silver is in the form of light thin leaves of argentite. The Frue vanner motion was too fast to save the thin leaves of silver, but the new vanner is doing the work remarkably well, and will prove a great boon to producers of this class of ore. There is sufficient ore in sight in the mine and on the dump to keep the mill running constantly for 3 years. The July shipment will amount to $30,000, and will be made in a few days.

THE SILVER ISLET CONSOLIDATED MINING AND LAND COMPANY.—Capt. Thos. H. Trethewey and Mr. H. S. Sibley have just returned from an expedition extending over thirty days examining the company's property. A force of miners were placed at work on the Edward's Island location, situated nine miles east of Silver Islet. They have struck a strong well-defined vein, carrying arsenical silver ore assaying 700 ounces of silver to the ton. The vein is about 20 inches wide, and heavily mineralized. They also brought in some magnificent specimens of black oxide of manganese from a vein they discovered on the company's property at Cape Gargantua. The vein is from 7 to 10 feet wide. The manganese is on both walls and distributed through the middle. It assays about 45%. The importance of this discovery is very great when taken in connection with the vast amount of high grade ores waiting to be developed in this district.

SHUNIAH WEACHU MINES CO.—A new vein running parallel with the old one has been discovered on this property. It is situated about 200 feet to the south; it is about 2 feet wide, and has a rich pay streak 12 inches in width. A force of men are at work on the new find; all the ore taken out of it is being barrelled for shipment. It is very high grade, composed of argentite and native silver. They have also opened up a large body of high grade ore in No. 2 level west and east from No. 4 shaft.

MCKELLAR'S ISLAND.—The United States Barytes Company are operating a large deposit of baryta on this island. They shipped 1,000 tons to Buffalo, N.Y., on June 28th. This shipment will be followed by regular monthly shipments of from 1,000 to 2,000 tons. This deposit is said to be the largest and best quality known to exist on this continent.

Explorers are swarming over both the silver and iron districts, and reports of wonderful discoveries of both metals are being made daily, many of which have to be discounted when the actual facts become known. Well authenticated reports by experts competent to judge of the finds of iron on the Aticokan River go to show that the metal is there in almost unlimited quantities, and of the finest Bessemer quality, giving average assays of 67% and free from all impurities.

(Later Correspondence to the REVIEW).

THE BADGER SILVER MINING COMPANY.—Another rich strike of bonanza ore has been made on this property at a point 2,000 feet west of No. 1 shaft. An adit level was run in on the course of No. 1 vein for 134 feet; a cross-cut was then started north and driven for 50 feet, when a well defined vein was encountered, striking a little north of east and west on the course of No. 1 vein and dipping to the south. The vein is two feet wide with a pay streak of about 14 inches. Only one shot had been put into it when your correspondent visited it, and about 200 pounds of ore were blown out that would average 600 to 700 ounces of silver to the ton of 2,000 pounds. It is the intention of Supt. Shear to drift on this vein at once from the point of discovery, and also drive the lower level in No. 1 shaft on through the mountain. The vein is four feet wide at the breast of this level, carrying good milling ore averaging 40 ounces to the ton; when the length of this vein is taken into consideration the amount of ground to be opened on it is enormous.

The east and west levels at No. 2 vein are each in respectively 60 and 70 feet. The vein is carrying its width steadily, and the quality of ore is the same as that taken out of the shaft. In the adit started in to intersect the shaft at a depth of 76 feet the vein was encountered at the contact of the clay and rock. It is 3 feet wide, and stood up in a comb-like form in the clay. It is carrying 100 ounces of silver to the ton, and getting richer as they approach the shaft. It is only six weeks since this vein was discovered; 12½ barrels of high grade shipping ore has been taken out of it that will average 3,500 ounces to the ton, besides 250 tons of milling ore that will run all the way from 35 to 100 ounces of silver to the ton. I do not think that there is a better showing anywhere in America than there is on this vein for the amount of time and money expended on it. From where it outcrops on the west side of the hill to the point of discovery in the adit it is about 2,200 feet, and at every point where it has been opened it carries high grade ore. It is safe to say that they have 3,000 feet of this vein on their property.

No. 3 (Porcupine) vein sinking in No. 3 shaft and drifting in No. adit level is being proceeded with. The shaft will be sunk deep enough to intersect the adit, which will be 810 feet in length; it is now in 210. The ore being taken out of the shaft assays 125 ounces to the ton and out of the adit 100 ounces. The mill is running on No. 3 ore, and is treating 35 tons daily, the Krause Atmospheric Stamp doing 20 tons, and the five-head battery of stamps 15 tons daily. Supt. Shear has just had a Krause separating table placed in position in the mill. This a new invention, and the first one of the kind set up in Canada. There are three in operation in the United States. It is triangular in shape, about 8 feet across the head, and tapering to an apex. The length is 16 feet. It is very simple in construction, and is designed to have the same motion as a shovel in the hands of a miner washing ore. The writer had the pleasure of inspecting it at work for several hours, and it is apparently giving entire satisfaction. It separates the concentrates into different grades, the heavies: coming over at the head and the lighter grades lower down the table. The water is supplied by a perforated tube running down the front of the table. Its capacity is 9½ tons of pulp direct from the head daily.

THE BEAVER MINING AND MILLING COMPANY.—The mill is running night and day, treating 25 tons daily. They have not finished the old 1887 dump as yet, nor do they seem likely to for some time. They expected that only a portion of it was worth milling, but as they get into the pile its quality keeps up giving a steady run of 30 ounces to the ton. None of the high grade milling ore has been put through as yet, but I believe that some of the higher grade will shortly be run through with the old dump. The Beaver is in first-class condition in every respect. They have an immense amount of ground opened up; ten slopes are at work, and fifteen more can be started at any time. They have 23 barrels of concentrates on hand, assaying from $500 to $1,500 per ton, besides 300 barrels of high grade shipping ore.

A. Lougheed, P.LS., has just returned after surveying 1,740 acres of iron lands on the Black Sturgeon River for Detroit capitalists. The deposits are 35 miles up the river from the Canadian Pacific Railway at Black Bay. Mr. Lougheed describes the ore as a hard red hematite assaying 64% metallic iron and free from impurities. The most northerly deposit is 1¾ miles in length, and has an average width of 200 feet The next one south is about 1½ miles long, and an average width of 35 feet. The most southerly location is half a mile in length. No ore was found in place on this location, but large quantities of float ore of a high quality covered the ground. The locations contain respectively 1,000, 500 and 240 acres. The lands are well timbered with white pine, spruce and tamarac, and plentifully supplied with water by the Black Sturgeon River. Mr. Lougheed estimates that there is a sufficient quantity of ore in sight to warrant the building of a 50-mile railway. There is no capping of Jasper granite or otherwise excepting a slight covering of red gravel in places.

The country rock is a reddish slate. This property ought to prove very valuable owing to the short haul necessary to bring it to deep water, and taken in connection with the immense deposits of magnetic iron west of Port Arthur, and the carbonate of iron in the immediate vicinity of the town ought to bring about the erection of blast furnaces at Port Arthur at an early date.

Lake of the Woods.

Work on the reduction works at Rat Portage is at a standstill owing to the delay to the machinery, which is being held by the customs at Port Arthur. The Government passed an order-in-council exempting mining machinery not made in Canada free from duty, and the collector at Port Arthur claims that duty should be paid and then remitted if it came under the order. The company has been obliged to stop work awaiting the settlement of the question, and all the men were discharged last Wednesday. The collector referred the matter to the Department of Customs, and the minister has been considering (?) it for some months. The cessation of work has brought forth many strong terms against the dilatoriness of the Minister of Customs and the action of the Collector. The Board of Trade met Saturday evening to take some action, and the general desire is that the Winnipeg Board of Trade should assist in this matter, as it is as much to the interest of Winnipeg that this should be settled as to Rat Portage.

[On enquiry at the Department of Customs, the Hon. M. Bowell replied to the above dispatch as follows:—"The parties have been told that all mining machinery not made in Canada *is free*. This they have not established, and in addition claim free admission of machinery imported before the law was passed, though not in Bond. —*Edit.*]

The buildings of the Lake of the Woods Gold and Silver Reduction works at Rat Portage are fast assuming shape. In fact, the main building is about completed, and the foundation for the engine house, the furnace house and the laboratory is being laid, and they will be rushed along as fast as possible. As the works will, when completed, be one of the institutions of the country, a short description may not be uninteresting. The works are located just across the bay from the town, on a rocky promontory jutting out into the lake, on the south side of the C. P. R. track, and about 100

yards distant therefrom. The company owns 2½ acres of land, which was purchased from the Hudson's Bay company. The building which is erected on this land is in main 115 feet long by 106 feet wide and 75 feet high, in all five stories. It stands on a ledge of solid native quartzite granite, and is built of heavy timber and well put together. The sum of $2,000 so far has been expended on rock-work alone. This embraces the foundations of the main building, the boiler room, the furnace room and the laboratory. The company intend constructing 150 feet of wharfage to facilitate the handling of home ore, which dockage can be extended to 1,000 feet if necessary as the site is surrounded by water on three sides. These docks will afford ample storage for the ore to be brought in from the Lake of the Woods district. A switch is to be put in by the C.P.R. and ore beds to accommodate foreignores will be built. The ore bins will be situated 11 feet above the level of the top of the rock-breaker, and will be run in cars by gravity. The ore bins in the building will occupy the top stories, and will have a capacity of 210 tons. The ore from the dock will be brought in by a steel cable over a tramway and dumped directly into a rock-breaker, the cable being worked from the engine. The ore when dumped into the rock-breaker, will be reduced by it to the fineness of chestnuts and wheat grains, and will drop through the breaker into large steel buckets attached to an endless chain belt. The ore will be carried in these buckets to the bins, 40 feet above, having a capacity of 210 tons.

Manitoba and N.-W. Territories.

The Alberta Railway and Coal Company has let out contracts for the construction of a large number of miners' houses. The houses and lots are to be obtained by the employés from the company on the following terms: Cost of house and lot from five to six hundred dollars, on a rental purchase of $12 a month at 6 per cent. per annum interest, the house and lot becoming the property of the employé when principal and interest are paid. The sinkers have got down to the coal in No. 2 shaft. The engine and boiler have arrived for the same. A large staff of carpenters are at work forming trestle work to connect with the shaft and for convenience in loading the railway cars and teams. A large quantity of stone has been quarried and hauled for the foundation of engine and boiler beds and houses of the shaft.

Local papers announce that an expert of extensive experience in coal mining—no name is mentioned—has offered to defray 10% of the cost of boring for coal at Medicine Hat. He is confident that excellent coal will be found in the immediate neighbourhood of the town.

British Columbia.

Development work on the claim of the Lillooet Hydraulic Mining Co. at Lilooet is being actively pushed. At the last "clean up," representing ten days' work for four men, $175 was taken out, the running expenses being $90.

At Fish Creek, which is reached from the C.P.R. a few miles east of Illecillewaet, development work has been carried on during the most of the past winter, and two tunnels have been driven at different levels, showing excellent veins of argentiferous galena.

At the Vancouver Enterprise mine on Cayuse Creek, a tunnel is being driven under contract to reach a supposed buried channel of the creek some 600 feet distant, where rich pay gravel is looked for. Rock has been, however, struck in the tunnel, and the work may prove more troublesome than was expected.

The Raney brothers are actively engaged in opening out a mine of magnetic iron ore on the west side of the North Arm of Burrard Inlet. There is, unfortunately, a large proportion of pyrite in the ore taken out so far, but it is hoped that by sinking ore will be found in quantity free from this deleterious admixture. There is said to be a fine deposit of clay on the same property.

Certificates of Incorporation have been granted to the Middle Creek Gold Mining (capital, $5,000,000) and the North-Western Gold and Silver Mining Company (capital, $1,000,000).

The Nanaimo *Free Press* says the last of the importation of coloured miners left the mines on Friday, and the colliery work is now done entirely by whites and Chinese. The recent find of an eight-foot seam of coal at the Union colliery is more than confirmed, for a second bore at 700 yards distant from the first bore also struck the seam, and a third bore at about equal further distance also struck the coal within 16 feet of the surface. This is looked upon as a nice strike, and secures the permanency of the Union mines.

Notice of application for Incorporation is given by the Crow's Bar Mining Company (Limited), capital $25,000 in 5,000 shares of $5. The trustees who shall have the management of the affairs of the company for the first three months are D. L. Beckingsale, S. Herbert, J. W. Hoone, J. Van Volkenburger, all of Vancouver. The company is formed to acquire and work for gold and ther minerals.

A company of which Major Vaughan is the moving spirit is engaged in an active search for coal in the valley of the lower Fraser. By co-operating with the C.P.R. Co. they have secured the use of the Diamond Drill belonging to that company, and are now boring at Kanaka Creek, that site having been chosen on the advice of Dr. Lawson, as the most likely one to test the general question of the presence of coal in the valley of the lower Fraser.

There is some talk among the more enterprising inhabitants of Lillooet of placing a steam tug on the Fraser between Lytton and Lillooet, that portion of the river being navigable. With a Government subsidy and a mail contract such a venture could doubtless be made to pay, and could afford much easier access to that portion of the interior than is now possible, and would lead to more active mining developments in a really promising district.

Prospecting is active on Illecillewaet Mountain this year. A large number of claims have been taken up both in the vicinity of the C.P.R. and on the North Fork, and assessment and development work is being done on most of them. The Selkirk Mining Co. have let a contract for the completion of their lower adit, which it is calculated will strike their lead at a point about 200 feet farther than it has already been driven. No active mining has been done on the adjoining Maple Leaf claim, but the property has recently been carefully examined and reported upon for eastern capitalists by Dr. A. C. Lawson, and it is probable that further development work will be commenced at an early date to test the value of the claim more thoroughly.

The erection of the smelting furnace at Golden is progressing favorably. The dimensions of the buildings and style and make of plant are as follows: One building for offices and analytical laboratory, 20 x 30; one for roaster furnace, 70 x 80; one for 2 calcining furnaces and ore crusher, 53 x 53, with an additional shed for coke, 53 x 13; one ore house, 40 x 40; also a receiving platform, 90 x 76, close to a spur of the C.P.R., capable of accommodating 12 box cars. There will also be a shed for coal fuel, 20 x 40. These buildings will be composed of square timbers with shingled roofing, and the usual precautionary measures in case of fire. The most of the plant was manufactured by Fraser & Chalmers, of Chicago, Ill., and consists of one water jacket furnace, 7 x 10, with No. 4 blower, 33 x 72; and one Blake crusher, 14 x 24. The belt rolls and sample grinder, 5 feet 6 inches, power elevator and all casting for the calcining furnaces were also furnished by the American firm. The motive power will consist of one 30-horse power slide valve engine and tubular boiler, 12 feet long by 42 inches in diameter; these were manufactured in Toronto. The supply of water will be taken from the Kicking Horse, by means of a No. 6½ Knowles pump, capable of a volume of 150 gallons per minute. This plant is intended or adapted to treat ores of the sulphurous or argentiferous galena class, but will also reduce ores carrying a limited percentage of copper. These works are intended to treat about 40 tons of ore in 24 hours, and will employ a minimum of about 30 actual workingmen, exclusive of supernumaries, if kept running in full blast.

In order to further aid the development of the mineral wealth of the province, the following reduction of fees for assaying, to come into effect on the 1st prox., has been ordered by the Hon. John Robson, Minister of Mines: Tests of single samples for gold, silver, lead and copper to be made for $1.50 each; when two or more samples are tested, the charge will be $1 each, and for all other tests a proportionate reduction will be made.

The General Phosphate Corporation.—The *Times* correspondent at Ottawa, writing under date of 25th July, says: "I learn on the best authority that the majority of the phosphate lands of the Dominion have been bonded by the Canadian representatives of the Phosphate Trust for a period of two months, with the option of purchase at the end of that time." We need hardly inform our readers that the statement is as absurd as it is untrue.

We learn that Mr. J. Lainson Wills, who has been absent in Europe and South America for several months, has returned to Buckingham.

Coke Bricks for Furnace Linings.—At a recent meeting, in Dusseldorf, of the Society of German Iron Manufacturers, F. Burgess, of Gelsenkirchen, referring to the subject of furnace linings, said it was well known to those who had to do with blast furnaces that the hearth and bottom of a furnace are the parts which, so far, have been the least successful in performing the duty expected of them. Often, after a short time, only a few inches remain of a hearth that was 3 or 4 ft. thick when set in. Then streams of water must be played on to keep the hearth in any condition at all. The great inconveniences of this state of things need no emphasising. The cause of this quick destruction of refractory material lies clearly in the circumstance that the hot slag, which in most processes is now acid and now basic, dissolves the lining in the shortest time and carries it away as slag. An experiment will show that the best refractory stone of the most widely differing composition, when placed in a stream of slag, will be completely melted away in one to two hours. This fact determined me to look for a better material. Carbon suggested itself to me, because it is apparent in the blown-out furnaces that the best inner coating consists of small coke and graphite cemented with lime and slag, and in this case it is the carbon which has proved the refractory armour. In practice, also, it is well known that slag runs best in a bed of coal or coke ash. The first experiment, which in 1882, was to make a combination of coal, coke dust, graphite, &c., with clay, and to use it in the form of bricks. The firm of Dr. Otto & Co. furnished him with several samples of this brick, which were somewhat defective, as in the process of making the bricks the carbon had been partially burned out; but even these gave good results. It was not possible to patent this process in the metallurgy of Brundkerl. It is mentioned that the lead furnaces in the Harz region were lined with such a mixture of coke dust and clay. In 1885 there appeared a paper by A. Purcel, on ferro-manganese, in which it was stated that already for several years in La Voult and Taimain, France, hearths and bottoms of graphite bricks had been used. The raw material was retort graphite of 1 to 2 per cent. ash, which, ground and burnt with tar, was then made into bricks and calcined. Part of the tar was caked, and burned the graphite into a hard and durable brick. Experiments were made with ground coke poor in ash, instead of graphite, and these experiments always gave good results. In 1885 furnace No. 2 was lined with this material. And the use of it, even with large production, has given satisfaction ever since. The cost of the bricks is about 100 marks per ton.

Improvements in the Manufacture of Copper.—The improvements in Copper smelting, by P. C. Gilchrist, relate to the separation of copper from impurities, more especially arsenic, antimony and tin. In roasting of white or pimple metal for the production of blister copper, in the treatment of metallic bottoms for the removal of arsenic and conversion into blister or into refined copper, and also in the toughening and refining of blister copper, reverberatory furnaces are used, lined with shrunk dolomite, magnesia, chrome iron ore or other basic or neutral lining by which means it is possible to maintain during the operation of refining a basic slag instead of the acid slag as hitherto. A purer product is thus obtained, together with a larger yield and increase output. It has been found that a suitable amount of lime to add when charging white metal containing 75 per cent. of copper, is from 2 to 3 cents per seven tons of white metal charged. The metal should be melted down slowly under air. Much less slag will be formed than is usual in sand-lined furnaces. A good heat should be kept on the furnace throughout the charge. It is often advantageous to add a few shovelfuls of lime to the slag shortly before tapping the charge. Care must be taken not to form too thick a slag or the operation will be retarded. It is often convenient to charge in also some copper oxides or slags, and to subject the surface of the latter to the action of an air blast, the oxidising action of which materially assists the diminution of the arsenic. The object of the smelter should be to obtain as little slag as possible, and with a low percentage of copper in it, skimmings of slag should be made three or four times, as desirable. When the sample begins to show a blister fracture a few shovelfuls of lime are to be added once or twice until the bath is ready for tapping. The slags obtained when working as described will not average more than 30 per cent. of copper, whereas when working with the ordinary sand bottom the slag usually averages 55 per cent. of copper, besides weighing considerably more per ton of blister produced. It was found when treating 400 tons of metallic bottoms in a basic lined furnace that there was obtained 323 tons of blister and 107 tons of slag, averaging 25 per cent. of copper, and that when treating an equal weight of metallic bottoms in a sand-lined furnace there was obtained 191 tons of blister only and 221 tons of slag, averaging 55 per cent. of copper. A slag in which there is no more silica than 20 per cent. should be worked with, as with more siliceous slags the elimination of the impurities takes place more slowly. —*Journ. Soc. Chem. Ind.*

The Davis-Colby Ore-Roaster *

By Sterling G. Valantine, Ph.D., Lebanon, Pa.

The annual use of large quantities of sulphurous iron-ores (over 1,500,000 tons in the United States) has led to a search for the best methods of desulphurization, in order to make this material more available for the manufacture of a good quality of pig-iron. Although such ores can be used raw in small amounts, they must be previously roasted if they are to constitute the entire ore-charge of a furnace.

In a former paper some of the chief conditions necessary to satisfactory roasting of ore were examined on the basis of experimental data They indicated, too, the most prominent characteristics of a good kiln. It is proposed to give in this paper some description of the latest application of a gas fired roaster to the preparation of sulphurous ores, as exhibited in the Davis-Colby kiln, including a statement of some results already obtained in actual practice. The principles involved in the construction and work of this roaster cover the most prominent points heretofore shown to be necessary for good results.

The Davis-Colby ore-roaster is the outcome of some years of trial and practical experience. In the years 1878-9 the Katahdin Iron Works built at their furnace a Westman kiln, which was fired with wood, for the purpose of making the ore used there available for the manufacture of charcoal car-wheel iron. The ore at that locality is a hematite, resulting from the oxidation of a ledge or vein of pyrites, and carries a good deal of sulphur The Westman kiln being in many points unsatisfactory, changes made from time to time to secure increased efficiency resulted in what is now known as the Davis-Colby gas-fired roaster. This has been and is yet in constant use at the Katadhin Iron Works, and kilns of the same type have been since introduced at other points.

The illustrations, reduced from drawings kindly furnished by Mr. A G. Davis, will give a clear idea of the construction of the kiln. In general it consists of two concentric shafts of brick-work, enclosing between them an annular space, *E*, 18 to 24 inches in section, to contain the ore under treatment. The inner shaft, *F*, is continued to a proper height above the top of the roaster to form the draft-stack, as shown in Plate II. ; or it may be covered, as in Plate I., the products of combustion being carried downward and out through the flue, *F*, to a separate chimney. This would allow of any utilization of the fumes deemed expedient. A cone-covered top, as shown, permits of more convenient charging, as ore can be dropped from car-hoppers upon the cap, *L*, giving an even distribution of the ore. In the outer wall are

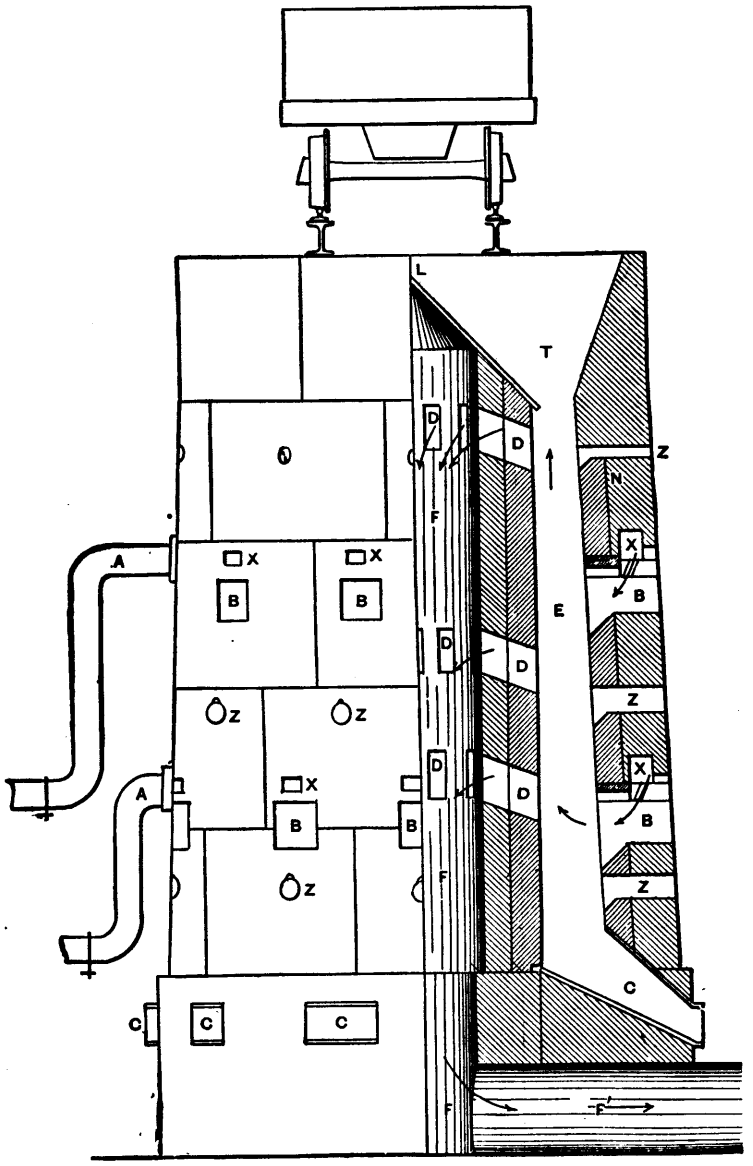

FIG. 1.—Down Draft Davis-Colby Ore-Roaster.
(Scale : $\frac{3}{16}$ inch to 1 foot.)

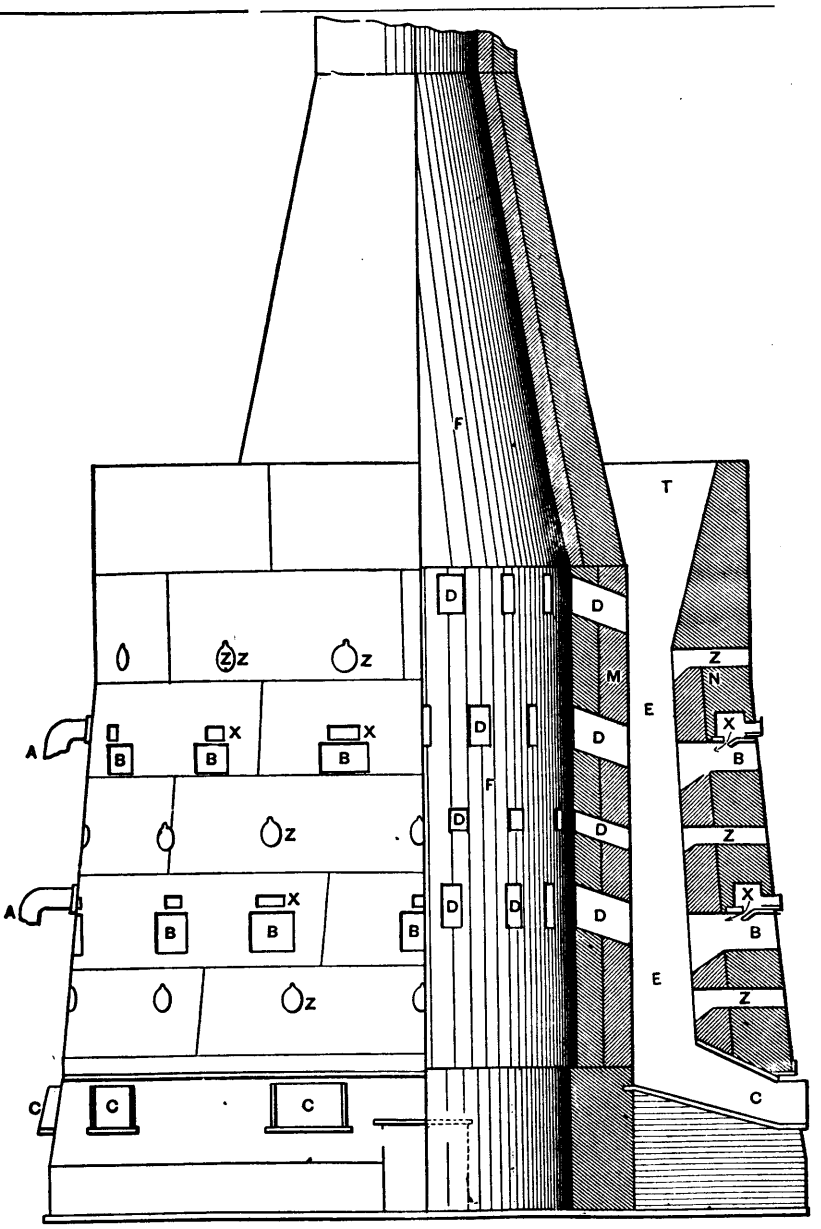

Fig. 2.—Davis-Colby Ore-Roaster, Cornwall Anthracite Furnaces, Cornwall, Pa.
Scale : $\frac{3}{32}$ inch to 1 foot.

placed the chutes, *C* ; the fire-arches, *B* ; the gas-flues, *X*, and the poking-holes and air-holes, *Z*. Openings in the inner wall, *D*, admit the fumes and products of combustion to the draft-stack, *F*. These opening are placed higher or lower, according to necessities arising from the character of the ore under treatment The external shape, as shown in Plates II. and III., is that of the Gjers kilns, which were remodelled to the new type. These illustrations are given to show how readily the ordinary style of roaster may be adapted to this new design. In some cases, particularly where dense hard magnetites are to be roasted, the height of the kiln is increased above that shown, for the purpose of giving the ore a longer exposure to heat ; and the fire-arches are put at a greater vertical distance apart, so that the ore may partially cool after its first heating, and be cracked or fissured, thereby exposing the remaining sulphur more thoroughly to the action at the second fire-arches. A gallery around the outside, at the proper height, gives workmen convenient access to fire-arches and gas-flues.

Gas from the mains, *A*, enters the flues, *X*, in the outer wall, and is distributed to each of the fire-arches, *B*, flowing downward through the outlets, as indicated by the arrows. Two or more sets of fire-arches are used. In these the gas is burnt, the flame and heat impinging on the ore as it descends in the annular space, *E*, raising it to any temperature required. This heating is done in the presence of abundant air, entering at the chutes, *C*, the fire-doors, *B*, and the poking-holes, *Z*. After passing through the ore the air enters the draft-stack through the openings, *D*, carrying with it the gaseous products of combustion and sulphur oxides from the ore.

The ore is filled in at the top, *T*, passes down the space, *E*, which gradually widens downward, and is drawn below from the chutes. Its cross-section being so narrow, the whole body of ore is thoroughly exposed to the fire.

At most places where these roasters have been introduced, the gas used for firing has been surplus gas from the blast-furnace. Where this supply is abundant and clean, or where the gas can be cleaned for introduction to the flues of the roaster, it answers very well, and is economical. Small blast furnaces can the better allow this method, as their surplus supply of gas is generally sufficient, and likely to contain a larger amount of combustible constituents than that from larger furnaces, the latter, as a rule, having little surplus gas above that required for hot ovens and boilers. But there are serious objections to depending on the use of furnace gas under the circumstances generally prevailing. The gas-flues and small openings into the fire-arches require to be kept open and free from dirt ; and while this can, of course, be readily done, it increases the attention required in

working the kiln, and is so far an annoyance and disadvantage. The difficulty of getting a clean furnace-gas is an important objection to its use. Then, too, the variations in the quantity and quality of furnace gas are against it. When a furnace man is especially desirous of securing well-roasted ore, he may find such fuel unequal to the task of preparing it. There are, after all, few furnaces that afford gas enough to heat their blast, furnish their steam, and roast their ore at the same time. It is questionable economy to make any endeavour to turn a blast-furnace into a gas-producer. It may be desirable at times however, to use waste furnace-gas for whatever part of the work of roasting it may be equal to, and augment the supply from another source.

Producer-gas, therefore, is a preferable fuel for the roaster, and can be obtained cheaply from some such apparatus as the Taylor producer. With such an arrangement the gas supply can be kept uniform in quantity and quality, or can be varied, as the case may demand, thus giving increased control of working.

The principles involved in the construction and working of the Davis-Colby roaster are well calculated to produce good results. The heat is under almost absolute control. Any set of fire-arches, or any single fire-arch, can have its supply of gas increased or diminished at will. The double set of fire-arches serves to keep the ore at the desired temperature until drawn into the chutes, so that from the first point of heat it is held, during its entire descent, at such a temperature as to make the action of atmospheric oxygen upon it most effective.

The air required for a proper oxidation of sulphides in roasting is furnished abundantly through the poking-holes, fire-doors and chutes, passing through the hot ore into the chimney. Thus, the hot ore is always exposed to an oxidizing atmosphere, and a prime requisite for good results is well attained. The narrowness of the ore-section has

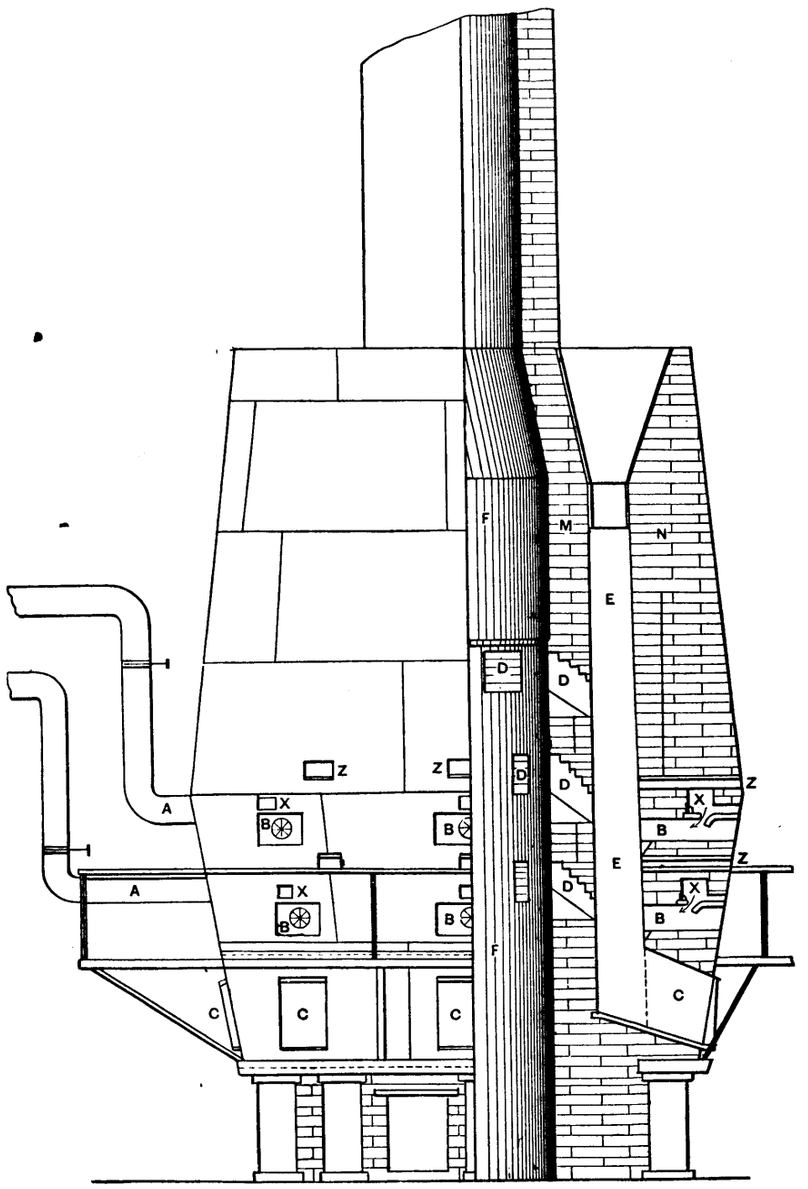

Fig. 3.—Davis.Colby Gre-Roaster, Colebrook Furnaees, Lebanon, Pa.
(Scale: $\frac{3}{16}$ inch to 1 inch.)

the advantage of making it very difficult for any ore to pass the two or more fire arches without being well exposed to oxidation. Since the openings into the draught chimney are just opposite, and a little above the fire-arches, the heat and air are drawn through the whole of the annular space, all gaseous products of consumption passing promptly into the stack and being removed.

Sulphur of iron can be decomposed by atmospheric oxygen alone at ordinary temperature, a very slow reaction indeed, but, like most chemical reactions, the process of oxidation is accelerated by heat. On the other hand, a high temperature, without oxygen, affects a partial decomposition of FeS_2, leaving a compound very nearly FeS, volatilizing about half the sulphur, but cannot carry the process further alone.

Oxygen being present, however, the chemical affinity between it and sulphur is increased by heat, and a complete oxidation of all the sulphur is theoretically attainable. Oxygen is absolutely necessary for the removal of the second half of the sulphur. Heat is required in such a degree in each case as will most effectively enhance oxidation, *and as long as it is desirable to continue the oxidizing action, the heat should be kept at the most favorable point, with ample opportunity for admission, at the same time, of atmospheric oxygen.* It is this fact that brings out the peculiar effectiveness of the Davis-Colby roaster.

Some analyses are appended to show results obtained in actual practice with the Davis-Colby roaster.

Excellent results have been obtained in working on Katahdin, Me., ore, which is very open and porous, and well adapted to roasting. The following table shows its composition when raw :—

Raw Katahdin Ore.

	I.	II.	III.	IV.	V.
Iron	47.75	57.34	44.80	39.50	53.50
Phosphorus....	.017	.025	.04	.035	.034
Sulphur	3.90	1.29	.98	2.50	2.48

The roasted ore contains the following percentages of sulphur :—

	1	2	3	4	5	6
Per cent. Sulphur, -	0.07	0.15	0.10	0.18	0.12	0.10

The roasted ore runs, as a rule, from 0.05 to 0.20 per cent. of sulphur, averaging not over 0.10 to 0.12 per cent.

Cornwall, Pa., ore, containing on an average from 2½ to 3½ per cent. of sulphur, gives the following results when treated in Gjers Kilns :—

Cornwall Ore Roasted in Gjers Kilns.

Per cent. Total Sulphur.	Per cent. Sulphur as Sulphate.	Per cent. Sulphur as Sulphide.	Per cent. Total Sulphur as Sulphate.
1.133	0.283	0.850	24.977
1.380	0.135	1.245	9.782
1.873*	0.096	1.777	5.125
.800	.....	.....	.....
1.410	.....	.....	.....
1.050	.....	.....	.....
1.120	.....	.....	.....

The same ore roasted in the Davis-Colby kilns shows results as follows : —

Cornwall Ore Roasted in Davis-Colby Kilns.

Per cent. Total Sulphur.	Per cent. Sulphur as Sulphide.	Per cent. Sulphur as Sulphate.	Per cent. Total Sulphur as Sulphate.
0.577	.....	.....	.....
0.779	.....	.....	.....
0.674	.....	.....	.....
0.666*	0.533	0.133	19.96
0.602	0.497	0.105	17.44
0.398	.....	.....	.....
0.697	.....	.....	.....
0.782	0.358	0.424	54.21
0.798	0.480	0.318	39.85
0.596	0.315	0.281	49.14
0.740	0.534	0.206	27.83
0.850	.....	.....	.....

*Samples of clinkered ore.

As being of interest in this connection, the following results are given as obtained by another type of gas-fired roaster, the Taylor kiln, on magnetite ores from the Jones mine, Berks Co., Pa. This one is similar to Cornwall ore, and carries about the same amount of sulphur. The analyses are by Mr. R. H. Voudy, of the Phœnix Iron Company, and the roasting was done in their kiln :

"Jones" Ore Roasted iu Taylor Kiln.

Per cent. Total Sulphur.	Per cent. Sulphur as Sulphide.	Per cent. Sulphur as Sulphate.	Per cent. Total Sulphur as Sulphate.
1.087	0.656	0.431	48.85
1.059	0.552	0.507	47.87
1.045	0.618	0.427	40.86
.912	0.548	0.364	39.91
.909	0.444	0.465	51.15

As to the ability of the Davis-Colby roaster to dispose of fine ore, it may be well to state that, when properly charged, as much as 30 to 40 per cent. of fine ore can be used. But fine and coarse should be thoroughly mixed in filling, as a solid mass of fine ore before a fire-arch chokes off the gas and prevents the heat and air from penetrating the ore. Kilns of the size shown in the illustrations, roast from 75 to 100 tons of a reasonably porous

ore in twenty-four hours. Of course a hard, dense ore requires a longer exposure, and the output of such ore is somewhat less. The roaster at the Katahdin furnace, 20 feet high, and 15 feet in diameter, roasts about 40 tons per day, the entire supply for the furnace. The kilns at the Colebrook furnaces and Cornwall anthracite furnaces, as shown in the illustrations, roast from 75 to 90 tons of Cornwall ore per day.

The occurrence of clinkers in this roaster causes little difficulty in working. They are local, seldom extending beyond the bounds of one or two fire-arches, and as the annular space is so narrow, and widens downward, they are readily reached and broken up while hot. Indeed, with proper attention, there is no reason why clinkers should be allowed to form at all, owing to the easy and full control of the heat. But carelessness of men in charge will sometimes bring about that result. The upper fire-arches should generally be kept at a somewhat lower temperature than the second set, gradually raising the ore to the desired heat as it descends, so that if clinkering does take place it is only after long heating at a lower temperature, and after atmospheric oxygen has had full play on the reasonably hot ore. It is seldom necessary to sinter an ore in roasting, but it it is done, it should be the final act of the process, as it renders further effective roasting impossible.

The cost per ton of roasting ore in this kiln varies with the circumstances, and it is scarcely possible to give figures. The cost is greatly affected by the method of breaking and filling the ore, and by the use of furnace, or produce-gas.

New kilns, with a caprcity of 75 to 100 tons per day, are built by contract for $3,000, including royalty. But the system can be adapted to any ordinary Gjers kiln, the expense varying with the size and shape of the original roaster.

It is possible that this roaster may find a new field of work in the preparation of gold and silver-bearing lead ores, and other metallurgical processes of which roasting forms a part.

* Transactions of the American Institute of Mining Engineers. (Ottawa Meeting, October, 1889.)

LEGAL.

Burk v. Tunstall.

This was an application for a writ of prohibition against George Tunstall to restrain him as Gold Commissioner for West Kootenay from further proceeding in an action brought in his court by Robert Burk to recover $70 for labor performed in the Cariboo mining claim in Illecillewaet in the district of West Kootenay. The following is the verdict of the Supreme Court :—

"The grounds taken by Mr. Wilson in applying for rule nisi were that Mr. Tunstall is a gold commissioner appointed by the Provincial Government, and that the powers given to a gold commissioner sitting as a judge in a mining court under section II. of the Mineral Act are ultra vires, to the Provincial Legislature, the power of the appointing judges being solely vested in the Governor-General.

"It is to be regretted that no argument was addressed to me in support of the powers claimed by the gold com missioner under the Act, as no one appeared in opposition to the rule.

"The sections of the Mineral Act, so far as they are of importance with reference to this application, are as follows :

"Sections 4 authorizes the Lieut.-Governor in council to appoint gold commissioners either for the whole province or for a particular district. Sec. 5 establishes in every district a court called the mining court over which the gold commissioners shall preside.

"Such mining court by sec. 6 is to have original jurisdiction as a court of law and enquiry to hear and determine all mining disputes, and is to be a court of record, and the gold commissioner is to have the same powers for enforcing the judgments or orders of his court as are exercised by the Supreme Court or a judge thereof.

"Sec. 10 gives a jurisdiction as to dispntes relating to real estate held under the Act. Sec. 11 gives jurisdiction as to personal claims arising between persons engaged in mining, and in respect to supplies furnished to persons engaged in mining, and sec. 12 authorizes the gold commissioner to issue writs of ca. re. ne exeat and ca. sa. in all cases in which by law he has jurisdiction, which apparently means in all cases in which the Act clothes him with jurisdiction.

"We here find a very large and extended jurisdiction vested in the gold commissioner, unlimited as to amount, and limited only by the fact that the questions to be decided by him must be between persons engaged in mining or in respect of supplies furnished to persons engaged in mining. This jurisdiction is in reality in excess of the powers vested in the County Courts, uncontrolled by any rules and unfettered by any restrictions. The issues that can be raised uuder these sections may involve property of a very great magnitude and questions of the greatest importance. In addition to these judicial powers the gold commissioner is vested with certain judicial functions respecting the recording of claims, defining of boundaries of claims, laying over claims, and other matters of considerable importance to a mining community, but which are not involved in the question now before me.

"Prior to Confederation the Provincial Government had all the necessary authority for establishing courts of this character and of appointing the presiding officers, and secs. 4, 5 and 6 were enacted prior to Confederation.

Since Confederation the Provincial Legislature has power to constitute, maintain and organize provincial courts, including procedure in civil matters, under section 92, sub-section 14 of the B. N. A. Act. So far then as that act establishes a mining court and creates its jurisdiction it was within the powers of the Colonial Legislature, but when the Provincial Legislature attempts to appoint judges of the courts thus constituted with other than ministerial powers, it trenches on the powers expressly given to the Governor-General by section 96 of the B. N. A. Act. It is true that the language used in that section is limited to the judges of the Superior, District and County Courts in each province, and it might be contended that these courts having been expressly named, all other courts are excluded. If this were so, the Provincial Legislature would only have to constitute a court by a special name to enable them to avoid this clause, but in the section itself after the special courts thus named, the courts of probate in Nova Scotia and New Brunswick are excepted from the operation of the clause. If these courts had not been so excepted the conclusion would naturally be that they would have been included within the terms under which the other courts are described.

"But there is a further view which I think is conclusive on this point. It is a prerogative of the Crown to appoint all judges, and such prerogative cannot be taken away except by express words, and this prerogative has been delegated to the Governor-General, and I see nothing in the Act taking this right away and vesting it in the Lieutenant-Governor. In the Magdalene college case, 11 reg. it was held that when the King had any prerogative, estate or interest, he shall not be barred of them by the general words of an Act of Parliament, and Lord Cairns in Theberge v. Landey, 2 app., cases 102, says their Lordships wish to state distinctly that they do not desire to imply any doubt whatever as to the general principle that the prerogative of the Crown could be taken away except by express word.

"I, therefore, hold that the power of appointing judges of the mining courts is vested in the Governor-General, and that although the appointment of a gold commissioner for certain purposes of a ministerial nature, which are defined in the Mineral Act, is entirely within the powers of the Provincial Legislature, yet to clothe that officer with the important and extensive judicial jurisdiction which section 11 of this Act purports to do, is entirely beyond the power of the Provincial Legislature.

"I may point out that under the 7th section of the Mineral Act, the County Court, if there is one whose jurisdiction extends over the district for which a gold commissioner is appointed, has exclusive jurisdiction in all mining questions under the Act, and it will be for the Government to make provision to meet the difficulty that has now arisen.

"I, therefore, direct that the rule for a prohibition be made absolute."

Prosecution Under the B. C. Coal Mines Regulations Act.—Mr. Francis D. Little, manager of the Union Colliery, Comox, was charged before the Magistrate's Court, Comox, on 20th inst., with a contravention of the Coal Mines Regulation Act, inasmuch as he did unlawfully employ a Chinaman named Cow, number 99, underground in said mine contrary to the provisions of the Act.

Mr. Archibald Dick, Inspector of Mines, prosecuted.

Several witnesses were examined, whose evidence went to show that the man was a Chinaman and that he had been employed as charged. A second case was also proceeded with, the party being Toong, another Chinaman. Considerable discussion ensued as to whether or not the parties were Chinamen or could be considered as such, both of them being British subjects, Toong having been born in British Hong Kong, and, as he said, belonging to the British Queen, and not to the Chinese Emperor.

Mr. Luxton, after considerable argument, contended for the defence that the Act of the British Columbia Legislature was unconstitutional because it legislated on trade and commerce, interfered with the treaties between Great Britain and China, and legislated aliens as well as questions on criminal law, which were *ultra vires* beyond the power of the Legislature of British Columbia. He submitted that these cases showed conclusively that a statute which enacts words under which it is sought to create an offence cannot be altered in its language for the purpose of including an offence in it, he claimed, therefore, that section 12 cannot be altered by the magistrate or any other court to include the words "or Chinaman" within its provisions, and without the insertion of these words the offence is not constituted by the Acts as committed by the defendants.

Section 95 of the Act which imposes the penalty says that "any person who is guilty of any offence under this Act, shall be liable, etc.," but neither section 12 nor any other section of the Act makes the employment of a Chinaman an offence under the Act, therefore no penalty could be imposed for so doing. The above is one of the objections I have against the Magistrate assuming jurisdiction in this case.

But even assuming for the purpose of argument, that the Magistrate has jurisdiction, expressly given by the Act, then I submit that no offence has been committed by defendant because the person named Cow in the information is not a "Chinaman" as he certainly has proved on his own testimony that he was born in Hong Kong, and if he was born there I submit he is a British subject.

The Magistrate asked—Is it not the question, of Chinamen or no Chinamen, and would not any Chinese person, even if he is a British subject, come within the prohibitory section of the Act.

Mr. Luxton replied—The question arises, "What is a Chinaman?" The prosecution here says that because Cow was born in Hong Kong, which is geographically in China, he is a Chinaman. I claim if a person is born of Chinese parents in British Columbia he is a British subject, the same as he would be if he was born in the British colony of Hong Kong.

The Magistrate—Is it not a question of Chinamen by race and not by nationality?

Mr. Luxton continued—The race of the Chinamen is the Mongolian race, and had the Legislature intended to restrict the employment of persons of the Mongolian race generally in coal mines, the words of the Act would have been instead of "and no Chinaman," the expression, "and no person of the Mongolian race." There is authority for the distinction in Legislative enactments in the usuage of the Legislature of California where they legislate against the "Mongolian race," and not against Chinamen.

The Magistrate reviewed the arguments of Counsel, the conclusiveness of which he was bound to concede, so far as the want of jurisdiction of justices to entertain, hear or determine charges for the unlawful (because pro hibited) employment of Chinamen in coal mines was concerned, but the Magistrate otherwise considered the facts alleged in the informations to be sufficiently proved, and it was only his want of jurisdiction that compelled him to refrain from convicting the defendant of the offences charged. The constitutional objections raised against the validity of the Act purporting to prohibit the employment of Chinese in coal mines, the Magistrate said he regarded as (practically) beyond his province to decide upon, therefore he should in any event have left it to be dealt with by a higher court.

He dismissed the charge in both cases, but without costs.

An English Syndicate Secures the Blake and Knowles Steam Pump Works.—An English syndicate has secured control of the Blake Steam Pump Manufacturing Company at East Cambrige, Mass., and the Knowles Steam Pump Works at Warren, in the same State.

This purchase differs in one respect at least from others which have been made recently by English capitalists. All the common stock of the corporation is retained by the old owners of the plants, only the debenture bonds and preference stock being offered for sale. The debenture bonds provide that out of the earnings of the company three per cent. of the amount of the bond issue shall be set aside each year to constitute a sinking fund. Each year three per cent. of the bonds will be drawn and paid off at a premium of ten per cent. The reason given for the deal is the fact that two of the largest stockholders in the old concerns, Messrs. Blake and Taylor, are anxious to be relieved of the care of business, the former on account of advanced age and the latter because of poor health.

A Big Natural Gas Pipe Line.—The Pittsburgh *Commercial Gazette* says that a natural gas line, 20 miles long, and costing in the neighborhood of half a million dollars, is to be built at once from the wells of the Carnegie Co., in Washington county, Pa., to the steel works of Carnegie, Phipps & Co., at Homestead. Mention was made in the columns of the *Gazette* a few days ago of the purchase by the Carnegie firm of 10,000 acres of gas lands in the county named. Some of the best gas land in that section were included in the sale, and it is to this field that the line mentioned above will be built. The placing of this contract, as well as the other large one made by the Philadelphia Co. for its new line to the Bellevernon field a few days ago, indicates a big revival of the pipe-laying industry this year.

The Desulphurization of Pyritiferous Iron-Ores.*

By Sterling G. Valentine, PH.D., Lebanon, Pa.

Until within late years, the preparation of sulphurous ores for the blast-furnace has received comparatively little attention. After the first improvement made on the old style of heap-roasting and roasting between walls, there has followed an almost general adoption of the Gjers kiln or some modification thereof, and the majority of iron-masters have seemed perfectly satisfied with so much progress. However, the Westman kiln was developed in Sweden, and other gas-roasters for sulphurous ores have been since constructed. They are in use on the continent of Europe and in America to a limited extent.

The following experiments were made in order to furnish additional information as to the proper conditions for the elimination of sulphur from ores where it is present as sulphide of iron, FeS_2. I desire here to acknowledge the kindness of Dr. Franklin Menges, of the laboratory of Pennsylvania College, at Gettysburg, Pennsylvania, for lending his valuable aid in carrying out a part of these experiments and analyses.

In the first series of these experiments, pure, roughly-pulverized pyrites crystals were used, containing 53.42 per cent. of sulphur. They were made with a view to determine the effect on pyrites, of heat alone, in various degrees of intensity and duration, air being altogether excluded. The heats at a low temperature were made in glass combustion-tubes, sealed at the end, where the pyrites to be tested was placed, and with only a small opening at the opposite end. Although not allowing circulation, this arrangement still permitted a part of the evolved sulphur to escape. The heats at high temperatures were made in Hessian and graphite crucibles, tightly luted, every precaution being taken to exclude air. The temperatures attained are given approximately, and are as nearly correct as it was possible to estimate them, using Pouillet's scale as a guide.

The following table will show the effect of heating pyrites, FeS_2, air being excluded :—

Approximate Temperature in Deg. Fahr.	Duration of Heat.	Sulphur in Residue. Per cent.	Loss.	Per cent of Total Sulphur Expelled.
Original Pyrites...	.....	53.425	.....	.....
1250	45 min.	45.500	7.925	14.830
"	5 hrs.	42.591	10.834	20.270
1400	1 "	45.140	8.285	17.379
"	1 "	43.570	9.855	18.446
"	6 "	41.850	11.575	21.665
1600	30 min.	37.933	15.472	28.990
1800	1 hr.	39.389	14.036	26.272
2600	30 min.	29.519	23.906	44.720
"	45 "	31.519	21.906	41.003
"	1¼ hrs.	29.960	23.464	43.917

The residues from these heats had lost their metallic lustre and were generally grayish in color, soft and friable. The samples heated at a white heat were, of course, completely fused. The figures show that, except in the case of a high heat, comparatively a small part of the sulphur was expelled by heat alone without access of air. Contrary to the idea generally prevalent, it is shown by these results that, while a part of the sulphur volatilizes readily, it is by no means easy to get rid of half of it if air is excluded.

The next experiments were undertaken to ascertain the effect of heat on FeS_2 when air is given access freely:

Approximate Temperature in Deg. Fahr.	Duration of Heat.	Sulphur in Residue. Per cent.	Loss.	Per cent of Total Sulphur Expelled.
Original Pyrites...	.....	53.425	.....	.....
1250	1 hr.	4.271	49.154	92.050
"	2¾ hrs.	.700	52.725	98.680
1600	20 min.	.78	52.645	98.540
"	45 "	.08	53.345	99.850
1800	20 "	.133	53.292	99.751
"	1 hr.	.645	52.980	98.790
2200	15 min.	3.231	50.194	93.952
"	20 "	5.916	47.509	88.926
"	35 "	1.558	51.867	97.102
"	2 hrs.	1.181	52.244	97.780

It will be noted that a larger amount of sulphur remains in the residues when higher temperatures have been applied. I account for this by the fact that the high temperature being quickly reached, a sudden fusion of some of the particles of pyrites enclosed a portion of the sulphur in such a way as to prevent the action of air upon it.

A high temperature is, therefore, not needed for the complete decomposition of FeS_2, when air has abundant access. We say "complete" decomposition, for, although sulphur still is present in small amounts, yet the expulsion of 98 to 99 per cent. of it is, to all intents and purposes, "complete." Even at a temperature as as low as 1250° F., 98.68 per cent. of the sulphur present was expelled when air had free access. At slightly higher heat, 99.85 per cent. was driven off. These results do not bear out the very prevalent idea that, after having got rid of half the sulphur of pyrites, a much higher temperature is required to expel the remainder.

In this connection Ledebur, in his *Metallurgy*, says:

"Pyrite and marcasite are decomposed even at a low temperature, while about half the sulphur is volatilized (if air is present, burning to SO_2; if not, passing off as vaporized sulphur) and a compound remains whose constitution corresponds nearly to pyrrhotite (Fe_8S_9). By simple heating, without air, this lower sulphide of iron cannot be further decomposed. If, however, atmospheric oxygen has access to the glowing compound of sulphur and iron, a further part of the sulphur burns, volatilizing as SO_2; the remainder forms next, with the iron, sulphate of iron, which is decomposed, even at a red heat. A part of the oxygen of the SO is used for the higher oxidation of the iron, basic sulphates of iron oxide are formed, and SO_2 vaporized; on still further raising the temperature, the basic iron salt is also decomposed, SO_2 driven off, and oxide of iron remains behind."

In general, the above-described experiments agree with this statement of Ledebur. But it must be remembered that in saying that "half the sulphur is volatilized" at a low heat, he evidently means the one atom of sulphur in FeS_2. This, however, only reduces the sulphur from 53.33 per cent. in FeS_2 to 39.66 per cent. in Fe_8S_2. My results have shown that this is the actual result, although with a white heat, without air, I have succeeded in reducing the sulphur to a somewhat lower point.

From the two tables given it appears that, for proper desulphurization of pyrites, air is absolutely necessary, and of greater importance than an excessively high temperature.

Experiments made by Dr. Menges as to the amount of air needed for proper desulphurization of FeS_2, gave the following results: Working with similar quantities of pyrite in each case, in a current of 900 cubic centimeters of air per minute, the sulphur volatilized without any subsequent condensation in the tube, and on gradually reducing this quantity to 450 c.c., and then to 300 c.c., no condensation occurred. Starting with a current of 400 c.c. per minute, the sulphur volatilized, condensed again further on in the tube, but was subsequently oxidized in the same current without raising the heat. These results show that with ample air-current all sulphur volatilized will readily burn to SO_2, and that in a deficient air-current any sulphur condensed will be subsequently removed.

In view of the fact that many furnace-men are under the impresion that pyritiferous ores can be largely desulphurized in the upper part of the blast-furnace, the following experiments were made: Samples of pyrite were heated in a current of gas taken from the "down-take" flue of a furnace. The gas had the following composition by weight :

	Per Cent.
Carbonic oxide	31.17
Carbonic acid	10.06
Nitrogen	58.72

The results were as follows:

Approximate Temperature in Deg. Fahr.	Duration of Heat.	Per Cent. Sulphur in Residue.	Loss.	Per Cent. of Total Sulphur Expelled.
Original Pyrites.....	.....	53.42	.....	.....
1250	10 min.	41.14	12.22	22.98
"	1 hr.	33.93	19.48	36.68
1800	25 min.	33.88	19.54	36.58

These figures show that the desulphurization of pyrites in an atmosphere of furnace-gas is, at best, only partial, the results being comparable to those obtained when it is heated without access of air. In view of the already ascertained necessity for oxidizing atmospheric surroundings, it could but be expected that in an atmosphere devoid of free oxygen only partial desulphurization could be effected. The furnace-man who hopes to use the top part of his furnace as an ore-roaster has little success to look for.

When sulphate of iron occurs or is formed in the processes of roasting, the question arises as to its behaviour on heating; whether or not the presence or absence of air has any influence. It was, of course, known that sulphate of iron decomposes on heating to ferric oxide and sulphur trioxide,* but having seen no statement as to the effect of the presence or absence of air, I made the following experiments:

Two heats, in presence of air for twenty and thirty minutes respectively, at about 1600° F., gave residues showing 0.031 and 0.030 per cent. of sulphur; 99.87 per cent. of the original sulphur having been expelled.

Three heats, with the air excluded, at somewhat higher temperatures than the above, for thirty, thirty-five and sixty minutes, gave residues showing, respectively, 0.04, 0.04, 0.002 per cent. of sulphur; 99.81 to 99.9 per cent. having been expelled.

Sulphate of iron is decomposed by heat alone, the presence of air or its absence having no influence. From this it may be inferred that sulphate of iron is harmless in the blast-furnace, its sulphur being expelled by heat in the form of SO_3 and passing out with the furnace gases. The harmlessness of sulphate of iron is, indeed, known to most furnace-men, although all are not familiar with the reasons for it.

In view of this behaviour of sulphate of iron, we inquire next, how far the manner of heating pyrites affects its presence in the residue. Does the presence or absence of air affect the percentage of sulphur in the residue present in the form of sulphate, which we have found to be harmless? To throw light on this point, residues from some of the heats were analyzed to find how far the sulphur contents was in the form of suphate of iron.

1.—PYRITES HEATED WITHOUT ACCESS OF AIR.

Temp. ° F. Approx.	Duration of Heat.	Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. of Total Remaining Sulphur as Sulphate.
1250	5 hrs.	42.591	42.399	0.192	0.45
1800	1 hr.	39.389	39.247	0.142	0.39
2600	30 min.	29.519	29.485	0.034	0.10

2.—PYRITES HEATED IN PRESENCE OF AIR.

Temp. ° F. Approx.	Duration of Heat.	Per Cent. Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. of Total Remaining Sulphur as Sulphate.
1250	2¾ hrs.	0.70	0.231	.469	67.00
1800	1 hr.	0.645	0.158	.487	75.50
2200	2 hrs.	1.181	0.687	.494	41.83

There is a very marked difference in the results. It might be expected that free access of atmospheric oxygen must be a condition for the conversion of sulphide into sulphate. The results show clearly the correctness of that view. Without access of air, practically all the sulphur remaining is in the form of sulphide, but when air has access, a large part, sometimes the larger part, is in the form of sulphate, a fact which, in view of the harmlessness of the latter in the blast-furnaces, emphasize the necessity for abundant air in the roasting of pyritiferous ores. Not only is the sulphur removed in this case, but even of what remains, the greater part is harmless.

In this connection, it was of interest to note the effect of heating in an atmosphere of furnace-gas on the amount of sulphur left in the residue in the form of sulphate. Analyses of the residues from those heats made in a current of furnace-gas, given above, showed as follows :

Temp. ° F.	Duration.	Per Cent. Totals in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. Total Sulphur as Sulphate.
1250	10 min.	41.148	41.089	0.059	0.143
1250	1 hour.	33.882	33.800	0.082	0.212
1800	25 min.	33.936	33.806	0.130	0.382

These results show that this manner of decomposing pyrites is not conducive to the formation of sulphate in the residue, and that the results here, also, are comparable to those got by heating without access of air.

It must be borne in mind that all the above experiments were made on sulphide of iron alone. The question arises whether the conclusions reached on pure pyrites will hold good for a pyritic ore. Of course, sulphide of iron can be expected to act in the same way under the same circumstances under the action of heat. Whether or not an ore containing it will permit desulphurization on the basis of the above-ascertianed behaviour of FeS_2 depends entirely on the character of the ore itself. If its structure is sufficiently porous to allow air to gain a ready access to the interior of the ore-pieces, it can be expected to sulphurize at a low heat. If it is a close, dense ore, this characteristic is equivalent to exclusion of air from the greater part of its sulphur contents. Dense

* Colerado Meeting American Institute of Mining Engineers.

* "Roscoe & Schorlemmer," vol. ii., Pt. 2, p 101.

ores are not difficult to sulphurize because they cannot be heated properly, but because air cannot penetrate them. Therefore, because pyrites can be decomposed at a low heat in presence of abundant air, it does not follow that all ores can be desulphurized under corresponding conditions. While it may be said that atmospheric oxygen is a *sine qua non* for proper roasting, no general rule can be laid down concerning the proper temperature to be used.

In order to test the correctness of these views, the following experiments were made :—Small pieces of Cornwall ore, about the size of a walnut, containing, as nearly as could be judged, the same amounts of sulphur, were heated at low temperature under free access of air. The original raw ore showed 2.644 per cent. of sulphur. The following results were obtained :

Temp. °F.	Duration.	Per cent. Sulphur in Residue.	Loss.	Per cent. Total Sulphur Expelled.
1200	2 hrs.	.346	2.318	87.01
1200	4 "	.178	2.486	93.31
1500	1 hr.	.099	2.565	96.28

From these results it would seem that a comparatively open-grained and porous ore can be readily desulphurized at a comparatively low temperature when air has access freely.

The necessity of an oxidizing roasting so that the sulphur remaining shall, as far as possible, consist of sulphate, is proved by an analysis of the same ore :

Temp. °F.	Duration.	Per Cent. Total Sulphur in Residue.	Sulphur as Sulphide.	Sulphur as Sulphate.	Per Cent. Total Sulphur as Sulphate.
1200	2 hrs.	.346	.235	.111	32.13
1200	4 hrs.	.178	.088	.090	51.12
1500	1 hr.	.099	.027	.072	72.72

The importance of having the remaining sulphur as far as possible in the form of the harmless sulphate, and of an oxidizing roasting to secure this end, can be readily seen.

Experiments were also attempted with a very dense Jersey magnetite, but it was found impossible, with the stock of it on hand, to select small pieces comparable as to their sulphur contents, and the results were worthless.

One thing, however, was clearly shown, namely, that the density of this ore so completely excluded air from the interior of the ore-pieces, as to make futile any attempt to desulphurize it at a low temperature. It required the use of a high heat.

The action of the heat itself on the ore probably varies. It may either cause a cracking of the ore-piece and allow the entrance of air in that way, or it may act, as pointed out by Akerman, in enabling the sulphur to take up oxygen from the ore itself, for its oxidation. It is certain that the degree of heat required for desulphurization varies with different ores ; but an abundant supply of air should always be present.

It is certainly possible, however, to use too high a heat. It may be questioned whether a pyritiferous ore should should ever be heated fully to its sintering point- A fused ore is harder to reduce in the furnace, and heating it to that point appears to be often exceedingly prejudicial to proper roasting.

To test this point—how far fusion or clinkering of ore affects the amonnt of sulphur that can be expelled, an how far its influence goes to affect the amount of thd sulphur remaining in the clinker present in the form oe sulphate, the following experiments were made.

(To be Continued.)

Geological and Natural History Survey of Canada.

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RAPIDE PLAT DIVISION.

NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned and endorsed, "Tender for the St. Lawrence Canals," will be received at this office, until the arrival of the eastern and western mails on Wednesday, the 23rd day of July next, for the construction of a lift lock, weirs, etc., at Morrisburg, and the deepening and enlargement of the Rapide Plat Canal. The work will be divided into three sections, each about a mile in length.

A map of the locality, together with plans and specifications of the respective works, can be seen on and after Wednesday, the 9th day of July next, at this office, and at the Resident Engineer's office, Morrisburg, where printed forms of tender can be obtained.

In the case of firms there must be attached to the tender, the actual signatures of the full name, the nature of the occupation and residence of each member of the same, and, further, an accepted ceeque on a chartered back in Canada for the sum of $6,000, must accompany the tender for Section No. 1, and an accepted cheque on a chartered bank in Canada, for the sum of $2,000 for each of the other secttons.

The respective accepted cheques must be endorsed over to the Minister of Railways and Canals, and will be forfeited if the party tendering declines entering into contract for the works at the rates and on the terms stated in the offer submitted. The cheques thus sent in will be returned to the respective parties whose tenders are not accepted.

By order,
A. P. BRADLEY,
Secretary.

Department of Railways and Canals,
Ottawa, 13th June, 1890.

Money Orders.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
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" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
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On Money Orders payable abroad the commission is:

If not exceeding $10	10c
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For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa,
1st November 1889.

SEALED TENDERS, addressed to the undersigned, and endorsed "Tender for Caisson," will be received at this office until Friday, the 18th day of July next, inclusively, for supplying, erecting and completing in place, a Wrought Iron Caisson for the Dry Dock now in course of construction at Kingston, Ont., in accordance with the plans on exhibition at this office, and at the Engineer's office, 30 Union street, Kingston, and with the conditions and stipulations contained in a Form of Tender, copies of which can be obtained on application to the undersigned and W. O. Strong, Esq., Resident Engineer, 30 Union street, Kingston, Ont.

Tenders will not be considered unless made on the form supplied, and signed with the actual signatures of tenderers.

An accepted bank cheque, payable to the order of the Minister of Public Works, equal to five per cent. of amount of tender, must accompany each tender. This cheque will be forfeited if the party decline the contract, or fail to complete the work contracted for, and will be returned in case of non-acceptance of tender.

The Department does not bind itself to accept the lowest or any tender.

By order,
A. GOBEIL,
Secretary.

Department of Public Works,
Ottawa, 13th June, 1890.

North-West Mounted Police.

RECRUITS.

APPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is 5 feet 8 inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—

Staff-Sergeants	$1.00 to $1.50 per day
Other Non-Com. Officers	85c. to 1.00 "

	Service pay.	Good conduct pay.	Total.	
1st year's service,	50c.	——	50c.	per day
2nd "	50	5c.	55	"
3rd	50	10	60	"
4th	50	15	65	"
5th "	50	20	70	"

Extra pay is allowed to a limited number of blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Head quarters of the Force, Regina, N.W.T

Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver, cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall, within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it length. Provided that should any person making an application purporting to be for the purpose of mining iron thus obtain, whether in good faith or fradulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may by acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees, in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quarts mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominian Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior