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Mining Legislation in Nova Scotia.

There are many people who believe that every evil under the sun can be cured by legislation, and carry their ideas so far that superfluous nursing results in an overgrown and useless bantling. The various well-meant attempts at temperance legislation afford the best example of the futility of trying to make people good or wise by act of parliament. Proportionally speaking, more accidents happen from falling into the water, runaway horses, and fire-arms, than from the explosions of mines, railway accidents, etc., but no legislator has yet introduced a bill to forbid persons unable to swim from going near the water, nor must any one have a certificate before he is allowed to drive a horse.

The isolated accidents continually happening to individuals, and daily recorded in the newspapers, attract but a fleeting attention, while the mind is aroused, and public interest excited by the contemplation of a catastrophe overwhelming a number of our fellow beings. It is to this feeling of public opinion, which is so promptly and energetically expressed whenever a community is startled and saddened by an unusual fatality, that we owe the most valuable and effective legislation for the safety of the community.

The calling of the miner, in all circumstances one of peril, has specially enlisted the public interest, since the sympathy of the philanthropic Earl of Shaftesbury initiated the first practical legislation ameliorating his condition. In the Province of Nova Scotia, the explosion at the Drummond Colliery, in 1873 accentuated the necessity of a Mines Regulation Act. The explosion at the Foord pit, causing the loss of some forty-five lives, led to additional inspection, the inauguration of a system of certificates for the under managers and overmen, greater facilities for conducting inquests, and fuller recognition of the rights of workmen to present their views at any investigations, etc. Some of these improvements were adopted in the English Mines Regulation Act of 1877, and this imitation reflects credit on the Grand Council of the Miners' Union in Nova Scotia, a body who have been ably represented by their secretary, lately appointed to the Legislative Council, the Hon. Robert Drummond. The recent explosion at Springhill, which happened in a colliery admittedly one of the best managed in the Province, excited much interest and sympathy. The coroner's inquest, before a jury composed principally of practical miners, showed that the management had done the best they could; they had spent large sums in improving the ventilation; the use of powder had been discontinued in the section of the mine which formed the immediate seat of the explosion; the dust was damped by water; and powder was used only a few times a week, to blow down stone enough to allow the tubs to pass. The requirements of the law appeared to have been complied with, and no want of care was shown. When the evidence was summed up it appeared that a shot fired in this stone had ignited gas and dust and caused the explosion.

A series of amendments, some of which had been in contemplation for some time, were introduced into the Provincial Legislature. The managers of the collieries, and representatives of the principal lodges, were heard before the Committee of the Legislative Council. Among the most notable changes were the following: The earliest age at which boys were to work about mines was raised from ten to twelve years, and hereafter any boy on seeking employment at a mine must produce a certificate of his being able to write and that he has an elementary knowledge of arithmetic. All persons hereafter, on seeking employment as engine drivers, etc., must be holders of certificates granted by an examiner to be appointed by the government.

Hitherto the use of gunpowder within twelve months after gas had been found in a mine was permitted only under the direction of a man specially appointed for the purpose of firing shots, and when gas issued so freely as to show a blue cap on the flame of the safety lamp it would be generally used only when the workmen were out of the mine. Under the proposed legislation whenever gas has been detected on any three consecutive days in a mine, the use of any explosive is prohibited except when the men are out of the pit. This practically excludes the use of explosives in the most gaseous mines of the Province. An additional clause says that under certain circumstances, if a mine be damp and not dry, the use of explosives may be allowed until gas is found on any two consecutive days in any two consecutive weeks. The discussion over the legislation thus briefly outlined, was interesting. The question of the use of roburite, and of nitro-glycerine compounds with nitrate of ammonia, was discussed, but the general opinion expressed seemed to be of doubt as to the propriety of legislation stamping any of them with the full mark of safety. It may be said, perhaps, that so far as the blasting of coal is concerned, if the danger of gunpowder be admitted, then it is as well to let the coal be got by wedging as to incur the greater cost of a patent explosive, the absolute safety of which cannot be guaranteed. The opinion was advanced and received with favor that the Government should appoint a small committee to collect the latest and most authentic information on the subject of the explosives that could replace gunpowder in the presence of inflammable gas. The most practical attempt made in this direction appears to be that of the French Government, which declares by its inspection a mine to be gaseous, and prohibits therein the use of any explosive which at the moment of its detonation, reaches a temperature exceeding 1500° Centigrade. There appear to be several compounds fairly coming under this head, but it is at present a question how far their cost would permit of their use in Nova Scotia. The advances lately made toward the composition of a flameless explosive are promising, and it is to be hoped that before long one may be found that can exert its disruptive power in the presence of the most ignitable substances. Amendments were also introduced to facilitate the settlement of disputes as to the deductions to be made from the coal on account of any impurities left in it by the miners. Another important amendment referred to the classification of coal miners. Hitherto men who claimed to be competent coal-cutters were necessarily hired on their own representations, but after the close of the present year, all must be holders, either of certificates that they have cut coal long enough to show their capability, or be holders of certificates based on examination. There is no doubt that wherever coal is mined under conditions of danger, such as the presence of gas, drawing of pillars, only cutters of experience should be employed, and this regulation by putting the working faces directly in the charge of steady men should work well for masters and employed.

These are the most striking innovations of the legislation sought this year, and it is to be hoped that they will help to reduce the many accidents that are recorded. If it were possible in any way to legislate the miners in the Nova Scotia gold mines into a habit of handling dynamite with more care, it would be a blessing. Already this year the newspapers report two serious accidents, both apparently due to gross want of the ordinary precautions. In both cases property was destroyed, and in one instance several men were seriously injured. A Bill was also introduced compelling all coal companies to pay their men fortnightly; this is now the practice at several mines, and can be easily carried out.

In concluding these remarks on the amendments to the Mines Regulation Act, it may be said that the most important is that limiting the use of explosives. There is no doubt that before long gunpowder will be an explosive of the past wherever gas is met. Mining experience teaches that when a mine gives off gas, and powder is used, it is only a question of time when the two will unite with disastrous results. All possible care, and the most lavish expenditure on the part of the owner, may at any moment be nullified by the inattention of a subordinate official, or the carelessness of a miner, and a mine may be likened to a chain, with the weakest link replaced by the most inefficient person employed therein. The only other district in the Dominion in which coal is mined to any extent is British Columbia. It would be well for the Government and coal operators of that Province to take to heart the lesson learned in Nova Scotia, and without waiting for the bitterness of

personal experience, to recognize that prevention is best for safety of life, when there is no remedy after an accident.

Ontario's New Mining Laws.

The mining laws of the Province of Ontario were amended in some important particulars during the Session which ended on the 5th instant. Three measures were introduced at an early period of the Session, one of which provided for the staking out of mining claims, another for the reserving of minerals in all future sales of public or agricultural lands, and a third for amending in some particulars the general Mining Act.

The first of these Bills appears to have been carefully framed, and had it become law, we are disposed to think that it would have been gladly accepted by the class whose interests it was intended to serve, viz.: the mining prospectors. In some respects, perhaps, it should have gone more largely into detail, and we think also that the working conditions were out of proportion to those required of persons who might acquire locations in another way. But these are matters which could have been worked out in committee, and was it not for the general anxiety of the Legislature to bring its labors to a close, owing to the lateness of the Session, the Bill could no doubt have been framed into a law. The Commissioner of Crown Lands has, however, had the benefit of a free discussion of its provisions, and he will, it may be assumed, have less hesitancy in dealing with it more vigorously next year.

The Act which amends the Public Lands Act is a veritable "looking backward," for it returns to the policy which prevailed in the olden time in the Province of Ontario with respect to the Crown's interest in patented lands. It provides that in any letters patent for lands hereafter granted for agricultural purposes all mines, minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent, and are a property separate from the soil. The Act declares that they shall "continue to be the property of the Crown and be public property, independent from that of the soil above it," unless the proprietor of the soil had acquired it from the Crown as a mining location or otherwise. It will be remembered that previous to the Act of 1869, all ores of gold and silver in lands patented in Ontario were reserved to the Crown in the grant; but by that Act all such rights or claims on the part of the Crown were abandoned. The present Act proposes that henceforth the Crown shall part with its surface rights only, reserving to itself every other ore and mineral as well as gold and silver. We do not notice that any provision is made for the sale of the property so reserved to any other party, nor to the right of such party to go upon the land and sink shafts or otherwise explore for minerals or operate the mines; and this looks like an important omission. It does not, however, appear to be the intention to apply this provision of the Public Lands Act generally, for it is provided that the Governor-in-Council may by order set apart any tract of the Province not being mineral lands, in respect of which the grants or patents shall expressly vest in the grantee the minerals and mining rights, or such of them as may be specifically mentioned in the order or patent. Of course, it will be understood that the reservation applies to future sales under the statute, and is in no sense retroactive.

The amendments to the General Mining Act deal with five different subjects, viz.: the prices of mining locations; conditions of occupation; royalties upon ores or minerals payable to the Crown; leasehold tenure of mining lands, and the establishment of a Bureau of Mines.

The Act of 1869 underwent but one alteration from that year to the present, and that consisted in raising the price of mining locations from $1 to $2 per acre. The activity in mining operations during the past two or three years, and notably the boom created by the discovery of great bodies of nickel ore in the country north of Georgian Bay, appears to have convinced the Government that an increase in price could be borne by the parties anxious to invest in mining lands, and that a step in this direction was desirable in the public interest. Accordingly, we find that the new Act makes a very substantial advance in selling prices; but, unlike the former provision, the figures are graduated on a basis of assumed values. Thus, in the whole of that part of the Province above the French and Mattawa rivers and Lake Nipissing, in the districts of Nipissing, Algoma, Thunder Bay and Rainy River, the prices of mining lands or locations are fixed as follows:

If within a surveyed township and within 12 miles of any railway	$4 50	per acre.
If within 12 miles of any railway, but in unsurveyed territory	4 00	do
All other mining lands in surveyed territory	3 50	do
All other mining lands in unsurveyed territory	3 00	do

As regards all Crown lands sold as mining lands or locations, and lying south of the French and Mattawa rivers and Lake Nipissing, the following prices are fixed:—

If within a surveyed township, any part of which lies within 12 miles of any railway	$3 per acre.
If situate elsewhere	2 per acre.

But it is provided that where any locality is shown to be rich in minerals, the Governor-in-Council may set apart the whole or any part of it, and fix the price per acre at any greater sum as above specified, or may temporarily withdraw it from sale altogether.

Some consideration, however, is shown to parties who had been prospecting for minerals, or who had paid money on locations before the withdrawal of lands in the Sudbury district from sale last year; for it is provided that in certain cases, such parties may acquire grants of farming lands at the old prices and subject to the old conditions.

But the person who desires to obtain a mining location is not obliged to purchase it at the foregoing figures; he may, if he see fit, acquire the right to hold and work the property under a lease for ten years, instead of a tenure in fee simple, with right of renewal for a further term of ten years at the same rental if the covenants and conditions have been performed. The rental is $1 per acre for the first year, and twenty-five cents an acre per annum thereafter, for lands above Lake Nipissing and the French and Mattawa rivers, and sixty cents an acre the first year and fifteen cents an acre per annum thereafter for lands situated elsewhere—the rental in all cases to be payable yearly in advance. It is further provided, that at the end of the second term of ten years, if the covenants and conditions have been fulfilled, the lease may be renewed for a term of twenty years on such conditions and at such rent as the regulations shall provide, and so on from time to time at the expiration of every twenty years. It is also provided that the lessee may become the purchaser of the land, if he has complied with the conditions, in which case the sum paid for the first year's rental is to be treated as part of the purchase money; that the lease may be forfeited if default is made in payment of rent; and that in case of forfeiture or non-renewal of the lease the lessee may remove any mining plant and machinery which he may have placed upon the premises, if so agreed upon in the lease.

As regards conditions of occupation it is provided that, whether the land is held in fee simple or under lease, the occupier shall expend in stripping or in opening up the mines, in sinking shafts or in other actual mining operations, at the rate of $4 per acre during the first seven years where the location exceeds 160 acres, and $5 per acre where it is less. In default of such expenditure the tenure is to become absolutely forfeited in the case of a leasehold, and in the case of the grantee or owner the mineral right is to revert to the Crown, saving only his interests in the soil as agricultural land, distinct from the minerals.

The provision respecting royalties applies alike to occupation in fee simple and leasehold, but only as regards ores or minerals taken from lands sold, granted or leased by the Crown under the amended Act. The royalties are to be calculated upon the value of the ores at the pit's mouth, and are fixed as follows, viz.: Silver, nickel or nickel and copper, 3 per cent.; all other ores except iron are to be subject to such royalty, not exceeding 3 per cent., as may be imposed from time to time by Order in Council, and iron ore not exceeding 2 per cent. But "to assure speedy development," it is provided that the royalty thus reserved is not to be imposed or collected upon any ores until after seven years from the date of the patent or lease, except as to mines known to be rich in nickel, and as to those not until after four years. It is reasonable to assume that the lawmakers of Ontario are desirous of promoting a speedy development of the mineral resources of the Province. One can hardly suppose that there is a member of the Legislature on either side of the Chamber, no matter whether out of or in the Cabinet, who favors a policy of tardy development of the industry. Yet the very language of the statute implies that the royalties are calculated to hinder

development; for it is specifically declared that the object of postponing their operation is "to assure the speedy development." This, indeed, is a *rara avis* in the phraseology of an Act of Parliament.

The only remaining subject dealt with in this Act is a Bureau of Mines, established in connection with the Department of Crown Lands, and with the object of promoting the mining interests of the Province. The head of the Bureau is to be known as "Director of the Bureau of Mines," and it is provided that he is to have all the powers, rights and authority which an inspector or local agent has or may exercise in any mining division or locality, and such other powers, rights and authority for the carrying out of the provisions of the Act as may be assigned to him by regulation for that purpose. In a word, he has scope enough for the doing of useful work, and we are confident that in Mr. A. Blue the government has found a Director possessing the ability and the energy to undertake it and do it.

EN PASSANT.

The subject of our next portrait sketch will be Mr. John Rutherford, Stellarton, the first Inspector of Mines for the Province of Nova Scotia, and one of the most widely known and respected mining men of that province.

According to the Annual Report of the Department of the Interior, for 1890, just issued, twenty entries were made during the year for mining locations other than coal. The revenue received was $621, of which amount the sum of $181 was received in payment of fees for entry and for registration of assignments. The total area of mining locations sold up to date is 1,152.56 acres, for which $5,846.50 has been realized. Some 170 applications for petroleum locations in the District of Alberta were filed, but as the applicants could not furnish affidavits in accordance with the mining regulations, that they had discovered petroleum in the lands applied for, entry could not then be granted to them. Subsequently, the regulations were amended to permit of their holding the lands upon making an affidavit, and this has been done in most cases.

There were 107 applications for coal mining lands during the year; eleven of the applicants were given the privilege of purchasing within a specified time the location for which they applied, and 18 were given permission to prospect. Five bought the land applied for, and one, being a homesteader, was permitted to mine coal by paying a royalty of five per cent. The revenue derived from the sale of coal lands in 1890 was $8,898.75, being an increase of $7,236.25 over the preceding year. The total area of coal lands sold up to date is 13,079.76 acres, and the total amount received therefor, $135,070.07.

Several important modifications of the Ontario Mining Bill have been secured by its opponents in the Legislature. The proposed prices of mining locations have been reduced, and above all, there has been a great change wrought in the royalty clause. No royalty will be imposed on iron, while other minerals will not be taxed until after seven years has elapsed from the date of the patent or lease. Those adverse to the Bill are by no means satisfied yet, but some of its most objectionable features have been modified by these concessions.

The increase in the production of granite in the United States has been very marked, having more than doubled in the last ten years. A bulletin on the subject prepared by Dr. William C. Day, under the supervision of Dr. David T. Day, has been issued by the United States Census Office, from which it is learned that the total value of the output in 1889 was $14,464,095, as compared with $5,188,998 in 1880, a gain of $9,275,097 or 179 per cent. in the decade. This represents 62,287,156 cubic feet of granite, produced by 22,313 workmen from 874 quarries, to whom $9,620,485 were paid in wages. The total expenditure was $11,504,021, thus showing a profit of $2,960,074 on an invested capital of $19,115,449. The uses to which granite is put are manifold, and too well known to need enumeration, but that which consumes most material is street paving, for which it is steadily growing in favor. Like all other productions of the Department, this bulletin contains a great deal of other information.

In an article on "Summer Schools of Science," the *Educational News* of St. John, N.B., makes the following pertinent remarks on the geological maps of Nova Scotia, so often referred to in these columns: "The only regret on this point is, that the minutely accurate geological maps of the county, completed by the survey two or three years ago, owing to the peculiar judgment and temper of the deputy head at Ottawa, had not yet been published, and are only proposed to be published on a surface sixteen times smaller than the maps of all the Cape Breton counties. A deputy has in such details, it appears, obstructive powers which even cabinet ministers may find it ticklish to deal with. We only stop to say that this and other points may soon be so clearly put to our people that the government may find no difficulty in dealing with the matter." Surely these continued representations must have some weight with the director, and some day the wishes of the people of the Lower Provinces will be gratified. But from present indications, the question seems to have been given the five years' hoist.

The preliminary estimate of the mineral production of Canada in 1890 has been issued by the Division of Mineral Statistics and Mines, under the direction of the Geological Survey. On the whole, the production last year was somewhat less than in 1889, the respective aggregate values being $19,500,000 in the latter, and $19,000,000 in the former year. Of the precious metals, 65,014 oz. of gold worth $1,166,227 were extracted in 1890, a decrease of 7,314 oz., or $128.932; and 400,687 oz. of silver valued at $420,662, an increase of 17,369 oz., or $76,814. During the year 3,117,661 tons of coal were won, as against 2,719,478 tons in 1889, the estimated value of the respective outputs being $6,396,910 and $5,584,182—an increase of 398,183 tons and $812,728. The output of phosphate is reported at 31,753 tons, 765 tons more than in 1889, representing $361,045, or an increase of $44,383. The price of copper advanced materially in 1890, or rather had rallied from the previous year's depression, caused by the failure of the French syndicate, and thus, although the production declined 344,839 lbs. to 6,454,913 lbs., its value at an estimate of 15c. per lb., was $968,241, as compared with $885,424 in 1889. Eight thousand tons of asbestos, worth $1,039,661, were mined in 1890, and 6,113 tons, representing $426,554 in the preceding year. The nickel contents of the matte shipped at Sudbury are estimated at 1,336,627 lbs., worth $1,002,470. Of pig iron, 21,772 tons were made in the Dominion, valued at $331,668, a decrease of 4,149 tons and $168,184. The production of iron ore enlarged, on the contrary, by 3,280 tons, being 76,511 tons in 1890, though as the returns for 1889 were not complete, the disparity was probably somewhat less. The exports of crude and cut mica in 1889 were valued at $28,718; in 1890 the production was worth $68,074. The other minerals with some variations present about the same figures as the previous year. It may be observed, however, that the estimated value of several of the above mentioned products seems to be somewhat wide of the mark. A closer attention to commercial quotations will ensure greater accuracy.

In another portion of this issue our readers will find a very full report of the first Quarterly General Meeting and dinner of the General Mining Association of the Province of Quebec. That both were an unqualified success every one present will admit. The discussions on the papers presented were unusually interesting and will exercise an influence for good in the community.

Although still in the swaddling clothes of early infancy, the Association is strong in membership, and is already exerting an influence which is felt beyond the confines of the province. The *Financial News*, (London, Eng.), has the following comment on the Montreal meeting: "A considerable sensation was caused in the Convention by the introduction of a petition by the Council, recording objections to recent legislation imposing an 'iniquitous' tax upon mines. Although a majority of the Liberals have resolved to petition the Governor-General to veto the Act, *much uneasiness has been caused by the resolution of the Council of the Association, as that institution wields great influence in the provinces, and if it be used against the Government it will prove a very serious obstacle.*"

Our readers will be interested in noting the objections to the Act as embodied in the Petition to the Governor-General in Council, printed on another page. It will be seen that the main issue is its unconstitutionality. The other points have been purposely stated in general

terms, in order that the Committee may go into them minutely when a hearing is given by the Privy Council. In the meantime, the Petition is being numerously signed all over the Province. Any of our readers who may not yet have appended their signatures may do so at the following districts: Black Lake, John J. Penhale; Sherbrooke, F. J. Falding; Quebec, Hon George Irvine, Q. C.; Buckingham, S. P. Franchot; Ottawa, B. T. A. Bell; Montreal, A. W. Stevenson, 17 St. John Street.

The application of electricity to mining operations is becoming more clearly demonstrated, and consequently better appreciated every day. A special feature of the Meeting, and one which attracted much attention, was the papers on electric mining plants and the experiments with the Marvin electric percussion drill. The machine was minutely inspected, all its parts being carefully examined, and its work closely watched. Although very unfavorably situated, and laboring under much disadvantage from the hasty manner in which the experiments had been arranged, the drill created a very favorable impression as a factor in mining work in the near future. Our readers will find a full description of the drill and what is claimed for it in the paper by Mr. Ward Leonard, reproduced in our report of the meeting.

Talking of electric plants reminds us that an Electro-Technical Exhibition was opened the other day at Frankfort-on-Main, at which are exhibited the latest and highest achievements of electrical science. Five different types of electric railways and an electric yacht, or launch, adequate in size to carry one hundred persons, will be exhibited. There will be, also, five different systems of long distance transmission for electric power, one of which, it is promised, will transmit 300 horse power a distance of 50 miles. Another feature of the exposition will be a series of twenty workshops adapted to different forms of mechanical work, and each equipped with the most recent and highly improved electrical tools and appliances. These shops will be manned by skilful workmen, and kept in operation during exhibition hours. Finally, there is to be an extensive scientific and industrial laboratory supplied with every material and complete apparatus for experiment and illustration.

At the Mining Conference held in Dunedin, New Zealand, an interesting paper on the "Present Position and Future Prospects of the Mining Industry" in that country, was read by Mr. James Allan, B.A., from which the following is taken:—

"In the thirty-six years ending with 1888, the value of minerals produced in New Zealand was upwards of £52,000,000—five-sixths of this sum being from gold and silver, and about one-twentieth from coal. The production of gold has been marked by a gradual decrease since 1866, when the value of the year's work was £2,844,517, whereas in 1889 the value amounted to only £808,549. The output of coal, on the contrary, shows a steady, but moderate, increase. In 1885, the output was 511,063 tons, and in 1888 613,895 tons. The estimated available quantity of coal in the colony is 1,200,000,000 tons, of which 500,000,000 tons are brown coal or lignite, an equal quantity of pitch coal, and the remainder bituminous coal of excellent quality. Iron ore has not been worked to any considerable extent, but large deposits of good ore are known to exist, with limestone and coal, for smelting, in close proximity."

The Annual Report of the Commissioner of Mines for Nova Scotia has been presented to that Legislature. It contains, among much other interesting matter, the following summary of the mineral production of the Province in 1890: Gold, 24,358 oz., decrease, 1,797 oz.; iron ore, 51,191 tons, increase, 5,284 tons; manganese ore, 266 tons, increase, 199; coal raised, 1,984,001 long tons, increase, 227,722; coke made, 36,738 long tons, increase, 1,173; gypsum, 146,003 tons, decrease, 1,341; grindstones, etc., $8,385, decrease, $9,615; moulding sand, 170 tons, no change; antimony ore, 26 tons, decrease, 29; limestone, 35,000 tons, increase, 16,000; copper ore, 1,000 tons, increase, 500 tons.

The progress of the coal trade in 1890 was most satisfactory, notwithstanding the unfortunate strike at the Springhill collieries. The total sales were 1,786,111 tons against 1,555,107 tons in 1889. Of this, 601,956 tons were sold for home consumption, as compared with 550,425 tons in the previous year; 751,931 tons were shipped to the Province of Quebec, against 631,796 tons in 1889; New Brunswick took 224,776 tons, as compared with 195,174 in the preceding year. The sales to Prince Edward Island, Newfoundland, the United States and the West Indies were also considerably larger than in 1889.

As has already been observed in these columns, there was a very appreciable falling off in the yield of gold last year, 1,797 oz., due principally to the lack of development. In the current season, however, the deficiency will probably be made up; in several of the older districts the mines are being equipped with improved machinery, and will be in a better position to mine the lower grade quartz, which in the future is destined to become the mainstay of the gold industry in Nova Scotia. This is made evident in the detailed returns of last year: 41,886 tons of quartz were crushed, yielding 24,358 oz. for 160,264 days' labor, while in 1889, 39,160 tons produced 26,155 oz., but for 211,548 days' labor.

Among other noticeable features of the Report are a series of valuable suggestions with regard to the use of explosives, timbering, and many other points connected with the safe and economical operation of a mine, and also an exhaustive summary of the British and German experiments on the explosiveness of coal dust. Mention is made of the Jamaica Exhibition, to which a fairly creditable collection of specimens was sent and much admired. The Report closes with the full text of the enquiry into the cause of the accident at the Springhill Collieries, and the finding of the coroner's jury thereon. The conclusions arrived at are very much in line with the *Review's* comments on the accident.

That copper mines are capable of returning large profits under advantageous circumstances and skilful management, is made apparent in the annual report of the Tharsis Sulphur and Copper Company, limited, which has declared a dividend on a full issue of stock of 22½ per cent. In the last twenty-four years this Company has paid to its shareholders £4,633,432, nearly four times the amount of its authorized capital, £1,250,000, which was not until last year fully issued and subscribed for. The balance at the credit of profit and loss account was £297,487, against £249,169 in 1889, out of which £281,250 has been paid in dividends, and the remainder, £16,237, carried forward. The total extraction of ore was 501,480 tons, and the shipments 265,197 tons. The deliveries of iron ore were 206,437 tons. The outlook for the present year is favorable: the world's production of copper does not appear likely to be excessive; the Anaconda mine has been closed down indefinitely, and there seems every probability of present prices being fairly maintained. This being so, we hope to see our Canadian mines sharing in the consequent prosperity.

The last issue of the Ontario *Official Gazette* records the appointment of Mr. Archibald Blue, Toronto, to the position of Director of the Bureau of Mines, to be established under the new Mining Act. The announcement will be hailed with pleasure. Always thorough and painstaking, Mr. Blue has rendered yeoman service to his Province as Secretary of the Bureau of Industries, as Deputy-Commissioner of Agriculture, and more recently and to the point, as Secretary to the Royal Commission appointed to enquire into the mineral resources of Ontario. The editing and compilation, and some of the best work in that most valuable Report, was done by Mr. Blue, which is a sufficient guarantee of itself that his new labors will be well and faithfully performed. We heartily congratulate the Ontario Government and Mr. Blue on this appointment.

The British Columbia Legislature is ever active in advancing the mining interests of the Province, and in that respect furnishes a laudable example to the Legislature of Quebec, whose chief aim seems to be the retarding of the mining industry. It has appointed a committee to devise ways and means to promote mineral development; it has appropriated $36,000 for the construction of roads and bridges in the West Kootenai district; the five per cent. royalty clause in the "Act in aid of certain railways," (see CANADIAN MINING REVIEW, May, 1890), has been repealed by it; and charters have been granted for a railway from Fort Sheppard, on the Columbia River, to Nelson, and for one through Crow's Nest Pass to the same destination. Moreover, aid has been given to the erection of reduction works, and assistance is always forthcoming to any scheme for the material advancement of the welfare of the industry. The Coal Mines Regulation Act has been recently amended in its relation to the employment of Chinese labor, and is now much more severe, imposing a fine of not more than $5 for each day of employment in contravention of the provisions of this section, both upon the employer and Chinaman, and in actions the burden of proof is thrown upon the defendants.

Apropos of the recent discussion on the amendments to the Coal Mining Regulations of Nova Scotia, elsewhere referred to, we have received a letter from a prominent colliery manager in the Province, in which he says:—

"The amendments were very numerous. The great objection raised in many cases was that the wording was imperfect and left room for the driving of many a 'carriage and four' through them. It was considered strange that with a Department of Mines, a Commissioner of Mines sitting in the House of Assembly and a member of the Government, that such a bill should not have been introduced in the ordinary way—it seemed a reflection on the Commissioner, Mr. Church.

"According to the bill, the New Year's festivities among the miners will call for the refrain: 'Certificated! For I'm certificated, and we are all certificated men!!!'

"The machinery for examination and registration was not devised, nor was it stated how the necessary expense was to be met. It was assumed that the Government would eagerly meet the bill of the numerous small officials that the proposers of the measure seemed to think would be required at each mining centre.

"One amendment proposed that all safety lamps previous to being taken into the mine, should be tested in gas by the most accurate gas-testing machine. The coal men present pointed out what seemed to them practical difficulties in the way of compliance with this ordinance. They threw their acknowledged ignorance on the mercy of the Committee and asked for information as to on whom would fall the onus of deciding from time to time which was the *most* accurate machine. It seemed as though there was a taint of the 'Shaw machine' about the clauses, but the enquiry produced only vague references to 'Patterson's process.' That beautiful process for desilverizing lead was the only 'Patterson's process' that the enquirers knew of, and so they left it with the Committee.

"Boys, it was proposed, should be able to 'count to fractions,' and ready concurrence was given for the law to require knowledge of the three R's. before a boy should be admitted to work; but to 'count to fractions' made too indefinite a × on the school book to please the managers, who feared suits at law for possible inattention to the Act's numerous requirements.

"The eight hour movement found expression in the limitation of boys' employment to 48 hours a week, which met with a vigorous opposition from Cape Breton men, whose shipping season is short and who desire to make the most of that season for trade with the St. Lawrence.

"What seemed curious to some people was that this fatherly regard applied also to boys who worked in the open air, while no similar legislation has yet been introduced with reference to child labor in factories, where the atmosphere and the monotony of work are much more injurious to health than in mines.

"The important subject of blasting in mines producing gas came up, and by all it was felt that further restrictions should now be made. The difficulty, however, was where to draw the line, and it was settled that two findings of gas a fortnight would bar the use of explosives in customary course of working. This decision would probably satisfy most of the Cape Breton miners, but without knowledge of the actual wording it is in doubt whether the use of explosives of any sort can be continued at Pictou and Springhill. Mr. Poole contended for the wording of the English Act which, though complicated, classified mines on a danger scale, based not, as heretofore, on gas alone, but on the relative humidity and character of the dust coupled with gas. The final construction of this clause will be watched with great interest.

"Since writing the previous pages I have seen the last issue of the Stellarton *Journal* which, on the first page refers to the meeting at Halifax, and gives the names of those present. You will notice the praise bestowed on the managers for having behaved like gentlemen. Of course the praise of so undoubted an authority is most gratifying, and to be put on equal footing with members of the P. W. A. a greater honor than was to be hoped for."

Have coal operators any rights? This is a question often asked by the operators themselves, when some new-fangled piece of legislation is enacted, aimed at one of their sources of profit and diverting it into the pockets of their employés. The right of the miners to strike when they please have always and in all countries been recognized; to organize; to secure the passage of laws framed exclusively for their benefit, and to claim higher wages whenever the coal industry showed signs of prosperity, in all of which they have the tacit sympathy of the public and very often the support of the legislature. Those of the operators on the other hand, are not so well defined. The privilege of discharging or employing whom they will, is admitted by some, but strenuously denied by many others. The right to have their property protected in the event of a riot is another privilege not conceded by many, while others again appear to hold that they and capitalists in general have no rights whatever worth consideration.

A most flagrant instance of this feeling was evinced at the last session of the West Virginia Legislature, the members of which, like a good many other legislative bodies nearer at home, do not appear to be generally chosen for their education, judgment or sound sense, but rather for their willingness and ability to oblige the rank and file of their constituencies in the way of this and similar enactments. The miners of the State having come to the conclusion that they wanted something, finally pitched upon the weighing of coal before it was screened and the abandonment of the "unjust" system of paying them in scrip and store orders. As to the latter, it did not occur to them that with the poor credit of most of their number, they would have a hard time of it between pay days, while the former was all to their advantage. Bills were therefore framed in accordance with these resolutions, by the afore said obliging legislators, and rushed through the House. In consequence, a convention of operators was held in Charleston a short time ago, for the purpose of passing a series of resolutions expressive of their opinion of the bills passed, and of binding themselves together to secure the non-enforcement of the law and to test its validity.

The great objection to weighing the coal before it is screened is this: if a miner is paid for only clean coal, he takes his pick and makes an inbearing under the seam to a depth of about three or four feet and then drills a hole above the seam and puts in a moderate charge of powder—just enough to break off the ledge of coal his inbearing has left hanging. His effort is to get down as much weight as possible with as little breakage from the shot, because he knows that if the coal is mashed up by the discharge of the blast he will not be paid for it. On the other hand, if he is paid before the coal is screened his only effort is to get out the greatest possible quantity, and he does not care whether it comes out in the form of slack, badly broken up, or whether it comes in good, saleable lump coal. Powder is very cheap, and by putting in a heavy charge the miner can break down and dislodge in small bits twice as much coal over the same inbearings as he could with a small shot when his effort is to get the coal out in lumps. Under the proposed arrangement it makes great difference to the operator, except in a few districts where the slack is used for the purpose of making gas; otherwise it is entirely unsaleable. It cannot be shipped, and must usually be thrown into some convenient dumping ground or given away for the sake of getting rid of it. Regarding the making payment in scrip or store orders the law might easily be avoided by trusting the miner to the extent of his wages, but this course would be decidedly objectionable. The question will probably be fought out in the courts.

Probably one of the most notable of recent mineral discoveries in Canada is that of a vast deposit of amber on Cedar Lake, near the mouth of the Saskatchewan River, reported by Mr. J. B. Tyrrell of the Geological Survey. It occurs mixed with sand and many fragments of partly decayed wood on a low beach behind a gradually shelving shore and along the face of a deep wet spruce swamp. The pieces were for the most part smaller than a pea, but could be readily seen glittering among the sand and vegetable *debris*. Some pieces were found as large as a robin's egg, and it is stated that others much larger have been picked up. Mr. Tyrrell says: "It is difficult to make an accurate estimate of the quantity of amber on this mile of beach, but it may confidently be said to extend throughout the distance in a band thirty feet wide, with a minimum depth of two feet. This band has thus a total bulk of 316,800 cubic feet. A number of specimens collected from various parts of it, showed an average of a little over ten per cent. of amber, which, in natural fragments, weighed about forty-six pounds to the cubic foot. The amount of amber on this strip of beach would therefore be about 31,680 cubic feet, or 1,457,280 pounds. At a minimum value of twenty-five cents a pound, this would represent a total of $364,320. This estimate refers merely to the material that is now washed up on the ridge of the beach, without considering the source from which it is originally derived."

Another remarkable instance of the manner in which the too-confiding English investor is duped by the unscrupulous company promoter, has just been ventilated in the Chancery Division in England, before Mr. Justice Sterling. The case was a shareholder's petition to wind up the Anglo-Austrian Printing and Publishing Company, a concern formed to acquire five printing businesses in Austria. A certain Mr. Horatio Bottomley was the promoter, a gentleman who is figuring in the courts in another winding-up suit, that of the Hansard Union Publishing Company. The chairman was Sir Henry Isaacs, late Lord Mayor of London, and Mr. Bottomley himself was vice-chairman. Over £90,000 in cash was subscribed, and of this sum only £26 5s. remains, the rest has disappeared. No businesses have been acquired, and there is nothing to show for the money. One dividend of 8 per cent. was paid out of the capital, the directors were liberally remunerated, and the remainder has been appropriated by Bottomley. At one time he drew £75,000, and several smaller sums afterwards. The credulity of one class of Englishmen is almost beyond belief, but these constant exposures of swindles are likely to turn them to the opposite extreme and make them as suspicious as they previously were confiding—a feeling much better for their own pockets, but exceeding hurtful to genuine enterprises put upon the market.

Successful Meeting and Dinner of the General Mining Association of the Province of Quebec at Montreal.

The first quarterly general meeting of the General Mining Association of the Province of Quebec was held in the new club room of the Windsor Hotel, on Wednesday, 29th ulto. Owing to the late arrival of some of the trains, the opening session was not held until close upon eleven o'clock, when there were present:—A. M. Evans, M.E., Bell's Asbestos Co., Black Lake; D. A. Brown, Bell's Asbestos Co., Boston; L. Klein, M.E., American Asbestos Co., Black Lake; John J. Penhale, United Asbestos Co., Black Lake; Richard Penhale, Albert Mines, Capelton; W. H. Irwin, and R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal; H. J. Williams, Beaver Asbestos Co., Thetford; C. Koenig and C. Cirkel, Templeton Asbestos Co., Templeton; A. H. Murphy, Thetford Asbestos Co., Thetford; Hon. George Irvine, Q.C., Johnson's Asbestos Co., Quebec; J. Lainson-Wills, F.C.S., General Phosphate Corporation, Ottawa; S. P. Franchôt, Emerald Phosphate Co., Buckingham; T. P. Bacon, New Rockland Slate Co., Montreal; J. B. Smith, M.E., Anglo-Continental Guano Works Co., Glenalmond; O. M. Harris, Canadian Phosphate Co., Montreal; G. A. Smith, Macgregor Lake Phosphate Co., Templeton; Dr. W. T. Gibbs, Dominion Phosphate Co. of London, Buckingham; F. D. Taylor, M.E., Montreal; W. H. Jeffrey, Richmond; F. Bacon, Park Bros. & Co., Montreal; Prof. Harrington, Montreal; G. W. Schleisinger, M.E., Boston; E. J. Brainard, Hamilton Powder Co., Montreal; F. A. Barr, Edison Electric Co., Toronto; M. D. Barr, Toronto; W. Hamilton-Merritt, M.E., Toronto; J. T. Donald, M.A., Montreal; T. Kirkhouse, Montreal; E. Ward Leonard, Edison Co., New York, J. W. Kirkland, Thomson-Houston Electric Co., Boston; Hector McRae, Ottawa; W. P. Lockwood, St. Francis; B. T. A. Bell, Editor CANADIAN MINING REVIEW, and others. There were also present a number of science students from McGill University. Hon. George Irvine, Q.C., in the chair. The minutes of the last meeting having been read and confirmed, the following new members were elected: J. Lainson-Wills, Ottawa; T. M. Williams, Billerica; W. H. Jeffrey, Richmond; W. T. Gibbs, Buckingham; W. P. Lockwood, St. Francis; D. A. Brown, Boston; F. D. Taylor, Montreal; C. Magee, Ottawa; James Cooper, Montreal.

Report of the Council on the Quebec Mining Act.

HON. GEORGE IRVINE said: Since the last meeting of the Association the Committee appointed for this purpose took some action with regard to carrying out the intentions of the Association respecting the mining Act recently passed by the Quebec Legislature. After communicating with Mr. Mercier on the subject, he appointed a meeting with the committee, and we attended accordingly. Mr. Mercier expressed a desire to look thoroughly into the matter, and asked me to make a statement of my views with regard to the difficulties which existed, and this I promised to do. Owing to the general elections, which took place shortly afterwards, he deferred his departure to Europe, and requested me to send a statement, of which the following is a copy, to the Attorney-General:—

Copy Memorandum on the Quebec Mining Law, Submitted to the Hon. the Attorney-General.

In order to understand the objections on constitutional grounds taken to the recent Mining Law passed by the Legislature of the Province of Quebec, it is important to consider how the law stood previous to the passing of that Act, and what the rights of persons holding mining lands were.

It has always been held that minerals not being gold and silver, belong to the owner of the soil, and that grants from the Crown in which there is no reserve, convey the ownership in the minerals to the grantee. The course of legislation in this Province and the jurisprudence of our courts fully establishes this.

The first regulations adopted by the Crown Lands Department respecting the sale of mining locations were passed in 1874, and may be found in the report of the Commissioner for that year. These regulations were in force when the Act of 1880 was passed, and a large number of grants were made under it. The lands so granted, except in so far as respects the Royalty or tax imposed by the recent Act are not affected by it.

The Act of 1880 carefully guarded all vested rights—it provided (1422) S. 3, "It shall not be necessary in any Letters Patent for lands granted for agricultural purposes to mention the reserve of mining, which reserve is always supposed to exist under the provisions of this section." The grantees of lots for agricultural purposes whose titles date subsequent to the passing of this Act are guaranteed the right in the event of their discovering minerals on their lots to acquire the right to the full mining property by paying the difference between the price of mining property and what they had paid for an agricultural lot. It will be seen by this that no interference with the rights of property were attempted. The rights of owners of property granted by the Crown were not interfered with, and they remained with their ownership quite undisturbed.

The whole of this existing state of things is changed by the Statute now complained of—Clause 1425, which is substituted for the former clause designated by the corresponding number, enacts: 2. "As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section.

It is submitted that no enactment corresponding to this can be found in any legislation heretofore passed by any dependency of the British Empire, still less in the Imperial Parliament, for it not only in a few words takes the property from a large number of Her Majesty's subjects, but falsely asserts that the right to do so was admitted. It would be interesting to find the person who admitted that the Government had the right to take his property from him, and it further seems unnecessary, if it were universally admitted that the baser metals belonged to the Crown and not to the owner of the soil, to pass a Statute altering the existing law, and declaring that such minerals belong to the Crown.

The Statute to which we object then proceeds from Section 1455 to 1512; to provide for the means by which any stranger, on obtaining a permit from the Government, may proceed to expropriate the mine, which happens to be on private lands, and take it away from the proprietor unless the latter chooses to pay the price which may be determined on; the law, however, giving to the proprietor the option of buying his own property if he is willing to submit to this imposition.

It is submitted that this Statute interferes with private rights in such a way as to render its disallowance necessary and constitutional.

(Signed), GEORGE IRVINE,
President General Mining Association of the Province of Quebec.

QUEBEC, 31st March, 1891.

So far, I think our interview with Mr. Mercier, although it has not yet produced any beneficial results, was satisfactory as far as it went. In the meantime I have drafted a petition containing fuller information than the previous one, praying for the disallowance of this Act, which I will submit to this meeting, and will be glad to make any changes that may be deemed necessary.

The Petition to the Governor-General-in-Council.

To His Excellency the Right Honourable Sir Frederick Arthur Stanley, Baron Stanley of Preston, &c., &c., Governor-General of the Dominion of Canada, in Council, Ottawa.

The humble petition of the undersigned proprietors of of mining lands, and persons interested in mines in the Province of Quebec, represents:

That there was passed at the last Session of the Legislature of the Province of Quebec, an Act intituled, "An Act to Amend and Consolidate the Mining Law."

That your petitioners respectfully allege that the said Act is unconstitutional, that it has a retroactive effect, that it interferes with private rights unjustly, and confiscates private property, that it is contrary to the policy of the Dominion, and is injurious to a large and increasing commercial industry.

Your petitioners submit to Your Excellency-in-Council the following grounds on which they ask for the disallowance of the said Act.

1. Sub-section 2, of clause 1, repeals the existing law contained in Article 1425, of the Revised Statutes of Quebec, and enacts: "As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section." Your petitioners represent that it is not a fact that it was ever admitted that minerals, other than gold and silver, on conceded lands, belonged to the Crown; but that on the contrary, the whole course of legislation and jurisprudence in the Province of Quebec, as well as the system of administration by the Crown Lands Department of the Province, admitted the contrary to be the case.

2. The Statute complained of proceeds to provide, from section 1455 to 1512, for a system of confiscation of the minerals on private lands; any person desirous of acquiring the minerals on the land of another, obtains from the Government a permit of exploration, and after satisfying himself of the quantity of land which he will require, a surveyor's plan, with an offer of price is deposited with the Commissioner, and unless the proprietor elects to pay the price offered, the property in the minerals passes to the holder of the exploration permit.

3. The statute law of the Province of Quebec, as it stood previous to the passing of the Act in question, is to be found in the Revised Statutes, from Article 1421 to Article 1582, inclusive, which articles are taken from the Act of 1880, chapter 12.

4. Previous to the passing of this Act the Department of Crown Lands had made regulations for the sale of the Crown Lands containing mineral deposits, by which the price of such lands was increased as compared with lands sold for agricultural purposes.

5. Article 1423 provides: "It shall not be necessary in any Letters Patent for lands granted for agricultural purposes, to mention the reserve of mining rights, which reserve is always supposed to exist under the provisions of this section.—43-44 V., c. 12, s. 3."

Articles 1425, 1428 and 1429 enact: "Any person who, previous to the 24th July, 1880, obtained Letters Patent for agricultural purposes, but with reservation by the Government of the mining rights, any lot whatever forming part of the public lands of this Province, may, if he or his legal representative discover and wish to work a mine, purchase the mining rights so reserved by the Government, by paying in cash, to the Commissioner, over and above the price already paid for said lot, a sufficient additional amount to make up the sum of two dollars per acre, if for gold or silver, and one dollar per acre if for copper, iron, lead or other baser metals.—43-44 V., c. 12, s. 4."

Article 1428: "If, on any lot of land granted by Letters Patent since the 9th March, 1878, or which shall hereafter be granted, on the usual terms and conditions, for agricultural purposes, a mine of phosphate of lime has been found to exist, any purchaser of such lot, or his legal representative, shall, if he wish to work such mine, pay in cash to the Commissioner, a sufficient additional amount to make up the sum of two dollars per acre.—43-44 V., c. 12, s. 7."

Article 1429; "Every person who may acquire by Letters Patent, on the usual terms and conditions, for agricultural purposes, any lot whatsoever upon which he may discover a mine of baser metals, excepting phosphate of lime, shall, if he or his legal representative wish to work the same, pay to the Commissioner a sufficient additional amount to make up the sum of one dollar per acre.—43-44 V., c. 12, s. 8."

7. The law of 1880 thus carefully leaves the titles of those who held lands under agricultural grants without reservation of minerals untouched, and grants to those in whose grants the minerals had been reserved, as well as to those who had obtained grants since 1880, the right to purchase them on paying the difference between the agricultural and mineral prices.

8. The statute now complained of takes from those whose grants were made previous to 1880 the right of ownership in the mines which had not been reserved by the Crown, and which were their undoubted property, and deprives those who had purchased agricultural lots since 1880, and lands on which phosphates are found, granted since 1878, of the right guaranteed to them by these laws of becoming owner of the minerals by paying the difference in price.

9. The clause 1426 of the Act complained of, imposes on all mineral properties a tax, (therein styled a Royalty), "of three per cent. of the merchantable value of the product of all mines and minerals."

10. The imposition of this tax will be most injurious to the mining interests, and in some cases will entirely prevent the carrying on of mines, in those cases where the margin of profit is small, which your petitioners undertake to prove to Your Excellency-in-Council.

11. This action of the Provincial Legislature is contrary to the general policy of the Dominion, as your petitioners believe, the Parliament of Canada having at its session of 1890 granted encouragement to your petitioners by removing the duty on machinery imported for the use of mining operations, which policy is overturned by the imposition of such a tax.

12. That the said Act is *ultra vires* and unconstitutional.

Wherefore your petitioners humbly pray that Your Excellency will be pleased to exercise the power conferred on you by the British North American Act, and disallow the said Bill.

THE CHAIRMAN, in answer to a question by Mr. W. H. Irwin did not think it necessary to embody details in the petition.

Note on the Quebec Mining Law.

MR. BELL then read the following letter from Dr. Rossitter W. Raymond, Secretary of the American Institute of Mining Engineers:—

SIR,—I beg to acknowledge with thanks the copy of the new Quebec mining law, which you have kindly forwarded to me. Having but just returned from an absence of several months, principally spent in Egypt or on the ocean, I was not acquainted with the provisions of this law, and could scarcely credit the reports concerning them which came in a fragmentary way to my attention.

I have examined, therefore, with curiosity, the printed text of the law; and I confess that my surprise is now greater than ever. I did not deem it possible that the legislature of any civilized country could at this day be induced to enact a measure so barbaric in its injustice and unwisdom. Of the particulars which embody the injustice of the law, the following struck me as the most important, though not the only ones:

1. As I understand it, the law imposes a "royalty" of 3 per cent. of the gross value of the product upon mines already alienated from the Crown by actual sale without any reservation of the right to levy such a royalty. The exact effect of the phrase "unless otherwise determined by letters patent already granted," in paragraph 1426, I may, perhaps, fail to appreciate correctly. I do not know the precise form of such letters patent; and I am led to believe that the form has varied at different times, and in different cases. But it seems clear that under paragraph 1435 of the Quebec law hitherto in force, the

ri ht to exact royalty is qualified by the phrase, "unless such royalty be otherwise established by letters patent *or other title from the Crown*," the latter half of which is omitted in the new law. Moreover, that paragraph confines to gold, silver and phosphate of lime the royalty therein specially referred to.

Paragraph 1425 of the old law provides for the purchase of the mining rights expressly reserved by the Government in letters patent granted before July 24, 1880; and the only requisite is a payment of additional sums, sufficient with former payments to make $2 per acre for gold or silver and $1 per acre for other metals.

Paragraphs 1423, and 1426 to 1434 inclusive, provide similarly for all cases arising under letters patent; and the last named paragraph, together with paragraph 1545, authorises the increase from time to time, by the Lieutenant-Governor in Council, but cannot be construed as affecting the rights of those who had before such increase made the prescribed payment, and in the language of paragraph 1425 *purchased* the mining rights. In other paragraphs, the phrase is sometimes varied, and the right to "work" the mines is mentioned, but without any limitation as to time; and it is impossible to construe the payment per acre, thus provided for, as anything else than a purchase outright, or the tender and acceptance of a lump sum in lieu of all royalty forever.

The new law seems to levy a royalty even upon mines, the rights to which have been legally alienated from the Crown already. I have no doubt that if this be held to be its force, it will stand self-condemned as unconstitutional. Such a levy is no longer royalty at all. It is illegal taxation, or rather confiscation. Probably words are wasted in discussing this possible aspect of the case. The courts of a free country may be relied upon to defeat any such formal violation of justice.

But in another aspect the legal remedy may not be so clear; and the view I venture to suggest is therefore offered with less confidence. Yet it seems clear to me that the land owners coming under the provisions of the old law above cited have certain vested rights, aside from those which they may have acquired by supplementary payments per acre, or by absolute purchase in any other way of the mining rights of the Crown.

The law, taken as a whole, embodies the inducements held out by the Government to purchasers of land. One of them is, that the purchaser of agricultural land may, if he find ores of iron, copper, etc., buy for an additional sum per acre the right to such deposits. If he afterwards finds gold, silver, or phosphate, a further payment per acre will buy the right to these also. He is warned by paragraph 1434 that these prices per acre may be increased at any time; by paragraph 1435 that, as to gold, silver and phosphate, he will have to pay royalty unless he has obtained under preceding paragraphs, the "other title from the Crown" therein provided. But he is not warned that the Government may at any time decline to accept any lump sum whatever per acre in lieu of royalty, and enforce a ruinous royalty on mining of all kinds.

Now the question is, whether there is not an implied promise, on the part of the Crown, involved in these provisions, on the faith of which purchasers of lands have acted. Is it not an inducement to the purchaser of agricultural land that if he should find it to contain valuable mines he can buy the mineral right for an additional sum per acre? Or is it not an inducement to the purchaser of iron or copper-bearing lands that he may if phosphate or gold or silver should be discovered in them, buy the right to these for an additional sum per acre? Granted that the Government has reserved the right to increase at any time this sum as to any lands upon which the purchasers' option has not been exercised; granted also, that, under the terms of the law, the Crown remains in possession of the mineral right; yet is it not true that although that right has not been alienated, an option to buy it has been offered as a bonus to the purchaser of other rights?

It must be remembered that the substitution of a royalty, even of a reasonable amount, is not a mere modification of the procedure of a sale, for the purchaser of mineral rights has thereafter the free choice to work the mines or let them lie idle, as he may deem most to his interest. But under the system of royalty contemplated under the new law as universal, the previous purchaser of land is subject to the intrusion of licensed prospectors, and is forced, upon discovery of mineral alleged to be valuable, to work the mines or else let others work them.

I am not now inquiring whether this system would be wise as applied to the administration of Crown lands henceforward; but whether it does not involve a violation of good faith and obligation when applied to the purchasers of lands heretofore. In any such controversy between private parties, the courts would inquire whether the purchaser had performed, in pursuance of the alleged agreement, any acts which he would not have performed in the absence of the inducements offered. The answer to that question in the present case is, I take it, perfectly clear; and the proof will be speedily forthcoming if the new law goes into operation. Capitalists will certainly not wish to buy even agricultural lands to which they cannot somehow obtain a complete title, excluding all private trespass and official interference. Nor will they invest in mining rights held under royalty and subject to forfeiture. Mortgages upon such property will have no value as security; and what will be is only what would have been if the old law had been like the new one in these respects. But the old law held out inducements on the faith of which capital was invested or loaned. Hence, it seems to me, the new law violates an implied contract as to all purchasers of land under the old.

But whether this be legally the case or not, the essential injustice of the new law is plain enough. If it is not unconstitutional, it is unfair.

Aside from these features, the new law is unjust in that it singles out for taxation a particular industry—and the most laborious and precarious of all the productive industries. I do not mean to say that mining skilfully conducted may not be largely profitable; but it would be folly to deny that it presents peculiar risks, and that the profits of fortunate and well managed enterprises are offset in the calculation of general results by the cost of much fruitless exploration and many deserved and undeserved failures. The stimulus to industry in this field is the hope of exceptional good fortune. This it is that keeps prospectors at work, and commands a perpetual supply of capital for experiments and developments. Consequently, mining less than any other industry can bear a burden laid equally upon the successful and unsuccessful. Yet this law not only selects mining for special taxation, but practically discriminates against the unfortunate by taxing gross product instead of profits or dividends. I am not now saying that this is foolish and suicidal, but that it is unjust.

I might go on to characterise in a similar way the harassing restrictions thrown around mining operations under the law, the system of petty official espionage and tyranny ordained by it, etc. But these are part and parcel of the fundamental injustice which it contemplates.

I will add a few observations as to the unwisdom of the law, apart from its injustice. To make this special aspect clear, let us suppose the new system to be applied to Crown lands and their future occupants only. This was the case, for instance, with the Federal mining laws of the United States, of 1866 and 1872. They concerned exclusively the mineral lands of the public domain in certain States and Territories. It is much to be regretted that the Quebec law was not similarly limited. In that case, it would have furnished an interesting, instructive and not disastrous object lesson to the legislators of the province. For they would have seen very quickly that no capital would submit to its vexatious conditions, and no revenue would result to the government.

Who is going to pay for the privilege of exploring for minerals if the owner of the land has the preferential right to take the mine he may develop?

Who is going to make explorations even on his own land, if every pit he digs must be fenced and kept fenced forever?

Who is going to put money into the development of a mine which he cannot allow to lie idle if he finds that it is temporarily unprofitable, or if he gets involved in a lawsuit about way-leaves or damages or boundaries?

Who is going to bind himself to make monthly or quarterly returns of minute business details to a government bureau, or furnish complete maps and descriptions of all workings? It must be remembered here that the law provides for no use to be made of these data, beneficial to the mining industry. It establishes no body of trained and skilful engineers, whose supervision or advice might be really of service. The reports thus exacted will be simply a mine of information for informers, blackmailers, and opposing litigants, and the business of mining under such regulations ceases to be a private enterprise at all.

No doubt some enthusiastic reformers will say that the State ought to work the mines anyhow. We have such people on this side of the line, and perhaps they exist in Quebec; but I need not discuss that proposition here. I will only observe that under the new Quebec law, the State might as well prepare to work such mines as are not now in private hands, for I do not believe that private capital will undertake enterprises in which the public is to be a confidential, irresponsible and meddling partner.

I see that the Premier of Quebec has declared the motive of the law to be the obtaining of increased revenue. It is quite possible that certain concerns now profitable may yield something for a while under this process of squeezing; but unprofitable enterprises will not go on; capital will not be forthcoming for new ones; the goose will lay but one golden egg, and then die.

The folly of this scheme as a whole is carried into its minor details. A little acquaintance with mining should convince anybody that three per cent. on gross value would be a very unequal tax on the different substances enumerated. Levied as directed on the gross weight of gold, it would be, on low grade ores, ten or twenty or fifty per cent. of the net profit of the miner; and it would strike a fatal blow at the mining and treatment on a large scale, at small net profit per ton, of the auriferous ores of that class. In fact, the law is so contrived as to rest least heavily upon the miners of rich, concentrated materials, who employ proportionally the least labor, and benefit the country least, while it bears most heavily upon those who spend most money in wages, freights and machinery, carry on the most expensive business, and are content with the smallest profits per ton of raw material.

A more ingenious contrivance for injuring a fundamental industry, and with it all the business of the province, it would be difficult to invent.

Of the army of inspectors and informers, and the catalogue of petty offences and fines created by this law, I can hardly speak with patience; and perhaps it does not become me to say much on that subject. We are cursed in the United States with too many officials, and with the evils of too much "patronage" in the hands of our government. Until we get our own civil service, federal, state, and municipal, into a more satisfactory condition, we should not indulge in too free a criticism of our neighbors. I am sorry, in a sympathetic way, to see the people of Quebec exposed to the same evils, and in a form apparently worse than we are called to suffer; but after all, that is their business, not mine. Such citizens of the United States as are not so unfortunate as to be always involved in mining enterprises in the Province of Quebec, will have no cause to complain if this new law goes into effect. They have only to keep their money at home, or invest it in regions more justly and wisely ruled.

A vote of thanks to Dr. Raymond for the trouble he had taken was unanimously carried.

THE CHAIRMAN said it was desirable that the Association should adopt a resolution authorizing the presentation of the petition to the Governor General in Council praying for the disallowance of the Quebec Mining Act, and suggested that the committee appointed at a former meeting be authorized to present it. Carried.

Note on the Law Respecting Powder Magazines in the Province of Quebec.

THE CHAIRMAN submitted Articles 875 and 876, paragraph 17, Revised Statutes of Quebec, as follows:

875. Every person keeping a magazine for the storage of powder, or who sells and holds for sale any quantity of powder, must obtain from the Collector of Provincial Revenue a license to that effect.—41 V., c. 3 s. 60; 46 V., c. 6. s. 1.

876. No license can be granted for keeping a powder magazine within the limits of the City of Quebec and Montreal, or within a radius of five miles therefrom, or unless the building be erected according to the following rules:

1. Every magazine shall be built of stone at least two feet in thickness, covered with a fire proof roof made of metal, and adhering to the building by its own weight only.

2. It shall be enclosed, at a distance of at least ten feet clear, by a stone or brick wall at least ten feet high, with a stone coping having a single opening, of which the door shall be covered with brass, copper or zinc, and shall be so placed as not to open on any public highway, or on the side on which is the door of the magazine.

3. In the construction of the magazine or in the surrounding wall, only stone, brick, copper, brass, wood, glass, tin, slate, zinc, or leather can be used.

4. It must have but one entrance, to which two doors with copper fastenings shall be placed, one inside and one outside the wall; both made of brass, copper or zinc, or covered with the same material.

5. The floors shall be tongued and grooved and close-jointed, and each part thereof on which any person might walk or place his foot shall be covered with leather.

6. It shall be provided with two lightning rods, to be approved of by the Collector of Provincial Revenue.

Any powder magazine may, with the consent of the Lieutenant Governor in Council, be constructed in a different manner.—41 V., c. 3, s. 61; 46 V., c. 6, s. 1.

THE CHAIRMAN said: We all know the importance of taking such precautions as will render the powder magazines, which are an essential part in all mining operations, safe for the public and for the people who use them. We have on this subject a law which is apparently a good one. We have in Articles 875 and 876 of the Statutes a provision which lays down so far as regards the Cities of Quebec and Montreal and their immediate neighborhoods, a rule for a special magazine constructed in a particular way—special directions as to the kind of magazine that is required. It also requires that every one in other parts of the Province who have magazines, whether such are required either for the use of the person to whom they belong, or for storage purposes, that a license should be obtained from the Provincial Government, and a plan or specification of the magazines proposed to be built furnished to the Provincial Secretary. If the magazines are approved, the Government issues a license, the tax being $150. These are the existing regulations on the subject. I cannot say that it is desirable in the interests of mining companies, or the persons owning the magazines, that this law should be strictly complied with. It does not at all follow in the event of its not being complied with, that because an accident occurs, the owner of the magazine is liable for such accident unless it can be shown that the accident occurred through some neglect of the owner of the magazine. Besides that, if a license has not been applied for, and a magazine is kept without such license, the owner is liable to a penalty provided for in the Act. I am of the impression that this law is not being complied with at all; it may be in some places, but I am quite sure that there are a very large number of cases where this law has been disregarded. I had myself a plan of a magazine recently prepared, which I have sent in to the Government, and have reason to believe they will adopt it. It is stated by those who profess to understand something about the matter to be a safe kind of a magazine, and not by any means an expensive one. It is satisfactory to know that much. I may say that it will strike every person present as being most desirable in their own interest that the laws should be followed out. A plan of the magazine should be submitted to the Provincial Secretary and a license obtained, because in the event of an accident occurring, although it might not absolutely relieve the owner of the magazine from all responsibility, notwithstanding the fact that he has had the plan of his magazine approved of and obtained the Government's sanction, it would undoubtedly be a very strong point in his favour. I commend it strongly to the consideration of all gentlemen who have powder magazines, and who are interested in the subject.

MR. W. H. IRWIN.—I understand that in the new Mining Act they do not specify the class of magazine that is to be used.

THE CHAIRMAN.—The new Mining Act does not touch the magazines at all.

MR. L. A. KLEIN.—What I am afraid of is this: If the license will be raised say to $150 and expensive magazines be put up, this will induce the mine owners to put up one general magazine and keep a lot of material together, which, I think, would increase the danger.

MR. W. H. IRWIN. - Every mine owner is as careful as possible. Take our own district during the time we have worked there, we have not had one single accident, except last year, when we had a blow-up from lightning. No magazine will prevent that, and now we keep our material at two or more different places to avoid danger. Now if a high license be placed on our magazines, all the miners will join together and probably keep a large quantity of dualin in the one magazine, which will be more dangerous than at present. He asked whether it would be contrary to the law for several mine owners, as Mr. Klein suggested, to join together and erect a large magazine for the purpose of keeping their stores therein. He thought the object of the Quebec Government was to derive revenue from this license, and that it might be a violation of the Act, inasmuch as half a dozen different companies would only pay one license of $150 in lieu of several.

MR. KLEIN thought that it would not be necessary for the mine owners to do that. The suppliers would put up the magazine and the mine owners would buy their explosives daily. Nothing could prevent that and the Government would get the $150 license and twenty thousand tons might be stored there.

THE CHAIRMAN remarked that the mines of the asbestos district were within a comparatively small circuit, and there would be no great inconvenience in keeping their explosives in one magazine.

MR. W. H. IRWIN said that so far as the convenience of the miners was concerned, he thought it would be a great advantage over the present system, but at the same time the Quebec Government would consider that an evasion of the Act so far as it related to the license and the revenue to be derived.

Mr. A. M. EVANS remarked that the law of taxation would be all right if a man were to go to Thetford and put up a powder magazine for the purpose of selling that powder to miners, but the law has no right to tax the individual miner. It might as well tax him for his bread and cheese.

THE CHAIRMAN, in answer to a question, stated that a magazine of the kind he had submitted to the Government would not cost more than $500 or $600.

MR. W. H. IRWIN stated that last year their magazine was struck by lightning and that had it been built according to the plans suggested in the Act not only would the magazine have been blown to pieces, but being of stone and solid material would have done a great deal of damage. Their magazine was a wooden building on the top of a mountain and practically no damage was done.

THE CHAIRMAN stated that the kind of magazine suggested was more for preventing explosion than for considering what the effect of an explosion would be if it took place.

The Responsibilities of the Mine Manager.

This subject was eloquently handled by Mr. A. M. Evans, Manager for Bell's Asbestos Company at Black Lake. Mr. Evans touched upon (1) The responsibilities to ourselves; (2) The responsibilities to our employers; (3) The responsibilities to our employees. He spoke strongly in favor of greater educational facilities for the miner, and advocated closer attention to sanitation in mining settlements.

An Invitation to Visit McGill University.

PROF. B. J. HARRINGTON, on behalf of Sir William Dawson, invited the members to visit the Redpath Museum, and to attend the Convocation of the Faculties of Arts, Law and Applied Science, to be held in the Windsor Hall on Thursday.

Mining Bureaus.

MR. W. HAMILTON MERRITT, Toronto, having been called upon, to address the meeting, said: I received with great pleasure the kind invitation of this Association to attend your first quarterly general meeting, and as it came at a time when we were endeavoring to interest the people of Ontario in mining matters, I felt it important that I should be here to attend what I consider an extremely important event. I hope that we in Ontario will be able to follow your example and form a similar association, because I am confident that anyone who has the interest of mining development at heart must have come to the conclusion that combined effort is absolutely necessary in order to obtain that measure of recognition from the Government which the status of the industry and the extent of our mineral resources warrants. He commented on the recent Mining Bill introduced at the last session of the Ontario Government, pointing out the absurdity of having the operations of the Mining Act controlled and directed by the Department of Agriculture. He also advocated a closer recognition of commercial data by the Dominion Government, either in the present Bureau of Mining Statistics in connection with the Geological Survey, or elsewhere

MR. B. T. A. BELL pointed out the utter inefficiency and incompetency of the so-called Mining Bureau, attached to the Department of Crown Lands in Quebec, stating that until the Government consulted with trained and experienced mining inspectors, well versed in the wants and uses of the industry, it was hopeless to expect proper mining legislation. If the local Government had followed the example of the Province of Ontario, and appointed a competent commission to enquire into the requirements of the industry, he was sure no such iniquitous measure as the recent Quebec Mining Act would ever have been attempted. The Dominion Government had done much to foster our manufactures, to extend colonization, to build railways, to develop our great agricultural resources. What had it done to promote the most staple industry of them all, the development of our mines? The Geological Survey, it is true, had accomplished much, and deserved a more generous recognition. It must, however, be regarded as a scientific institution. Was there not an urgent demand for some department or section of a department where commercial data would be readily accessible. The present Statistictical Bureau operated by the Survey was practically useless as a means of supplying that commercial information respecting our minerals so much sought after by investors from other countries.

MR. W. H. IRWIN: I quite agree with Mr. Bell that this matter should be taken up by the P ovince, and that there should be established a proper bureau of mines, whose duty it would be to supply the public and miners with information bearing upon mining affairs. Of course, heretofore, the answer to that would have been, I suppose, that the mining community did not contribute sufficient revenue to warrant the expenditure. But as it seems to be the intention of the Provincial Government to tax mining property in some form or other, I think now is the time to bring the matter to official notice. He moved that the Secretary be empowered to prepare a resolution to be submitted to the Quebec Government. Carried.

This terminated the morning session.

In the afternoon Mr. J. T. Donald, M.A., Montreal, read the following paper on

The Chemical Composition of Asbestos.

Having of late devoted some time to the analysis of samples of asbestos from different localities, I have decided to lay before you some of the results obtained. These, I trust, may be of interest both to those who are engaged in mining in the asbestos districts of Eastern Quebec as well as to those whose labors are among the Laurentian rocks. I shall confine my attention to three points.

I. *Comparison of Canadian with Italian Asbestos.*—When Canadian asbestos was first placed upon the market it had to compete with the Italian mineral, and it is matter for regret that attempts were made to decry the Canadian article and to prejudice users by the statement that chemical analysis showed the latter to be inferior to the Italian. From different sources samples of the Italian were procured, some of which are now before you. An analysis was made of the best sample and the results are shown in column 1. Column 2 shows the composition of a sample from Broughton. The Broughton fibre was taken for analysis because of its marked freedom from foreign matter, the Thetford samples first selected for that purpose having been damaged by fire and smoke.

	ITALIAN	BROUGHTON	TEMPLETON.
Silica	40.30	40.57	40.52
Magnesia	43.37	41.50	42.05
Ferrous oxide	.87	2.81	1.97
Alumina	2.27	.90	2.10
Water	13.72	13.55	13.46
	100.53	99.33	100.10

Certainly chemical analysis shows that our Canadian fibre is in no wise inferior to its European rival.

II. *The cause of the harshness of fibre of some asbestos.*—Chemical analysis throws light upon this important point. From the analysis given above it may be seen that asbestos is principally a hydrous silicate of magnesia, *i. e.*, silicate of magnesia combined with water. It must be borne in mind that this water is not present as moisture, the moisture of bread for example, which can be driven off at a temperature of 212° Fah.; it is water more intimately associated with the silicate, but which may be dissociated therefrom and driven off by a high temperature, just how high I have not yet determined.

When harsh fibre is analysed we find it to contain less water than the soft fibre. In fibre of very fine quality from Black Lake analysis showed 14.38 per cent. of water, whilst a harsh-fibred sample gave only 11.70 per cent. It is well known that if soft fibre be heated to a temperature that will drive off a portion of the combined water there results a substance so brittle that it may be crumbled between thumb and finger. There is evidently some connection between the consistency of the fibre and the amount of water in its composition. It is probable that the harsh fibre was, as originally deposited, soft and flexible, and has been rendered harsh by having a portion of its water driven off by heat, either produced by movement of the associated rocks or resulting from the infection of molten matter through volcanic action.

III. *Comparison of Cambrian with Laurentian asbestos.*—Up to the present time Canadian asbestos may be said to have been obtained exclusively from the Cambrian rocks of eastern Canada. Of late, however, indications have not been wanting to show that it is possible that the great belt of Laurentian rocks to the north of the St. Lawrence may yet prove to be a rich source of this mineral. It has long been known that seams of short fibre are to be found in those rocks, but it is only within the last year that any attempts have been made to test these veins, and it is gratifying to be able to state that the results of these attempts are promising. Much of the Laurentian serpentine is different from that of Thetford and Black Lake. It is much lighter in color and is remarkably free from desseminated chromic and magnetic iron. The contained asbestos is, like the serpentine, of a lighter color than that from the Cambrian, and in consequence of the absence of iron there is little or no tendency to discoloration from percolating water. Is this Laurentian asbestos as suitable for use in the arts as is the Cambrian variety? Column 3 above gives the analysis of a sample from the Laurentian of Templeton, from which it is seen that so far as composition is concerned the two are practically of equal value.

In conclusion your attention is directed to the specimens before you. The world is being searched for asbestos, particular attention being paid to South Africa, which is considered a promising field. These specimens are said to be fairly representative of their localities, and it requires no expert to recognize the great superiority of the Canadian mineral.

MR. L. A. KLEIN pointed out that the only objection to Italian asbestos was that it did not stand spinning so well. He thought that Mr. Donald's sample could hardly be characterized as a fair specimen.

MR. W. H. IRWIN pointed out that to-day Canadian asbestos is used in every country in Europe for manufacturing purposes, even at the pit's mouth of the Italian mines. As Mr. Donald has explained, there is very little difference between the Canadian and Italian asbestos as to their composition, but there is a very great difference in their formation. The Italian asbestos is exceedingly long in fibre, but it is in such a shape that it is almost impossible to handle it properly with machinery, while Canadian asbestos costs so much less to manipulate, and allows it to be placed in the market in its manufactured shape at a price that will enable it to compete with any other asbestos material.

MR. A. M. EVANS inquired whether the formation of asbestos actually rises with the contour of the ground or whether it assumes its own level. He knew for a fact that on a level with Black Lake they had asbestos, and that 750 feet above, at Mr. Klein's place, they also had asbestos, and he asked whether Mr. Klein would be right in supposing that he had 750 feet of asbestos. This is a question for mining men in the future to take up.

MR. B. T. A. BELL asked if it might not be in the interests of the industry to have the occurrence of the mineral tested by the Diamond drill at depth.

MR. W. H. IRWIN said that as asbestos altered in character every few feet, a bore hole might not be a fair test.

MR. J. LAINSON-WILLS speaking of the Italian and Canadian asbestos, said he did not know whether the analysis as given by Mr. Donald represented the average composition of these separate minerals. They all knew that they are separate minerals, the Italian being fibrous serpentine, whereas the Canadian is fibrous only. There seems to be too much similarity between the minerals which are really different.

After some further discussion, the Chairman called upon Mr. J. B. Smith, M.E., to read his paper on

Mine Inspection.

Naturally assuming that this paper should deal with the inspection of mines in accordance with the mining laws and regulations of the Province of Quebec, and the recently passed amendments to the Mining Act, I found on consideration of these that they are not mining laws in the proper sense of the term, at least as understood among mining men in Europe, and that it is difficult to anticipate by the light of mining experience merely the effect of enactments which should more properly be considered from a politico-economical point of view.

The recent amendments to the Mining Act referred to concerns itself almost entirely with the sale and purchase of mineral lands and rights, and the imposition of a heavy and direct tax on the produce of all mines, and has for its object so undoubtedly the acquisition of revenue, that I hesitate to speak on the question at all from a miner's point of view, knowing little of the duties of mine inspection under such conditions, and knowing less of the effect of arbitrary laws which invest an inspector—who, from the responsible and delicate nature of his office, ought never to be more than a witness—with power to assess and collect taxes and impose penalties, and, with the summary jurisdiction of a police magistrate, to enforce them.

The tendency in the older mining countries of Europe, especially great Britain, has been of late years towards the reduction, if not total extinction, of royalties, dues, and such impositions, and the appointment of a Government inspector to collect these would, there at least, meet with very determined opposition.

We may, I think, take it for granted on general principles of economy that the less interference there is by the State with a young and promising industry the better for both State and people.

It would be considered monstrous if the Government were to impose a tax on the production of any staple article of food, say wheat for instance, yet a direct tax is levied on the mineral known as phosphate of lime, the sole use of which is for fertilizing the land, and which is the great plant food of the cereal of which bread is made. Is not this a tax on the production of food?

Enormous tracts of land in the Province of Quebec are lying exhausted and unproductive at the present time, actually incapable of growing wheat for want of a fertilizer, and yet a heavy tax is imposed on this mineral, already costly and difficult to mine—a fertilizer capable of reviving the wasted energies of the Province, and enabling

her farmers to grow enough corn to supply the wants of a much increased population to say nothing of export.

Perhaps no known industry is so likely to produce general prosperity in a new country as that of mining. It always attracts an energetic and useful population, and the best promise of revenue is to let such an industry develop itself without hindrance and with as little interference as possible.

Colonies rapidly become settled in the neighbourhood of mines, and a demand rapidly springs up for agricultural and other home produce, thus offering the surest guarantee of permanent prosperity to the whole country. Is it a wise policy for a country rich in minerals to hamper this industry with taxes and a complicated system of purchase, and harass those engaged in developing it with the troublesome interference of inspectors and the miserable espionage of informers, the latter of whom will certainly increase in proportion to the penalties of which they are to receive half for their information?

The laws and consequent inspection which are really beneficial to mines and miners, however, are those which control the actual working or operation of mining, and the conditions existing between owners and workmen, in order that the former may not derive profit regardless of the safety and health of the employees, and that the latter may not wrong themselves through the neglect of sanitary laws and the careless indifference to danger engendered by custom and familiarity.

In recent times the object of mining legislation in European countries has been almost entirely in the direction of ameliorating the condition of the workers. By regulating the hours of labor, by preventing the employment of women entirely and children of tender years underground at all, and by the prevention of accidents through the close and regular inspection of underground workings by competent mining engineers; and such inspection has led to other beneficial regulations from time to time.

The passing of the Metalliferous Mines Amendment Act of Great Britain, in 1872, was the result of a great number of Reports made from time to time by the inspectors themselves, showing the inefficiency of the existing laws to insure proper conditions of mining.

The inspectors prior to that time were, as a rule, fairly well educated engineers, though not to compare with the class of mining inspectors of the present day. They were generally practical miners, and men sensible of the high responsibility of their office. In their experience in the general inspection of mines they were brought face to face with a state of things which, at that time, it was not within their power to improve according to existing laws, and I think we have to thank them for the better laws enacted as the result of their reports and recommendations.

The laws, however, which they were indirectly instrumental in making, demanded a much more highly educated class of men to see the regulations enforced, and inaugurated a new epoch in the history of mining in Great Britain.

These Government inspectorships of mining divisions under the new Act were very properly lucrative and honorable appointments; young mining engineers were specially educated at the French, German and English mining schools with a view to obtaining them; many of them had actual experience in the working of mines in several of these countries.

The result of this was to raise the standard of mine engineering in Great Britain in a marked degree. By the light and application of scientific knowledge to mining it has become a more certain and regular pursuit. A mining inspector of the present day is at once an engineer, a geologist, chemist and mineralogist. The competitive examination system in England, insures the selection of the very best men of their class. Their knowledge is communicated to mine managers and in a great measure to the workmen by advice tendered in the intercourse which their close and frequent inspection necessitates. The visit of the inspector is rather hailed with pleasure than otherwise, and under this judicious system inspection cannot be considered domiciliary or in the light of espionage.

The owners of mines feel that useful regulations and close inspection secure a good system of mining, and relieves them of much responsibility.

The manager or agent feels himself also relieved of much personal responsibility in the case of unavoidable accidents.

The penalties imposed for violation of the laws are frequently applied to the relief of the sufferers of mine accidents.

In Canadian mines, perhaps more than anywhere else, mining inspection is urgently needed, not in the sense understood with regard to the recent mining law of Quebec, but for the proper working of its minerals and the prevention of accidents to the workmen.

In this paper I am not referring to coal mines, which usually need special regulations and special supervision, but to such mines and quarries as come under the provisions of metalliferous mining laws.

The sudden changes in such a climate from severe frost, where masses of loose rock and dangerous ground may be held together safely enough in winter, and break away with disastrous consequences in summer, necessitate careful timbering. It is evident that if this is left to the option of the owners or agents the question of safety will, in a great measure, be subservient to that of economy.

In order to see that mining operations are properly carried out, underground surveys should be made compulsory after a certain stage of development, and the duty of the inspector should be to see that such surveys are completed and filled in up to a fairly recent date, showing the addition to such plans of the latest workings. Such surveys are necessary also to prevent the encroachment of neighboring mines on each other's property, and for this purpose should have reference to a surface survey of the country, which should be made by the usual sworn surveyors. Copies of such survey should be deposited at the Record Office of the Province, together with other information supplied by the inspectors. Such records afford valuable assistance to subsequent mining and to the geologists of the country.

The storage of explosives on or about a mine should also come under the authority of the inspector of mines, as well as the quantity allowed to be carried into the mine for immediate use by workmen.

With respect to magazines for storage of explosives considerable latitude should be given in a country but unequally settled like Canada. The expensive magazine needed in a thickly populated neighborhood would be superfluous for a new mine opened in a district which is unsettled and but sparsely inhabited. It should not be overlooked either that great difference of opinion exists among scientific experts on this subject of magazines, and that whilst some recommend costly and elaborate buildings, heavily built and ponderous, others advise the lightest and most fragile of structures, and it is certain that in the event of a magazine explosion the result would be much more dangerous in the former than the latter.

Special rules and supervision are desirable too with regard to the charging and firing of blast holes, having particular reference to the kind of explosive material used.

Also for the securing safe means of ascent or descent of persons in the mines by ladders, and the angle at which they should be placed, with proper provision for resting at convenient stages where the mines are deep.

To secure the good health of the workmen it should be incumbent on the owners of mines to provide a proper system of ventilation, the noxious fumes of after-damp being the insiduous cause of many terrible diseases.

I do not purpose in this paper to supply a code of rules for the working of mines in this Province, and have merely given the foregoing as examples of such a code as could be usefully formulated to the advantage of both owners and employees in this country.

And in all mining countries the owner or agent of mining works should have a right to establish special rules, which may be desirable for the conduct and guidance of the persons employed, after submitting the same to the inspector of his division for approval and the consent of his department.

In conclusion it may be worth while to notice that in older mining countries arbitrary powers to fine and imprison without appeal are never given to inspectors—a system which it is evident, whenever employed, will lead to bribery and corruption.

In England the inspector is never invested with the powers of a justice of the peace—his duty being to report any violation of the mining laws, and prosecute if necessary.

In cases of arbitration, having regard to a dispute as to the violation of the rules, or as to whether it is a violation, the inspector of mines should be considered as one party to the arbitration and the mine owner or agent as the other, and an umpire should be decided on in the ordinary manner.

In England the cases of prosecution are taken by the inspector before a magistrate of quarter-sessions.

I regret that I have not had time to do greater justice to this subject as it is a very interesting one to me.

Its consideration has, however, suggested many things in connection with Canadian mining laws and inspection, which I hope to be able to refer to again at some future time.

Meantime if anything I have said leads to a discussion amongst the many eminent mining men present here to-day the best object of such a paper will be fulfilled.

MR. W. H. IRWIN, in referring to Mr. Smith's paper, thought it to be greatly in the interest of the mine-owner to have proper mine inspection. In the asbestos district they had an inspector well acquainted with the wants of the community, and although not a scientific or practical miner, thoroughly honorable and trustworthy. He referred to Mr. John White.

The CHAIRMAN: It was undoubtedly a great advantage to know that they were working under the inspection and sanction of a man who thoroughly understood mining work. In the event of any accident the mine operator needs a competent witness in the inspector to bring before the court.

MR. B. T. A. BELL: It is a notorious fact that in this Province no official record is kept of accidents and no enquiry or report is made regarding them by the present so-called Mining Service of the Government. During the past year there had been falls of roof and slides in different parts of the country, fortunately without loss of life, the mishaps having occurred when the men were out of the pits. It was the duty of the inspector to have examined and condemned these workings. The protection of the employee was the best safeguard to the employer. He thought the Association would be remiss in its duty if it did not make some representation to the Government on the subject.

MR. A. M. EVANS: In England, in 1862, for every 12,000 tons of coal raised they would kill a man, and after the Government took over the matter in 1870 40,000 tons were raised without any fatality. If the record of that country be taken to-day, as compared with 1870, he believed that the district of Lancashire can produce 50,000 tons without any death from accident. Such was not the case before Government inspection was introduced.

MR. A. W. STEVENSON thought the subject one of urgent importance, and he would move, "That the President, Mr. L. A. Klein, Mr. S. P. Franchot and the Secretary, be a deputation to confer with the Government on the subject."—Carried.

Visit to McGill University.

At the invitation of the Edison Electric Company, the members took carriages and drove to McGill University Grounds, where a Marvin Electric Percussion Drill and the necessary plant had been installed. Before explaining the plant, the party adjourned to one of the lecture rooms to listen to the papers on the application of electricity to mining operations. The first subject was:—

The Electrical Transmission and Conversion of Energy for Mining Operations.

By H. WARD LEONARD.

The transmission and conversion of energy is above all others the question of importance in every kind of engineering work, and in mining engineering this is most conspicuously true.

Until quite recently all practical methods of transmitting and converting energy involved the actual transfer of sensible matter over the distance in question and this matter necessarily possessed such qualities as weight, magnitude, temperature, inertia, and other qualities common to all matter.

It is, therefore, not surprising that all engineers, and particularly mining engineers, are watching with the keenest interest, the development of methods for transmitting and converting energy by means of electricity, for, in electrical problems, the many considerations and restrictions due to the inflexible characteristics of matter may be entirely disregarded and the possibilities of mining engineering are correspondingly increased.

The transmission and conversion of energy by water, steam, cables, compressed air, and so forth, we are all familiar with, and we know to our sorrow the limited distance, the low efficiency or the tremendous first cost which has hampered our engineering work at every turn.

With the utilization of electricity for the transmission and conversion of energy we absolutely reverse these conditions and are enabled to operate at practically unlimited distances with extremely high efficiency and very low first cost.

The invention of the incandescent lamp marks the commencement of an era upon whose threshold we now stand and in which the possibilities of engineering will be extended to a degree we can, at present, have no adequate conception of. Until the Edison lamp was invented and introduced, all distribution of electrical energy was by what is known as the series system, which did not lend itself readily to the development and use of electric motors. With the Edison lamp came the system of distribution on the multiple arc plan and the commercial possibility and development of electric motors dates from that time.

The stationary electric motor, supplied from the lighting circuit, was naturally the first on account of the number and simplicity of its applications; then the motor was applied to propelling street cars, and the modern electrical street railway system was rapidly evolved. The electrical engineer, in his search for "new worlds to conquer," next turned his attention to the mining field.

The great variety of the applications in this field, the distance from the mines to the principal cities, where electrical developments have been most rapid, and the lack of knowledge as to the exact requirements have, until recently, made even the simplest applications of electricity to mining rather rare.

Perhaps the greatest stumbling block has been the percussion drill. Until recently, when a mine owner asked if we could transmit his power, light his mine, and operate his pumps, hoists, tramways and mills, we would confidently reply "Yes!" But when he asked if we could replace or operate his air-drills we were obliged to say, "Not yet."

Since the drill is the most universal of all mining appliances operated by power other than hand power, it was not possible to make rapid progress until this deficiency was corrected.

The Edison General Electric Company has put upon the market in commercial form, during the past thirty days, three types of electrical drills which will enable the mining engineer to accomplish all that he has been able to accomplish heretofore by other drills, and not only this, but to accomplish far more than was heretofore possible and under conditions heretofore prohibitory.

First in importance comes the Electric Percussion Drill, the invention of H. N. Marvin, of Syracuse.

Following is a brief description of the principal features of this drill:—

Fastened upon a suitable tripod or column is a piece of boiler tube, seven inches in diameter and about two and a half feet long. In the forward half of this casing are placed 2 cylindrical coils of wire in the form of solenoids, each about 8½ inches long, having an outside diameter of about 6¾ inches, so as to make a loose fit with the casing, and an inside diameter of about 2⅛ inches. These two solenoids are placed so as to be against each other end to end in the casing. The bit plunger plays freely through the centre of these solenoids and is supported by two bearings placed just beyond the outside ends of the two solenoids respectively.

The back portion of the casing contains a spiral spring of the form frequently used for car springs. The plunger is composed of a central portion made of wrought iron

about fourteen inches long, and both the forward and back portion of the plunger, which are made of aluminium bronze, are rigidly fastened to this iron portion. The forward portion is about thirteen inches long and carries the bid socket. The back portion is spirally milled for a length of about 9 inches so that the cross section of this portion is hexagonal. At the extreme back end is a steel buffer which strikes against the cushioning spring.

The spirally-milled portion of the plunger is similar to that used in other percussion drills, and causes the drill to revolve upon its axis ⅙ of a complete turn with each stroke. The ends of the coils of wire are brought to contact pieces at the top of the adjacent ends of the two solenoids, where there is a socket for receiving the terminals of the cable, and thus making electrical connection with the drill. There are three conductors leading from the generator to the drill, one of which is connected to one terminal of each of the solenoids, and the other two conductors are connected to the two remaining terminals of the solenoids respectively.

The generator is of the simplest kind, the coils on the armature having their terminals connected to two insulated collars on the shaft.

One collar is a continuous metallic ring, and upon this one rests a brush which is connected with the conductor, which is common to both solenoids. The other collar is metallic for half of the circle, and the remaining half is insulated from the armature wires. Upon this half ring rest two brushes diametrically opposite each other and each brush is connected to one of the two remaining conductors leading to the solenoids in the drill.

If now we revolve the armature of our generator in a separately excited magnetic field, an electric current will flow, let us say, from the armature to the half ring, then through one of the two brushes which happens at the instant to be in contact with the half ring, along the corresponding conductor to one terminal of one solenoid, let us suppose the rear one; then through the rear solenoid itself, and back along the mutual wire to the continuous ring and then to the armature again.

This current, in passing through the rear solenoid, makes a powerful magnet of it, and this tends to pull the plunger back into a position such that the centre of its iron portion shall be in the centre of the rear solenoid.

When the armature moves forward a half revolution the polarity of its wires is reversed, and the other brush, with its conductor, is now in contact with the half circle; consequently, the current in the mutual wire will be in the reverse direction from that of the former wave; the rear solenoid and its conductor, formerly active, are now out of circuit, and the circuit is made through the other conductor and its corresponding solenoid, that is, the forward solenoid.

The magnetic action of this solenoid tends to make the plunger move forward, so that the centre of the iron portion shall be in the centre of the forward solenoid.

Thus we get a reciprocating action of the plunger, and every revolution of the armature of the generator will cause a complete stroke of the drill. By varying the speed of revolution of the generator we can make the drill strike any number of blows per minute we choose. In usual practice 600 blows per minute are found to give excellent results. The spiral spring, it will be observed, stores up the energy of the back stroke and returns it to the forward stroke, assisting the magnetic impulse and greatly increasing the strength of the blow.

In order that we may form an unbiassed judgment of this drill, I will quote the opinion of André, perhaps the best authority on power drills, who, many years ago, stated the requirements of a first-class power drill to be as follows:—

1. Simple in construction, strong in every part.
2. Few parts, especially moving parts.
3. As light in weight as can be made strong.
4. Take up little space.
5. Striking part of relatively great weight, and strike directly.
6. Piston alone exposed to shocks.
7. Piston capable of variable length of stroke.
8. Sudden removal of resistance should not injure any part.
9. The rotary motion should be automatic.
10. The feed of machine, if automatic, should be regulated by the advance of the piston as the cutting advances.
11. Should be capable of working with moderate pressure.
12. Should be readily taken to pieces.

It may be sufficient to say that the Marvin drill possesses every one of the good qualities André specifies, and in a most marked degree; but, in describing the good qualities of this drill, we can, if necessary, add considerably more than André specifies. For example:—

1. It is simple in construction and strong in every part.
2. It has a minimum of moving parts, that is, one.
3. It is very light in weight, for its strength—this being possible because of the perfect cushioning at both ends of the stroke.
4. It takes up very little space.
5. The striking part is of relatively great weight, and strikes directly.
6. The length of stroke is variable at will.
7. The drill cannot damage itself by its own blow.
8. The rotary motion is automatic
9. It has very few parts.
10. It can be entirely taken apart and put together again inside of ten minutes.
11. There are no joints to be fitted or packed.
12. It is not affected by heat or cold.
13. It can be operated at great distances from the source of power.
14. It has a much higher efficiency than other drills.
15. It is independent of the action of any valve.
16. The rate of striking is independent of the kind of material it strikes.
17. It will operate in the open air without striking anything, and hence can be made to strike an extremely light blow at its full rate, which is very important in starting holes, and so forth.
18. It can be rapidly moved from one position to another at a great distance, since the energy is transmitted through flexible cables.
19. No loss is suffered due to elbows, bends, valves, etc., in the conductors.
20. The conductors can be carried on very light supports, both because of their light weight and because the transmission of energy through them does not tend to distort their position.

The importance of the above characteristics will be apparent to any one who is familiar with the operation of the steam and air drills.

It is interesting to note that in driving the Hoosac Tunnel the average life of the power drills, before sending them to the shop, was fifty hours. Even to-day, after a development of twenty-five years, we find that it is common practice to have in the shop one-half the total number of drills employed.

In pushing engineering work it is frequently of paramount importance that the work be done quickly. Therefore, any means of greatly increasing the rate of drilling is extremely valuable. To increase the rate of drilling we must either increase the strength of each blow or else we must increase the number of blows per minute. A limit to the rate of striking is soon reached when a valve of considerable weight must be moved from rest by the concussion of the previous blow, and when a material substance, such as air or steam, must then fill the space back of the piston and raise the pressure to the working pressure. Also the strains and shocks caused by the valve and the air or steam soon become troublesome as we increase the rate of striking. With the Electric Drill the speed of rotation of a perfectly balanced cylindrical armature of small diameter alone determines the rate of striking, and there is apparently no limit to the rate of striking, except the possible rate of the magnetizing and demagnetising of iron, which is already done in daily commercial practice at the rate of 10,000 times per minute with the highest efficiency.

With 800 blows per minute we have already drilled at the rate of four inches per minute a hole 1½ inches in diameter in the hardest Quincy granite, and that with an expenditure of energy not exceeding three horse power.

I firmly believe that in a comparatively short time we will be furnishing percussion drills whose rate of striking will be several times as much as that we now employ, and that with no more and no heavier drills than are now used the rate of driving a heading will be increased many times. The importance of rapid driving of work is practically illustrated by the fact that in the Sutro tunnel, Mr. Sutro offered the men at work, in addition to their regular wages, the following bonus:

For every foot per month over 300 and under 400, $5.
" " " 400 " 500, $10.
" " " 500 $20.

A bulletin from the Census Department, under date of March of this year, shows that in granite quarrying the cost of labor is 84% of the total cost of production, and in Massachusetts, where the output is much greater than in any other state, and where the longest experience and most approved methods are met with, the labor is 82½% of the total cost. It will be evident that any labor-saving device in such a field will be extremely valuable.

Another drill of great value to the mining engineer is the Diamond drill. The Edison General Electric Company have, during the past thirty days, put upon the market an electric diamond drill which they have been developing for the past two years. The drill is the invention of J. E. Storey, of Denver. It presents a great many advantages over the diamond drills heretofore used, as will be evident from the following description of it:—

The drill weighs complete 239 pounds. The average power consumed is about 1¾ H.P., and with this expenditure of power the drill will bore a hole of 1¼ inches diameter in hard rock at the rate of two inches per minute, taking out a core of ¾ of an inch. The drill rod is rotated at the rate of 400 revolutions per minute without any load, and when drilling at full load the speed is practically the same.

The drill rod is geared by a single set of gears to an electric motor which revolves at 1,600 revolutions under conditions of full load. The motor has four poles, and the keeper joining the poles is in the shape of a surrounding cylindrical shell, which thoroughly protects all the parts of the motor and other parts of the machine.

Upon the drill rod is placed a rotary pump which supplies the drill with the necessary water.

In using the diamond drill the following points are of great importance:

1. The speed should be uniform and automatically controlled very closely, so that removing the load quickly will not permit the drill to run away.
2. The drill should run at as high a rate of speed as is consistent with smooth drilling and a proper supply of water.
3. The drill should be extremely steady, as any material vibration transmitted by the drill rod to the diamond points is disastrous to them.
4. The drill should be as light and compact as is consistent with the requisite strength.
5. The drill should be capable of being readily and rapidly moved considerable distances and put into operation again with the least loss of time.

Up to the present time diamond drills are operated by reciprocating engines, and the engine is fastened upon the same frame as the drill rod, to which it is geared by suitable gearing. The engine usually has two cylinders of the oscillating type to reduce the vibration as much as possible, and eliminate the dead points. With these small engines it is practically impossible to automatically get the close regulation of speed which is desirable, and the speed is governed entirely by hand throttling. The engines cannot be run at very high speeds because of the vibration they would produce, and because of the rapid depreciation of such engines at high speeds. It, therefore, becomes necessary to gear to the drill rod by gearing, which is oftentimes objectionably large, and would become even more so if a higher speed upon the drill rod were attempted, as is desirable. The space occupied by the drilling machine is quite large, as the engine, gears, etc., occupy much space. This is a great objection in cases of operation in tunnels, shafts, etc.

With the electric drill the motion is free from any jar, as there are no reciprocating parts, and the speed can be made absolutely constant under any condition of load up to full load. The speed of the drill rod can be made anything desired up to several thousand revolutions per minute, if desired, and under any conditions of speed above 1,600 per minute there would be no gears whatever. The weight of the electric diamond drill is, for the same power, much less than that of the steam diamond drill, and the space occupied is in a direct line with the hole, and is extremely small in amount.

The drill can be operated from any existing electric light circuit, and the current for it can be supplied at two miles' distance from the source of power by wires of size No. 10 B.W.G., having a diameter of about ⅛ of an inch. The drill can be carried wherever a man can carry 35 pounds, which is the weight of the heaviest single part, and hence can be quickly set up and operated in the most inaccessible places.

It will be evident that for prospecting work, when a certain territory is to be explored, this drill is particularly adapted.

Starting from a convenient and economical source of power, we can, if desirable, lay our wires along the surface of the ground, and in a very few hours can be operating our drill miles off. We can then reel up our wire and lay it again in an exactly opposite direction, and again be in operation at perhaps five or ten miles off in the course of a few hours more. In laying the wire, a couple of horses yoked abreast, and carrying the reel, is all that is necessary. For operating at a distance of one mile in any direction, the diameter of the wire necessary is but ⅛ of an inch, and the total weight of the wire only 340 lbs.

The facility with which prospecting, and also drilling, in permanent works such as mines, can be done with this drill, will no doubt lead to its rapid and general use.

There is every reason to expect that with the electric diamond drill the speed of the rotation of the drill can be very greatly increased, with consequent increase in the rate of drilling, which is of the greatest importance.

The Edison General Electric Company have a third kind of drill, which is a rotary high speed drill, having a solid steel bit, and this drill is used for drilling coal and similar comparatively soft materials, and also for drilling metals, where it will have an extensive use in the construction of steel ships and bridges, and similar works where the drill has to be taken to the work rather than the reverse.

With the three drills which I have described, the Edison Company is now able to do any class of drilling desired, and these drills are likely to play an important part in the future of mining engineering.

The electric mine locomotive and the hoists, pumps, ventilating fans, crushes, stamps, etc., operated by electricity, are instances of the application of electricity to mining which have already proved themselves entirely successful. The undercutting of coal by electricity is an important field in which the Edison Company has made great strides, the machines being of two entirely distinct types, which becomes necessary in order to properly comply with the conditions met with in practice in different mines.

The electric refining of metals, especially of copper, is an extremely interesting subject to the mining engineer. The Edison Company have established the majority of the plants of this nature in the United States, and I need only say that the results are highly economical and most satisfactory in every way.

The electrical transmission and conversion of energy at great distances is destined to come up in nearly every mining problem in the future. Mines are usually in a mountainous country, and it is seldom that a water power cannot be found within a few miles of a mine. The mining engineer in the immediate future will, to develop this water power, convert its energy into electric energy, in which shape he will transmit it to the distant mine, when it will be again converted into the various forms of energy which he may have occasion to require.

Among the applications will be the following:

1. The lighting of the mines and the buildings and grounds by arc and incandescent lamps.
2. The operation of any machinery in the mill, such as crushers, stamps, etc.
3. The operation of the drills.
4. The operation of the hoists.
5. The operation of the pumps.
6. The operation of an electric tramway in the mine.
7. The operation of ventilating fans.

8. The heating of the buildings when fuel is scarce.

9. The refining of copper and recovery of gold and silver in certain cases.

10. The concentration of magnetic ores in certain cases, such as iron, nickel, etc.

In order to give to you a commercial idea of a plant such as is likely to be used in mining operations in the immediate future, I will suppose a case and give you an estimate of the first cost and operating expenses of such a plant. Let us suppose that we have a mine where we have to operate the following devices:—

360 incandescent lamps of 16 candle power each.
10 arc lights.
1 hoist requiring 30 horse power.
1 pump requiring 20 horse power.

6 percussion drills for drilling 1½ inch holes at the rate of three inches per minute.

2 rotary diamond drills 1¼" hole, ¼" core, rate 2 inches per minute.

1 mine locomotive 10 horse power.

Milling machinery requiring 30 horse power.

Heating requiring 10 horse power.

The total power required for the above will be 180 horse power delivered by the main motors. Suppose that at a distance of three miles there is a good water power which can be developed and equipped with water wheels to produce 300 horse power by an expenditure of $15,000. In considering transmission of the power by electricity, we must first determine what loss we shall sustain in transmission, and then we must determine what electrical pressure we will operate with.

In designing such a plant, there are certain fixed laws governing the conditions of highest economy and minimum first cost, and some years ago I investigated these questions and deduced formulæ expressing these laws.

It may be interesting to note here, in passing, a fact which you will observe by examining the formulæ given, namely: If we pay proper attention to the laws governing the highest efficiency and least first cost, the cost of the conductors for the plant will be independent of distance and will depend solely upon the percentage of loss we decide to sustain in the conductors. Thus, under practical conditions to-day, if we are to operate at 15% loss we should employ a pressure such that, at the distance in question, the cost of copper for each horse-power delivered at the motor brushes would be $7 47. Similarly the cost of copper per horse-power corresponding to 20% loss would be $11.20 and that corresponding to 25% would be $16.00. This simple but invariable law, which is embodied in the formulæ given herewith, you will find of great assistance to you in considering questions of electrical transmission.

You will also notice that the formulæ show that the electrical pressure to be employed will vary directly with the distance. Thus, for 20% loss, the cost of copper being $11 20 per horse-power delivered at motor brushes, the e.m.f. necessary for transmission of 16,000 ft. will be 1,500 volts; at 32,000 ft. we should use 3,000 volts, and at 8,000 ft. 750 volts.

Suppose that after investigating the question of the value of the original power we find that a loss of 25% in the conductors will make the value of the power wasted in the conductors per year just equal to the interest on the investment made necessary by the power wasted in the conductors. This loss will then be the most economical to operate at, according to Sir Wm. Thompson's well known law. Now, by reference to the curves on sheet No. 2, we find that to operate at a distance of three miles with 25% loss, the minimum of first cost will be realized when we operate with an initial electrical pressure of 1,200 volts.

In order to secure the 180 horse power necessary at our various devices in and about the mine, we must deliver 200 horse power to our main motor in the form of electric energy in the conductor at the brushes of the motor. With 25% loss in conductors this will mean 266 horse power at the generator brushes or 300 horse power delivered by the water wheels.

For the sake of reliability and economy we will use two generators instead of one, each being of 133 horse power. At the mine there will be two main motors of 90 horse power each, wound for 900 volts and 83 amperes, producing a total of 180 horse power which will drive the drill generator of 17 horse power and a generator of 250 volts and 300 amperes for operating the incandescent lamps, the arc lamps, the mine locomotive, the hoist, the pump, the diamond drills and the heating. The main motors will also supply the milling machinery with the necessary 30 horse power.

By formulæ on sheet No. 1, we find that to transmit 180 horse power three miles with 25% loss and an initial pressure of 1,200 volts there will be required a wire having a circular millage of 190,000 circular mils; this is having a diameter of 436 thousandths of an inch, or a little less than half an inch.

We find by other formulæ on sheet No. 1 that the copper will weigh 20,000 lbs. and will cost $4,000, which results check each other and prove the accuracy of the calculation.

We are now able to make an estimate for the total plant, as follows:

Estimate of cost of plant for transmitting 180 H.P. a distance of three miles, with a loss of 25% in conductors, the plant to comprise the apparatus as specified.

Developing original water-power and installing water-wheels of 300 H.P.	$15,000
2 Generators, 100 K.W. each (1200 v.—83 amp. each), @ $36 per K.W.	7,200
2 Motors, 75 K.W. each (900 v.—83 amp.), @ $36 per K.W.	5,400
Copper, 32,000 ft., No. 000, B. W. G.	4,000
1 Six-drill Generator.	2,000
1 Generator of 250 v.—300 amp., 75 K.W., @ $36	2,700
6 Electric Percussion Drills	3,300
2 Electric Diamond Drills	1,100
360 Incandescent Lamps and appliances	360
10 Arc Lamps	220
1 30-K.W. Hoist	2,255
1 20-K.W. Pump	1,595
1 10-K.W. Locomotive	1,815
Heaters—10 K.W.	600
Conductors for all secondary transmissions	1,000
Labor of Installation	3,000
Poles	455
Freight, Cartage and Sundry Expenses	1,000
Total	$53,000

The operating expenses of such a plant will be those mainly due to the wages of two men for each shaft—one at the water-power and one at the mine.

A fair allowance for depreciation and repairs will be 5% per annum of the first cost.

The operating expenses will therefore be about as follows:

1 First Operator, per year	$900
1 Second Operator, per year.	600
Depreciation and Repairs, 5% on $53,000	2,650
Sundry Incidental Expenses	250
	$4,400

The production of the same power by steam, when coal is $2 per ton, and labor such that an engineer's wages are $2 per day, would not be less than double this amount; and in many instances, where water and fuel, suitable for the generation of steam, are difficult to obtain, such a plant would represent a saving of its entire first cost every year.

NEW YORK, April 28th, 1891.

THE CHAIRMAN then called upon Mr. J. W. Kirkland, Boston, who continued the subject in a paper entitled:—

Recent Developments in Electric Mining Apparatus.

MR. PRESIDENT AND GENTLEMEN:—No other section of this continent offers such exceptional and striking facilities for the introduction of electricity as does this great Province of Quebec. Nature has been bounteous in her distribution of water, and your hills have by their ruggedness forbidden these masses of water from pursuing a slow and unbroken course to the sea. In travelling through your country the visitor from the States is impressed by the fact that there is hardly a town, hardly a mine, hardly a factory, which is not almost within hailing distance of some river or torrent which has for ages been expending its kinetic energy in re-arranging its channel and cutting away the rock over which it flows. These waterfalls are destined to become the great agency for opening your mines and driving your mills and for transporting their joint products. So much for the water facilities; but we may still go further in congratulating you upon your possessions of cheap power. Even where water power is not at hand you are still more advantageously situated than are your neighbors—with your great woodlands waiting to be cleared in order that better things may be planted, and in the clearing supplying cheap fuel for your boiler fires.

In connection with the development which is bound to spring from these great natural bequests, one fact is assured; one powerful agent, electricity, must play an important part. The strides in its application have been tremendous in the last few years; the prophet who will not foretell still greater ones to come is faint-hearted indeed.

An electric mining equipment consists of three elements, each to be considered separately and each forming a distinct part of the problem to be solved. They are: the generating plant, the line, and the motor or other device for utilizing the current. The generating plant which comes first, from its very nature, differs but little from electric lighting installations, already so common, the dynamo electric machines having, however, rather a different form. The measuring and productive devices consist of the usual ground and potential indicators, the lightning arresters, the hand switch and the automatic cut-outs, the desirable position of which and the method of connection are often prescribed by underwriters' rules. The generators are, as a rule, wound for an electric potential of 220 volts, this seemingly odd quantity having become one of the standard units of electric pressure by reason of the fact that the incandescent lamp is conveniently made for a pressure of 110 volts, so that upon 220 volts two incandescent lamps may be run in series. The pressure chosen is one which is perfectly harmless to either human or animal life. It admits of very perfect insulation in the underground chambers of mines, which are, as a rule, impregnated with moisture which is always seeking to form a by-path for the electric current. The generating station requires primarily a source of power, whether of water or steam, and its position with reference to the mine is therefore determined principally by the condition of obtaining power cheaply and conveniently. It may be several miles from the mine or quarry, it may be in the quarry, or again it may be at the bottom of the mining shaft, as is the case in a somewhat celebrated plant in the Comstock Lode.

The line is so simple a feature as to require no description. You have your poles close at hand, generally needing but a few strokes of the woodsman's axe to prepare them for their work; your wire and supplies you can buy cheaply right here in Canada.

Having brought your power to the mine, the ways in which you can dispose of it are almost without limit; with it you may displace your ponderous steam pump, your costly air-compressor, your steaming, sweating, and worse still, short-lived mules; and last, but not least, your dangerous miner's lamp. With it you can ventilate the most remote corner of your workings, and the shaft which has previously been useless because mother nature has chosen it as an artery for her watery blood becomes, by the introduction of an electric pump, a dividend-paying property.

But I will come to my real purpose in reading this paper to-night. That is, to bring before you some of the specific methods in which this invisible agent is to be made use of.

As we have had the pleasure of listening to a very interesting talk by Mr. Leonard on the subject of electric rock drills it will not be necessary for us to deal very fully with that part of the subject, and I will confine myself to a few brief words, merely calling your attention to the form of drill invented by Mr. Chas. J. Van Depoele and manufactured by the Thomson-Van Depoele Electric Mining Co. This photograph shows the drill as it appeared in a practical test made upon it at the quarry of the Cape Ann Granite Co., Cape Ann, Massachusetts, a few months ago. To bring this photograph nearer to each of the members we have had prepared these prints, with which I hope all by this time are provided. The rock drill which is represented in the photograph and in the prints has a capacity to open a hole two inches in diameter in the hardest kind of granite that we were able to obtain for the test at the rate of something over 1½" per minute, and this with an expenditure of only about 2½ electrical horse power. The coils and connections, the carriers of the power-giving current, are completely enclosed within a solid iron casing and are simple in the extreme, a quality which should be one of the very first to be sought in designing all mining machinery, whether electrical or otherwise. A cable consisting of three separately insulated conductors of small cross-sections is connected to corresponding terminals in the junction box at the top of the machine, seen near the letter G in the print. This diagram which has been prepared from the patent granted to Mr. Van Depoele on his invention, shows the three wires running from the dynamo D, and the three coils or solenoids within the drill. The central coil is traversed by a current pulsating in intensity but constant in sign or direction, which serves to keep the iron core or piston in what is electrically termed a saturated condition—that is to say, a state of maximum magnetization at all parts of the stroke. It is termed a polarizer, and consists of many turns of small wire. One terminal of this coil is connected to one of the revolving brushes and the other to a stationary one which is in this case the negative. The current, therefore, in this coil varies from 0 to maximum and back again to 0, as the brush A moves from the position in line with the negative brush all round the commutator and back to its original place. Now examining the coincident conditions in the outside coils, first stating that these are wound of few turns of comparatively large wire, and so that if a north pole is at any instant at the inside end of the upper coil marked No. 1, a similar pole finds itself at the corresponding extremity of the coil No. 2.

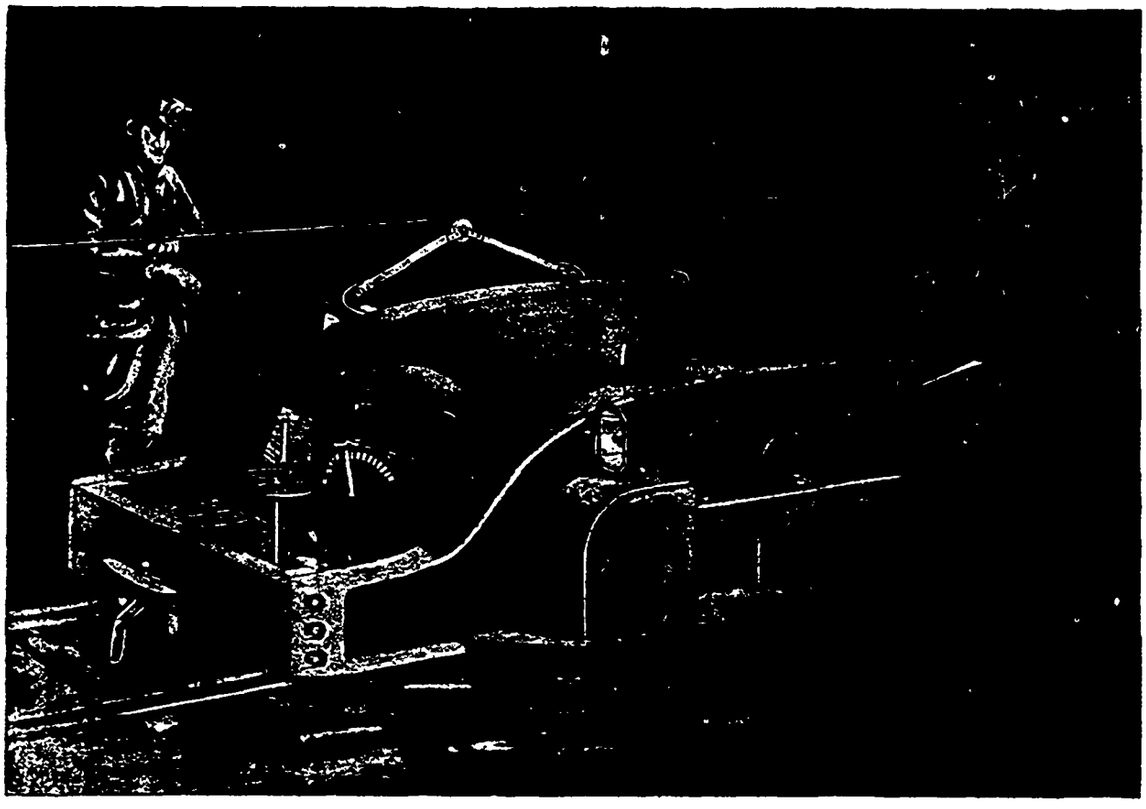
Now the polarizing coil is energized by a current produced by the difference of potential between the brushes A and *b* equal to one half the voltage of the dynamo—or 110 volts. At this instant the outside coils are neutral because the brushes A and B are at their middle points, and the core is now drawn towards the middle of the drill, lagging behind the magnetism an appreciable amount.

Assuming now that a one quarter turn of the yoke holding the revolving brushes has been made, the middle coil is now getting its maximum current due to the total electro-motive force of the dynamo; the outside coils are also at their maximum, and while one is tending to repel the similarly magnetized core in the direction of the other coil, the latter is itself at the same time exerting an attraction upon the core. Another one quarter turn and the current in the outside coils has waned and disappeared entirely, and the current in the polarizer has also decreased to one half its maximum value. Another one quarter turn and the conditions are the same as those when the brush RC was in line with the positive terminal, except that the direction of current in the two outside solenoids is at present of opposite sign. The core is therefore pulled toward the other extremity of the drill. This action is repeated continuously, the magnetized core always seeking to place its north pole as close as possible to the nearest pole of opposite sign, that is, it tends to embrace at each instant the greatest possible number of lines of force, or in lay terms, magnetism.

From the above I hope that those of you who have not neglected your electrical education will see why the core is kept vibrating, making one stroke up and down for

each complete revolution of the revolving brushes. The length of the stroke depends upon the rate of pulsation and upon the distance of the drill from the rock it is cutting.

This diagram, by the way, represents an electric generator in the usual conventional method which is probably



familiar to some of you. The motion is imparted to the revolving brushes by means of a small intermediate shaft, belted to a sliding yoke which revolves close to the commutator and carries brush-holders at its two opposite extremities. It may be well to state that an automatic device consisting of a steep pitched screw and nut gives the drill a turn of ⅛ of a revolution at every stroke, thus insuring a clean-cut round hole. I leave you to judge of the compactness and solidity of the drill and its tripod from the prints. The same form is at present made in three sizes, of which the one represented is the largest. These drills are also, when required, placed upon quarry bars for mine and tunnel work.

Before leaving reciprocating apparatus entirely, it will be well to touch upon a machine similar in principle to the drill, viz., the reciprocating pump, in which the power end resembles in outward appearance the corresponding end of a steam pipe, but which, instead of containing a carefully turned cylinder with close fitting piston and steam valves and joints, contains essentially the same arrangement of solenoids as I have described in connection with the rock drill. The pump is light and compact and lends itself readily to use in sinking shafts where space is of much importance, and where it is necessary to suspend the pump vertically and lower it by means of chains as the work progresses. A pump of this kind having a water cylinder of 4 x 8", built by the Knowles Pump Co., Warren, Mass., is now on its way to Fran'furt, Germany, for the great electrical exhibition to be held there during the coming summer. The results obtained from its tests may be of interest. I quote directly from the report of the expert in charge:—

KNOWLES' PUMP.

Weight complete on base, about.....	800 lbs.
Weight of motor end.....	400 "
Strokes per minute	120 "
H.P. consumed, about.....	2½ or 3
Gallons raised per minute.....	50
Head.....	100 feet

Remarks:—The water piston was so tight that it could not be moved by hand, so that a good deal of power was thus absorbed. After a day or two of continuous working this difficulty will be removed.

Passing now from electrical apparatus in which the magnetic attraction is exerted to produce rectilinear motion, let us turn to those in which the electric motor in its usual form delivers its energy by a rotary motion.

Mine traction is one of the first problems to be solved, and happily it is one to which electricity is peculiarly well adapted. This photograph and one of the prints which you have represents a new design of mining locomotive, capable of doing work at the rate of 60 h.p. This machine is being built for the Blossburg Coal Co., operating the Bear Run mine in Pennsylvania. Another of the same size is under construction for the Hillside Coal and Iron Co., another of 40 h.p. is to go to Schofield, Utah, and a fourth of 25 h.p. to the Livingstone Coal and Coke Co., Livingstone, Montana.

As will be seen, the mechanism is enclosed completely in an iron covering which prevents the admission of water and protects the moving parts from injury which might be caused by falling rock or careless workmen.

This machine weighs, complete, about 21,000 lbs.; it has an estimated traction of 2,000 lbs., at 10 miles per hour, and will haul a load of 85 tons at a speed of 10 miles per hour on a level. Its height over all is only 40 inches and its gauge is 36 inches up. The 60 h.p. motor is carried directly upon the axle of the machine, and is reversible. Its speed and traction are under the immediate control of the driver or motorneer, as he is sometimes called, who is accommodated at one end of the platform with rheostat handle, reversing switch, and powerful brake within easy reach. No single pound of material is wasted in the construction of this machine; the great weight necessary to prevent slipping is usefully disposed of in the frame and platform, and in strengthening all parts. In this respect the new locomotive differs from other types in which the weight is too often supplied by attaching otherwise useless masses of iron to the platform.

The same form is preserved throughout all sizes. The method of conveying the current to the locomotive has been often described before and is probably known to a great many of you. Still for those who have not followed electric traction very closely it will, perhaps, be well to speak a few words upon this subject. At one side of the gangway, placed within a few inches of the roof, a bare hard drawn copper wire is supported by means of especially designed mining insulators, which are, in turn, fastened either to the timbers or, if the roof is good, directly to the latter. A trolley arm of rather ingenious design maintains a gun-metal wheel in close contact with its bare wire and preserves an even upward pressure, accommodating itself to a considerable variation of the trolley wire.

The current entering the motor from the conductor enclosed in the trolley arm passes through the rheostat, the reversing switch, and the electric motor, and then passes from the wheels of the locomotive to the rails, which are bonded together by copper conductors through which it returns to the electric generator.

A complete line of frogs, switches, crosses, etc., are provided for the overhead wire which guides the trolley wheel in the proper direction.

It is not an unusual occurrence in mines to find steep grades of more or less length, which, if they were to be surmounted by the locomotive would require that it be of large capacity for hauling ordinary loads on level stretches; to do this work by such machines would therefore be uneconomical. How does electricity apply to these cases? I beg to call your attention to the third and last print—that of the electric hoist. By means of this machine a system of tail-rope haulage upon the grades is operated, running from the top to the bottom, and doing the work of a locomotive in raising the cars. The hoist shown consists of an especially designed motor, waterproof in construction, mounted upon one bedplate with a hoisting drum, and geared to it through a friction clutch. This motor is like the one used in the mining locomotive, reversible, and its speed controlled by a rheostat. A strap friction brake is applied by the foot lever shown in the print. This clutch is operated by the hand lever, and the rheostat and reversing switch are manipulated by a third lever. The whole machine is compact and simple having few moving parts and requiring no skilled labor for its operation.

The following are some figures upon the 15 horse power hoist:

Total weight.....	4,435 lbs.
Speed of motor varying between 700 and 1,200 revolutions per minute.	
Speed of winding drum varying between 24 and 41 revolutions per minute.	
Efficiency from the energy in the wires to load lifted.....	60%

When you consider that this figure of efficiency takes into consideration all the mechanical and electrical losses, such as friction of gears and of rope, you will, I think, admit that it is high.

I leave it to you, as practical men, to weigh the electric hoist against the steam hoist with all the small details of piping and valves which the name implies, and I feel certain that the latter will be found wanting.

The electric hoist is moreover a probable successor to the steam winch at the top of the mine shaft, used for raising cars and buckets.

These photographs show a form of electric pump which is quite worthy of mention. The mechanical part is made by the Goulds Mnfg. Co., and the electric motor is one of our standard type, especially prepared to be waterproof. An efficiency of about 70% is obtained from the complete and exhaustive tests made upon the various sizes of these machines.

Still another form of electric pump consists in the adaptation of a motor to a Knowles standard power pump in which the motion of the armature shaft is transformed into a reciprocating motion by means of a set of worm gears and cranks.

We have now touched upon the most prominent features of an ordinary electric mining equipment with the exception of the electric lighting, which is a matter somewhat apart from our subject.

It only remains to be said that incandescent lamps can be placed wherever desired and made to receive their current from the same wires which supply the energy for the motor and devices.

In conclusion, gentlemen, I wish to say that the Thomson-Houston International Electric Co. stands ready to give further information on these subjects upon demand; and I extend to you all in its name, collectively and singly, an invitation to visit the Thomson-Houston factories in Lynn, Mass., whenever you may find yourselves in that part of the country.

After a vote of thanks had been passed to the gentlemen for their interesting papers, the members visited the plant and witnessed the operation of the Marvin electric percussion drill, under direction of Mr. W. M. Schlesinger, the expert of the Edison Company, New York. The experiments, although conducted under much difficulty, sufficiently demonstrated the utility of the drill as a factor in mining and quarry work. The drill was then taken to pieces, and the simplicity of its parts pointed out. The members were well pleased with the demonstration, and many favorable opinions were passed as to its application in the immediate future. We believe that these experiments have already resulted beneficially to the company, several sales being reported.

A Jovial Dinner.

In the evening the first annual dinner of the Association was held in the Ladies' Ordinary of the Windsor Hotel, Montreal. About seventy members and invited guests were present. Hon. George Irvine, Q.C., President of the Association, occupied the chair, having on his right Sir William Dawson, Principal of McGill University, and on his left Mr. R. Archer, President of the Montreal Board of Trade. The vice-chairs were presided over by Mr. S. P. Franchôt, managing director of the Emerald Phosphate Company, Buckingham, and Mr. D. A. Brown, Bell's Asbestos Company, Boston. After an excellent dinner the Secretary intimated letters of apology from the following: Sir Donald Smith, M.P., R. Prefontaine, Q.C., M.P., W. B. Ives, M.P., R. N. Hall, Q.C., Frank Grundy, Manager Quebec Central Railroad; Prof. T. Sterry Hunt, New York; Rev. Abbé Laflamme, Quebec; Hon. F. Langelier, M.P., Quebec; Hon. G. A. Drummond, Montreal; Dr. G. M. Dawson and Dr. R. W. Ells, Ottawa; Mr J. M. Reid, President Gold Miners' Association of Nova Scotia; T. R. Gue, Halifax; John E. Hardman, S. B., Oldham; A. Blue, Toronto, and others.

"The Queen" having been honored, the chairman proposed the first toast, "Our Province," and called upon Mr. R. Archer, President of the Montreal Board of Trade, to respond.

MR. ARCHER thanked the Association for extending to him an invitation to be present. He referred to the Mining Act passed by the Quebec Legislature last session, and stated that the Board of Trade of Montreal made every endeavor to frustrate it. He expressed his pleasure in meeting the members of the Association around the festive board, and stated that he would urge the Council of the Board of Trade to assist in giving that protection to mining men which they certainly deserved.

Mr. Ernest C. Arnoldi sang in fine style, "Drill, ye Tarriers, Drill," which was quite an appropriate song, and was well received.

MR. W. HAMILTON MERRITT, M.E., Toronto, proposed "The Mining Industries of the Province of Quebec." He said: "I am very glad to have the honor of proposing this toast because, as an Ontario man, I feel it a pleasure to be amongst the Quebec mining fraternity and accepting from them their kind hospitality. I am delighted to have the opportunity of meeting personally the mining men of the Province, for I think if there is any branch of industry the world over, where there is good fellowship and a sort of Freemasonry, it is to be found among the mining fraternity. The mining industries in the Province of Quebec are indeed well worth the utmost enthusiasm on the part of Canadians, for in no province has there been such advancement in recent years as in your Province of Quebec. Your asbestos is known the world over, where its manufactures are used; your phosphate has established for itself a celebrity none the less wide, and of course the copper industry in Quebec has been proved to have a permanency about which there is no question whatever. The mining industry is so precarious, and capital so shy, that encouragement and not restriction, or vexatious regulations, should be the policy of every government; therefore, to-day I was surprised in hearing, in the discussion on the Quebec Mining Act, that if a man goes off into the comparative wilds and obtains a mining location, it is necessary for him to pay a license of $150 for the erection of a powder magazine. If this is the case I am sure there would be every justification for what might be termed a very decided "kick" all over the Province against it. I feel that all mining men are proud of the advancement that has been made in mining affairs in Quebec and in Canada generally; but when we realize our position in comparison to that of our neighbors to the south of us, where nearly six hundred million dollars are produced annually, while we produce less than twenty million dollars, I think it will be apparent to all that every assistance should be given us by the Government in bringing the industry to that condition which our mineral resources warrant. We cannot, and do not, expect the government to do prospecting and mining, but I believe that we have a right to request the acquisition and preservation of facts relating to mining and metallurgy, and the creation of an official and authentic reference literature relating thereto. Sir William Dawson touched the very root of what is claimed to be a serious weakness in the present system of the Geological Survey, when he said 'that if the excellent publications of that body were carefully searched through much valuable information relating to mining development can be found.' Now it is contended with reason that while a Geological Survey is necessary, systematic attention and judicious assistance to the mineral and metallurgical interests is an equal, if not a greater, necessity; and if it can be accomplished in no other way the former could be well curtailed to carry out the latter. While Sir William Dawson's able son was in charge of the Survey, we were able to induce the government to establish the Statistical Branch of the Geological Survey. This was a great step, and now we ask that mining and metallurgical information shall be condensed and not merely available in the form Sir William Dawson has indicated. The publications of the United States Geological Survey, edited by Mr. T. Day, is more what mining men desire."

MR. S. P. FRANCHOT, in responding, referred to the taxation which the Quebec Government has recently imposed upon powder magazines, saying that taxation came as sure as death, but that he had not heard of royalties in this connection before. Mr. D. A. Brown also responded and spoke very encouragingly of the asbestos industry in the Eastern Townships.

MR. FRANCHOT proposed "Our Science School and Professors," remarking that he felt grateful to the schools, and hoped that a kindly feeling between them and mining men would always exist.

SIR WILLIAM DAWSON replied. He referred to the fact that his interests in mining matters were more of an educational nature than a pecuniary one, and said that a very great deal of what was known as regards the structure of the earth to-day was due to the mining engineer and mine explorer, and geologists are extremely thankful to them for the information. Speaking of the School of Science recently established at McGill, he said that they looked to the members of this Association as educators of the young men who graduated therefrom. Your meeting here to-day will do more to assist you in asserting your rights, on account of the investigations carried on, than any direct agitation. He pointed out that the CANADIAN MINING REVIEW, so ably edited by the energetic Secretary of the Association, Mr. B. T. A. Bell, must also be considered as a great educational power.

A humorous song by Mr. W. H. Irwin was followed by Mr. B. T. A. Bell presenting the toast "Kindred Associations."

PROF. H. T. BOVEY, representing the Canadian Society of Civil Engineers, responded briefly, as did also Mr. W. Hamilton Merritt, representing the Canadian Institute of Toronto, who made a kindly reference to the services of the late Hon. Thos. White, to whom the mining men owed a great deal for his assistance in the promotion of mining matters.

The last toast, "Our Guests," was responded to by Mr. H. Ward Leonard in a very happy manner, and thus was concluded the First Annual Convention of the Association, the members of which have every reason to congratulate themselves upon its success.

Sifting of Anthracite.—A committee representing 90 per cent. of the anthracite output of Pennsylvania, recommended on November 7th, 1890, the adoption of a uniform size of mesh for screens. The following sizes were selected, and will go into effect in January, 1891:

Egg,	through	2¼	inches,	and over	2	inches.
Stove,	"	2	"	"	1¾	"
Chestnut,	"	1¾	"	"	¾	"
Pea,	"	¾	"	"	½	"
Buckwheat,	"	½	"	"	½	"

The small stove size was abolished.

Mining in British Columbia.

BY THOS. DRUMMOND, MINING AND CIVIL ENGINEER, A.M. CAN. SOC. C.E.

Before the discovery of gold in British Columbia, or what afterwards became known as that province, it was a comparatively unknown country, under the control and government of the Hudson Bay Company, whose interests were bound up in the fur trade, and in that alone. In 1849, the Company's headquarters were removed from Fort Vancouver, on the Columbia River, to Fort Victoria, on Vancouver Island, which had been established in 1843. In 1851, James Douglas was made Governor of the Colony, vesting in his person the authority both of the Hudson Bay Company and the Colonial Government. In 1856, Vancouver Island was divided into four electoral districts, and seven members were elected. At this time the united white population of the island was about 300. After the discovery of gold on the mainland in 1857, and the consequent rush to the new country, Douglas was forced, by the increased responsibility of government caused by the conflicting interests of the fur traders and gold miners, to resign his position as head of the Hudson Bay Company, which he did in 1859. In the same year the Imperial Government re-purchased the exclusive right of the Hudson Bay Company to trade, and the Company, as a monopoly, ceased to exist on the Pacific Coast. In 1858, the Province of British Columbia was created, and Douglas became its first governor.

The discovery of gold, then, marks a new era in the history of the country, and though the stirring events of that time are now things of the past, still they are not without interest, for with them began the real history of the province, which, from being a country comparatively unknown, was raised to the dignity of being one of the great gold producing centres of the world.

People by the thousands and tens of thousands rushed to its shore, and in their search for the precious metal also discovered the capabilities of the country; so that, after the gold excitement, many settled down, and formed, so to speak, the nucleus of the future growth and prosperity of the province.

In the first part of this paper, then, I propose to give a history of the more important discoveries of gold, and the dates at which they occurred, and also a short description of the methods adopted in separating the gold from the alluvial washings in which it is found.

Before going on with the paper, I would like to state that, in the absence of actual statistics, the subject matter of this paper has been obtained from the most reliable sources available—in many cases from personal observations, and, where I had not the opportunity, from miners and others who actually worked at the places to be mentioned later on—men to whom I am greatly indebted for information, and whom I know personally to be little given to exaggeration. Statements were verified by comparisons when possible, and different authorities who had written upon the subject were also consulted, such as Dr. Selwyn, Dr. Geo. Dawson, and other members of the Geological Survey of Canada, Bancroft's History of British Columbia, Sessional Papers and Reports of the Provincial Government, J. W. McKay, and many others; so that, though the information and figures given are not in the nature of actual statistics, still they are near approximations of these taken from the most reliable sources. I mention this because reliable information upon this subject is difficult to obtain, and were all statements accepted this would read more like fairy land than what I wish it to be: a sober history of events which have occurred in the history of British Columbia, and which there is every reason to suppose will be repeated in the near future in a more permanent form when the discoveries in quartz, even those already made, have been sufficiently developed to show their value.

For convenience, I have divided the subject into—

(1) Placer Mining.

(2) Vein Mining.

The first authentic discovery of gold in British Columbia, or what afterwards became part of that province, was at Gold, or Mitchell's Harbor, on Queen Charlotte's Island, in 1851. The discovery was in the form of a nugget weighing about five ounces, found on the seashore by an Indian, who sold it to the Hudson Bay Company. A vessel was shortly afterwards sent out by the latter to examine the locality, resulting in the discovery of a small vein of quartz containing gold, from which it is estimated that ore to the value of $20,000 was obtained by the Hudson Bay Company and other adventurers. The deposit then proving limited, it was abandoned. About the same time, or a little earlier, Mr. McKay also found colors of gold at various places on Vancouver Island, between Victoria and Nanaimo, when exploring for land.

Hudson Bay Company's Journals also state that in 1852 Indians brought samples of gold from the Skeena River. G. B. McClellan's party also discovered gold on the Similkameen River in 1853, when engaged on exploratory surveys for the Northern Pacific Railway.

Gold was also discovered at Pend d'Oreille by Colville men in 1854 or 1855, and worked with success, and the finding of gold in British Columbia was a direct result of this discovery, for Indians from the Thompson River, visiting their friends near Walla Walla, stated that gold like that was found in their country. Accordingly, some French Canadians and Indians crossed over and discovered paying placers in the vicinity of Necoamen, on the Thompson River, in the fall of 1857. The news spread and caused the Fraser River excitement of 1858. California was at this time filled with a mining population, attracted there by the gold excitement of 1848 and 1849, and when the authentic discovery of gold on the Fraser

River became known, a perfect rush was made for the new El Dorado. From thirty to thirty-five thousand people are said to have come into the province early in 1858.

Many of these became discouraged and turned back, but those, however, who did reach the Fraser River, pushed their way onward and found gold in paying quantities on the bars and tributaries, from the mouth of Harrison River up both the Thompson and Fraser Rivers as far as the season of 1858 would allow them to go. Some of the more important of these bars were as follows:—Maria, Hudson, Cornish, American, Union, Cameron, Emory, Texas, Hills, Sailor, Wellington, Spuzzum, Chapman, Nicaragua, Boston, Yankee, Mariner's, Lytton, Morman, Foster, Lillooet, French, Robinson, Upper Morman, British, Ferguson, and Long Bars.

Of these, Hills Bar, just below the town of Yale, may be taken as an example of the richest. It is reported to have produced $1,000,000 worth of gold during the excitement, from an area of less than half a square mile, and from a report of the Minister of Mines in 1875, it is credited with having produced up to that time $2,000,000. On this bar four men washed $4,000 in six days. Ned McGowan, of historical fame, took out $33,000 in three months. It is also said that the present site of the town of Yale with the flat opposite would yield a large amount of gold if worked by hydraulic power, and I understand that a company is now being formed with that object in view. The gold in the bars, especially below Yale, was fine, and in shallow ground, and at first they were only mined a little below the surface of the river, and in the most primitive manner, with pick, shovel, rocker and pan, and yielded, when worked even in this way, large returns of gold. Between Yale and Hope one rocker yielded $830 in eight days, another $800 in twelve days, and a third $248 in five days, and at Yale 150 rockers gave in one day 723 ounces. Sailor Bar is said to have averaged one ounce a day per man, and two to five ounces was quite common. As the surface of the bars was washed out, wing damming was resorted to, where possible, to reach deeper ground. Many flumes and ditches were also built to carry water to the benches along the river; they varied in length from one to fourteen miles, and cost many thousands of dollars. Water wheels were also built, one below Cornish Bar being 30 feet in diameter.

These pioneers and prospectors had many difficulties to overcome in making their way up to the new diggings. At first there were no steamers to the mouth of the Fraser, and afterwards, when there were, a great many were unable to pay their way, so they went from Vancouver to the mainland in canoes and small craft built by themselves, and many were lost in the dangerous tide rips and currents of the coast. Early in 1858, it was found that the Fraser River was navigable as far as Yale, which became the distributing point for the upper country. Beyond this, the country was rough, mountainous and comparatively unknown, and travelling by land and water was hard and laborious work. Supplies were scarce and difficult to transport, and the Indians, for a time, were hostile. Is it strange, then, that many became discouraged and turned back? The wonderful thing to my mind is, that so many succeeded in forcing their way onward through so many difficulties and dangers.

In the fall of 1859, rich diggings were discovered on Quesnelle River, and this stopped the onward march for a time.

In 1860, Keithley Creek was discovered, and this marks a renewed era of prosperity in mining, for with it was discovered the famous Cariboo District, one of the richest placer mining centres ever found.

In the winter of 1860 and 1861, miners discovered Antler Creek. They tried to get a grant of this stream from Governor Douglas in Victoria, but it was refused. The news became known and caused a second influx of miners, this time to the Cariboo District, During the same year (*1861*) William's, Grouse, Lightning, Jack of Clubs, Lowhee and other creeks, which have since become famous, were discovered. Of these. William's, Grouse and Lightning were the richest. These creeks, with their tributaries, yielded, up to the end of 1861, some $2,000,000.

William's Creek was discovered by William Dietz, better known as Dutch Bill. He located in the canon, and his claim, though the Discovery, turned out to be one of the poorest on the creek. Other owners located ground along the creek about the same time. The ground was supposed to be shallow, the yield of gold was poor, and he creek was known for a time as Humbug Creek. The first run of gold was found in shallow ground, over a stratum of blue clay. To test below this, Abbott & Co. sunk a hole 4 x 7 feet, and took out 57 ounces of gold, and the other companies soon followed their example. Deep ground was located in an old channel behind the canon, and also below it, by Black Jake, Barker, Cameron and others, and Barkersville, Cameromtown and Richfield were started. Starting at the head of the stream and going downwards, some of the claims were as follows:—

Steel & Co.,	Lillooet Co.,
Point Claim,	Forest Rose,
Abbott & Co.,	Cameron & Co.,
12 Foot Davis,	Tinker Co.
Adams and Wilson,	Raby & Co.,
Casto & Co.,	Caledonia Co.,
Dutch Bill,	Grizzly Co.,
Diller & Co.,	Never Sweat Co.,
Canadian Co.,	Ballarat Co.,
Welsh Co.,	Prince of Wales,
Wake Up Jake Co.	Sheepshead,
Cariboo Co.	Coonskin,
Aurora,	—and others.

As may be seen from the following examples, William's Creek was immensely rich. Diller is said to have taken out 202 lbs. of gold in one day, with only two men drifting; this represents about $38,784. Steel & Co.'s claim yielded, on two consecutive days, 287 and 409 ounces of gold, and in two months, $105,000. The Cunningham claim averaged 125 ounces of gold for the season of 1862, and on several occasions gave 600 ounces, or 50 lbs., a day. The Adams Claim yielded each of its three owners $40,000. The Caledonian gave for a time $5,000 to $6,000 a day, and the Cameron and Tinker were not far behind.

The Raby, in one day, yielded 310 ounces of gold, as witnessed by Milton & Cheadle. The Point Claim yielded $90,000 in dividends. The Wattie Claim $85,000. The 12 Foot Davis, a gore between two other claims, $25,000. Diller took out $100,000. Cariboo Cameron, $160,000. In 1863, three claims below the canon produced $300,000, and twenty claims were steadily producing from 70 to 400 ounces per day. In the Aurora one pan of picked dirt is said to have yielded 387 ounces, and $600 to $900 to the pan was obtained on several occasions. The Erricson Claim, according to the Victoria *Colonist*, produced for seven consecutive weeks, between June 17th and July 29th, 1864, as follows: 900, 640, 1,400, 1,926, 1,256, 1,300, and 2,600 ounces. Two miles of creek is said to have averaged $1,000 to the running foot, and that this is within possibilities may be seen from the following statement:—

Adams	Claim....	100 feet	.....	$120,000
Steele	"	80 "	.....	120,000
Diller	"	50 "	.....	240,000
Cunningham	"	500 "	.....	270,000
Burns	"	80 "	.....	140,000
Canadian	"	120 "	.....	180,000
Never Sweat	"	120 "	.....	100,000
Moffat	"	50 "	.....	90,000
Tinker	"	140 "	.....	120,000
Watty	"	100 "	.....	130,000
		1,340		$1,510,000

—or say $1,127 per running foot of creek.

Next in importance and richness was Lightning Creek, also discovered in 1861. For a time the annual yield is said to have been larger than on William's Creek, but it was not so lasting.

In 1861 the Campbell & Whitehall adjacent claims yielded $200,000, and Campbell is said to have taken out 1,700 ounces of gold in three days, as follows: 1st, 900 ounces; 2nd, 500 ounces; 3rd, 300 ounces. In 1870 the deep channel was bottomed, leading to the subsequent discoveries. At one time the Butcher, Aurora and and Caledonia Claims yielded respectively as follows: Butcher, 350 ounces per day; Aurora, 300-600 ounces per day; Caledonia, 300 ounces per day. The old channel was worked for a distance of 16,000 feet, and is said to have yielded $300 to the running foot. The following statement, taken from the report of the Minister of Mines for 1875, showing the yield of some of the more important claims, will give some idea of the amount produced by this creek:

Campbell & Whitehall	$200,000
Dutch & Seegel	130,000
Dunbar	30,000
Lightning	153,962
Discovery & Butcher	120,000
South Wales	141,531
Spruce	99,908
Point	136,625
Van Winkle	363,983
Victoria	451,642
Vancouver	274,190
Vulcan	56,955
Costello	20,476

A statement obtained by myself from miners, and supposed to give the total yield, is also given. The figures are much larger, and are perhaps exaggerated, though given for a later period than the above:

Van Winkle	$600,000
Victoria	600,000
Vancouver	300,000
Point Claim	180,000
South Wales	200,000
Lightning	220,000
Butcher Bench	250,000
Dunbar Flat	150,000
	$2,500,000

Grouse Creek was also very rich. Mr. Heron, the discoverer of the famous Heron Lead, told me that his company took out from 100 to 400 ounces per day, and made $300,000. The old channel was followed for about a mile, giving immense yields, and was then lost.

Antler Creek also yielded a large amount of gold, both from the benches and gulches, and also from the bed of the stream. The gold was taken from shallow ground, as the stream was never bottomed. One company made $83,000 in three weeks. The creek yielded $10,000 a day for some time in 1861, and some spots are said to have yielded as much as $1,000 to the square foot. Besides these, there were Jack of Clubs and Lowhee Creeks, and all the tributaries, gulches and ravines of the above streams, which, though not so rich, yielded in the aggregate a large amount of money and many independent fortunes. Some of these were as follows: Van Winkle, Chisholm, Last Chance, Davis, Anderson, Harvey, Cunningham, Cedar & McArthur's Creeks, and numerous gulches, ravines and valleys.

These deep places, however, were expensive to open before any return was obtained, and the actual working expenses were also heavy. The Van Winkle mine cost $40,000 to open before the channel was reached; it yielded a large amount of gold afterwards, however, three consecutive weekly clean-ups being as follows $15,700, $14,000 and $12,000; Cunningham Claim cost $100,000 to open work, and yielded $500,000. The California Claim, about the same cost and yield, also the Tontine. The Black Jack cost about $50,000 to open and work, and yielded $200,000. In Raby & Co.'s claim the pay roll for two weeks is said to have amounted to $12,000. Mr. Heron, the discoverer of the famous Heron Lead on Grouse Creek, told me that their weekly pay roll amounted to from $1,200 to $2,300. The great expense of working can easily be accounted for. The pay dirt was deep all the way from 30-90 feet, large pumps were required to keep the water down, often long bed rock ditches for discharging water were required, and expensive timbering was also necessary.

The timber, which was massive, cost 8c. per running foot, and lagging $7 a hundred pieces. The District was also far removed from any civilized centre, and provisions, supplies and transport were expensive, as may be seen from the following statement, which may be taken as an example of the highest prices paid at Cariboo at any time:—

Flour	$1.50 per pound
Bacon	1.50 "
Tea and Coffee	3.00 "
Sugar	1.50 "
Beef (fresh)	0.60 "
Beans	0.75 "
Nails	0.75 "
Boards	0.25 per foot
Gum boots	$30.00 to $50.00 a pair
1 spool thread	$0.50
1 clay pipe	0.50
1 needle	$0.50 to $1.00
Wages per man per day	$10.00 to $16.00

Packing from Quesnelle Mouth to Williams Creek by man power cost from $0.85 to $1.00 per lb.

Exorbitant freight rates consequent upon the inadequate preparations for the great rush were the causes. "It is not the first cost of the goods," said a trader to a miner, when selling him a darning needle for a dollar; "it is not the first cost of the goods, mine friend; it is the freight."

The distance to Cariboo via Harrison River, was 520 miles. Lillooet was the headquarters for the pack trains, which were inadequate to accommodate the great numbers, who, therefore, had to resort to all kinds of devices, packing on the back with dogs and with oxen. Mr. Cannel, who is well and favourably known at Kamloops, told me that he bought an ox at Lillooet, which was the first pack animal to go into Williams Creek, where it was killed, dressing some 900 lbs., and sold for 60c. per lb. Camels were also imported for packing purposes, several of which are still alive, and to be seen not far from Kamloops. The waggon road to Cariboo was finished in 1865. Stages were run, carrying passengers, mail and express, and easier access and cheaper supplies were the result.

The telegraph line was also bought by the Provincial Government about the same time. This telegraph line is famous, for it formed part of the line built by the Western Union Telegraph Co., which was to have crossed at Behring's Straits, and which was rendered useless as a transcontinental line by the successful laying of the Atlantic Cable.

I have given a somewhat detailed description of the Cariboo District, because it was the most important of the British Columbia discoveries, and it gives at the same time, a good example of typical life at a successful mining camp. As might be expected, lawless characters congregated, and gambling and kindred vices were prevalent. A Spanish packer, being asked if the Cariboo diggings were rich, answered that he had doubted it till he saw $27,000 gambled away in one sitting by three miners. But wise, just and capable men were in charge, and not a single case of murder is said to have occurred in Cariboo, which is an agreeable contrast to the scenes enacted at the mining camps in the neighbouring Republic. Chief Justice Begbie was a terror to evil-doers, to whom sure and impartial judgment was administered. Crime became, comparatively, unknown, and fire arms were practically discarded. This is all the more surprising, when we consider that the yield of gold was measured, not by the ounce, but by the pound; it became so plentiful that it was troublesome to ground, and miners returned ragged and rough, with so much gold, that men and mules had to be engaged to transport it. According to Macfie's estimate of those who went to Cariboo in 1861, one-third made independent fortunes, one-third made several thousand dollars, and one-third returned unsuccessful.

During the Cariboo excitement, mining camps of less importance were almost depopulated, and were only worked during later years when the Cariboo excitement had subsided. Among these were Tranquil Creek, Louis Creek, Jamison Creek, Barrière River, Adams River and Lake, Deadman River, Nicola River, Scotch Creek, and, in fact, nearly all the streams running into the Thompson River in the vicinity of Kamloops. They were discovered pricipally in 1858 and 1859, and, in many cases, have been worked almost without intermission ever since, principally by Chinese.

ROCK CREEK AND SIMILKIMEEN DISTRICT.

Discovered in 1859 and 1860, and mined to some extent at that time and then abandoned for Cariboo.

Between 1882 and 1888, mining was renewed, and

many new discoveries made. The principal streams worked up to date are as follows:—

Similkimeen River,	Cedar Creek,
South Fork, Similkimeen	Slate Creek,
Whip Saw Creek, [River,	Bear Creek,
Nine Mile Creek,	Rock Creek,
Tulimeen River,	Boundary Creek,
Granite Creek,	Mission Creek,
Collins' Gulch,	Cherry Creek.

This district yielded between 1885 and 1888, $553,500, out of which Granite Creek produced $383,000. The latter creek was discovered in 1885, and caused quite an excitement for a time.

Cherry Creek also yielded well, and has been worked almost without intermission ever since; in later years, principally by Chinese. I saw a piece of ground in this stream which had been worked over three times in seven years, and was then, according to Chinamen working there, yielding from $3 to $5 a day per man.

EAST AND WEST KOOTENAI DISTRICT.

First discovered in 1863. In 1865, 1,000 miners at work, getting from one to three ounces a day per man. The yield between 1874 and 1888, after the more successful days, was $582,878. This also includes returns from the Big Bend country.

The principal streams were:—

Wild Horse Creek,	Toby Creek,
Bull River,	Canon Creek,
Findlay Creek,	Quartz Creek,
Dutch Creek,	Perry Creek.

The streams were discovered at various times between 1863 and 1888. Wild Horse Creek produced, between 1878 and 1888, $255,780.

BIG BEND DISTRICT.

The principal streams mined were as follows:—

French Creek,	Carnes' Creek,
McCulloch's Creek,	Smith's Creek,
Downie Creek,	Fernie Creek.

It was discovered in 1865, and the principal mining was carried on in 1866, and in that year French and McCulloch's Creek each produced about $100,000, and four, six, and twelve ounces per day per man was not uncommon. One nugget worth $253 was found.

OMENICA REGION.

Discovered in 1869. The principal streams were:—

Vital Creek,	Lost Creek,
Silver Creek,	Black Jack Gulch,
Omenica River,	Finlay River,
Germanson Creek,	Bars on Peace River.
Mansen Creek,	

This district produced between 1874 and 1888, $350,000. This does not include the first and more prolific years, the yield of which is unknown.

CASSIAR DISTRICT.

The Stikeen River was first discovered in 1861 and worked for a time, but not with great success.

Cassiar proper was discovered by Thibert and McCulloch, who came overland from the Red River country. The district yielded, between 1873 and 1888, about $5,200,000. The principal streams were:—

Dease Creek,	Walker's Creek,
Thibert Creek,	Snow Creek,
McDames' Creek,	Quartz Creek,
First North Fork of McDames' Creek.	

Miners went to Cassiar by ocean steamer from Victoria to Fort Wrangell, at the mouth of Stikeen; then up the latter river for a distance of 150 miles to Glenora Landing by river steamers. Then across an 80 mile portage to Dease Lake, where a small steamer had been built. The Stikeen River runs within three miles of Dease Lake; but it is not navigable on account of the great canons of the Stikeen, about 90 miles long.

A trail was cut from Quesnelle Mouth to Dease Dake, a distance of about 425 miles. During the first year, freight across the 80 mile portage was 50 cents per pound, and poor pack-horses cost $250 each.

YOUKON DISTRICT.

Though this is beyond the boundary of British Columbia, I have included it here because its discovery is due to a great extent to the miners from Cassiar.

The principal streams are:—

Sayyea Creek,	Ross River,
Finlayson River,	Stewart River,
Lewis River,	Forty Mile Creek,
Big Salmon River,	Sixty Mile Creek.
Upper Pelly River,	

Rich diggings have been discovered, but, owing to the remoteness of the district, difficulty of obtaining supplies, and shortness of the season, it has not been worked to a great extent as yet.

SKEENA RIVER AND STREAMS OF THE COAST RANGE.

These include:—

Skeena River,	Lorne Creek,
Seymour Creek,	Bones Gulch,
Prospect Creek,	Douglas Creek.

Lorne Creek was the best, and produced as follows: In 1884, $17,000; 1885, $18,000; and in 1886, $12,000.

VANCOUVER ISLAND.

Leech River,	Nanaimo River,
Sooke River,	San Juan River,
Jordan River,	Cowachin River,

were the principal streams; of these, Leech River is said to have produced $150,000; and Jordan River about $35,000.

A tabular statement from the Report of the Minister of Mines, shewing the total estimated yield of gold between 1858 and 1888, is as follows:—

GOLD PRODUCTION.

TABLE shewing the actually known and estimated yield of gold; the number of miners employed; and the average earnings per man, per year, from 1858 to 1888, in the Province of British Columbia:

YEAR.	Am't actually known to have been exported by banks, etc.	Amount added to represent gold carried away in private hands.	Total.	Number of miners employed.	Average yearly earnings per man.
	$	$	$		$
1858, partial ret'n	543,000	.....	*705,000	3,000	235
1859	1,211,304	1/3rd 403,768	1,615,072	4,000	403
1860	1,671,410	" 557,133	2,228,543	4,400	506
1861	1,999,589	" 666,529	2,666,118	4,200	634
1862	1,992,677	" 664,226	2,656,903	4,100	648
1863	2,935,172	" 978,391	3,913,563	4,400	889
1864	2,801,888	" 933,962	3,735,850	4,400	849
1865	2,618,404	" 872,801	3,491,205	4,294	813
1866	1,996,580	" 665,526	2,662,106	2,982	893
1867	1,860,651	" 620,217	2,480,868	3,044	814
1868	1,779,729	" 593,243	2,372,972	2,390	992
1869	1,331,234	" 443,744	1,774,978	2,369	749
1870	1,002,717	" 334,239	1,336,956	2,348	569
1871	1,349,580	" 449,860	1,799,440	2,450	734
1872	1,208,229	" 402,743	1,610,972	2,400	671
1873	979,312	" 326,437	1,305,749	2,300	567
1874	1,383,464	" 461,154	1,844,618	2,868	643
1875	1,856,178	" 618,726	2,474,904	2,024	1,222
1876	1,339,986	" 446,662	1,786,648	2,282	783
1877	1,206,136	" 402,045	1,608,182	1,960	820
1878	1,062,670	1/5th 212,534	1,275,204	1,883	677
1879	1,075,049	" 215,009	1,290,058	2,124	607
1880	844,856	" 168,971	1,013,827	1,955	518
1881	872,281	" 174,456	1,046,737	1,898	551
1882	795,071	" 159,014	954,085	1,738	548
1883	661,877	" 132,375	794,252	1,965	404
1884	613,304	" 122,861	736,165	1,858	396
1885	594,782	" 118,956	713,738	2,902	246
1886	753,043	" 150,608	903,651	3,147	287
1887	578,924	" 115,785	693,709	2,342†	296
1888	513,943	" 102,788	616,731	2,007	307

Total known and estimated yield of gold, 1858 to 1888.....	54,108,804
Average number of miners employed yearly.....	2,775
Average earnings per man per year.	622

From it, the total yield of gold is $54,108,804. Assuming that the average value of the gold was $16.75 per ounce, this gives 3,230,377 ounces, or 269,200 lbs., and, taking the specific gravity of the gold as being 16, a cubic foot weighs 1,000 lbs. This gives 269.2 cubic feet, or it may be represented by a solid pyramid, with a square base, whose sides are six feet and height 22½ feet.

Of this amount, Cariboo is credited with producing about one-half. According to this statement, the average earnings per man, per year, for thirty-one years, were $622. Another average is from 1,200 miners, who crossed the bridge at the mouth of the Quesnelle early in 1861. Twenty soon returned, discouraged; the remainder returned in the fall, bringing down as their season's earnings, $1,500,000—or say, an average of $1,272 each.

From the foregoing you may, perhaps, imagine that placer mining has ceased in this province; this, however, is not the case—it has certainly fallen off from the yields in the palmy days, but, as may be seen from the statement it still produces annually nearly $800,000 worth of gold.

The shallow placers are, of course, practically exhausted; but, with better roads, cheaper supplies, improved machinery, and the method of working by hydraulic power, the miner still obtains a good return for his labors, and will for many a year.

There is little doubt, also, that during the course of the next few years much of the deep ground in the Big Bend, Kootenay, Similkimeen, Cassiar, Cariboo, and other districts, which, from its remoteness, was abandoned during the early days, will be tested and yield rich returns.

It is quite in the region of possibilities that new and rich placers may be discovered. The district between the head waters of the North Thompson and Cariboo is looked upon as being one of great promise.

Dr. Geo. Dawson, and other authorities of the Geological Survey, also consider that it is quite possible, if not likely, that rich placers may be discovered belonging to older formations and periods than those which have been worked. Such, for instance, as the extensive gravels of the Middle Tertiary, which were afterwards covered by basalts and other igneous rocks, and there is reason to suppose that the modern placers have been considerably enriched by the robbing of these old gravels. Still older conglomerates, as far back as those of the Carboniferous, have been successfully worked in several countries. These considerations are not merely of a theoretical nature, but are warranted by experience gained in California and other localities in the United States, in Australia, in New Zealand, and in Nova Scotia.

I have treated this part of the paper more in detail than I first intended, but I think it deserves attention because, as far as I am aware, it is not generally known that the Province of British Columbia has and still is producing gold in such quantities; and, in view of the discoveries of quartz within the past few years, I think it is only fair that attention should be directed to this point.

Before going on with the paper, it is, perhaps, not out of place to say a few words regarding the origin of the gold in the sand and gravel.

One theory is that, through the action of organic acids and alkalies, the gold is brought into a state of solution, and in this condition is carried by streams to other localities, where it is re-precipitated in the form of nuggets by organic matter, such as fragments of coal, etc. In a geological sense, then, gold may be, and probably is, largely distributed in this way. The usual theory, however, is that, through the agency of air, frost, etc., pre-existing vein matter and rocks containing the gold became decomposed and destroyed, and the indestructible gold is then deposited in a concentrated form in the various localities where it has been found, by the following agencies:

(1) The present system of water courses.

(2) Older systems of water courses, following the same general directions as the present systems, and in many places coinciding with the latter.

(3) Still older water systems.

(4) By the action of glaciers.

By these agencies, then, the gold is deposited with varying richness in many localities. In the beds of modern streams, in the older channels, on benches, in gulches, valleys, and ravines; sometimes near the surface, but often deeply buried under barren soil or igneous rock. Being found under so many varying circumstances, much must be left to the ingenuity of the miner. The general principles, however, for working are about as follows:—

METHODS OF WORKING PLACER MINES.

The following tools, appliances, and requisites are used in one form or another in placer mining, though, in individual cases, all may not be required. A plentiful supply of water, picks, shovels, axes, drills, hammers, crowbars, wheelbarrows, hoisting bucket, rope, nails, magnet, blow-pan, cross cut saw, whip saw, small car, miners' pan, cradle, quicksilver, pumps, derricks, water wheels, sluices, wing dams, etc.

Most of the above appliances are in such general use that a description is unnecessary; with the following, however, it is not out of place:—

The Miner's Pan is made of pressed sheet iron, is circular in form, about 14 inches in diameter on the bottom, 18 inches on the top, and five inches deep. It is used for separating the gold from the gravel by a sort of circular motion given to it in water, the pan at the same time being held in a sloping position. By this means the lighter sand and gravel drops over the lower side, while the black sand and gold remain behind. The remainder is then dried on a shovel or fry-pan in the fire, and the black, magnetic sand is then removed with the blow-pan and magnet. The pan is also used for cleaning concentrates from sluices and cradle, and also for washing gold amalgam where mercury is used. It is especially useful as a prospecting tool.

The Cradle or Rocker is also of more importance as a prospecting tool. It is a rough, wooden box, say 40 inches long, 20 inches wide, and 20 inches deep. On the bottom it is fitted with rockers like a baby's cradle, and it lightly inclined, say two to four inches. At the upper end and on the top, is a hopper, or coarse sieve, into which the gravel is thrown. The finer portion of the latter passes through and falls into the apron usually made of blanket. On the bottom, below the apron, riffles are placed, and the lower end is left open. The dirt is shovelled into the hopper, water is poured in with one hand, while the rocking motion is given with the other hand. The fine dirt and gold pass through, some of the gold is caught in the nap of the blanket, the balance on the riffles, while the water and waste dirt run out at the lower end.

A Puddling Box is sometimes used, especially if there be much clay. It is a box of any size, and has an augur hole about four inches from the bottom. The augur hole is plugged, the clay put in and puddled with plenty of water. The water and suspended clay are then run off through the hole, leaving the black sand and gold as before.

The Wing Dam is to turn the water from the claim. It starts at the head, runs in a slanting direction across the stream till about one-half is taken in, and then runs straight down for the remaining distance. The whole is weighted with heavy stones to keep it in place, and filled with soil and gravel to make it water-tight. It is built of timber. The space within the dam is then worked down to bed rock, and the dam is finally changed over to the other side, which is worked in the same way.

The Water-Wheel is used for hoisting purposes and for pumping water. In shallow places it is an undershot

* Waddington's estimate.

† Exclusive of a number of men working on or prospecting for quartz.

wheel, projecting over the side of the dam into the water, and running the pump, which is attached to it on the inner side.

The Sluice Boxes are made from boards which are generally sawn by the miners themselves with the whip-saw. The planks are usually 12 feet long and 1 to 2 inches thick. These are formed into boxes 16 to 20 inches wide and 12 inches deep, for ordinary placers, and larger for more extensive workings. They are made a little narrower at one end so as to fit into each other, and soon become water-tight. These boxes are then set in strings, supported on trestles, and are given an inclination of from 2 to 10 inches per box of 12 feet, depending on the character of the gravel and gold, and the available grade which can be given them.

The boxes are provided with riffles of various forms to catch the gold, which is generally coarse; quicksilver is, therefore, not much used. Where fine, both quicksilver in the crude state and amalgamated plates are used.

Placer mining may be divided into the mining of

(1) Shallow placers.

(2) Deep placers.

Shallow placers are such as are opened from the surface, the whole of the dirt being washed down to bed rock, the latter being not more than, say, 12 feet deep. They include the shallow beds of permanent streams and dry gulches, ravines and valleys, carrying water only during part of the season, or perhaps carrying none at all. They may thus be sub-divided into

(*a*) Wet diggings.

(*b*) Dry diggings.

Deep placers, on the other hand, are such mines as are opened from beneath, or both from beneath and above, as in the case of hydraulic mining. The pay dirt is deeply buried under barren soil, so that it would not pay to remove the latter, and mines are therefore opened by shafts, tunnels and bed-rock flumes, which require to be heavily and securely timbered. Mining of this description may also be classified under two heads, viz.:—

(*a*) Deep placer mining by hand.

(*b*) Hydraulic mining.

Let us first take a case of shallow placer mining, under class *a*, or wet diggings.

The boundaries having been staked out, the wing dam is first put in, and is closed across the lower end of the claim, or, as is usually the case, carried on far enough to keep the claim clear of water. The water-wheel and pump are then put into position, the wheel projecting over the side of the dam into the water, the axle of which actuates the pump, which in this class of mining is usually of a primitive character, consisting of a wooden box, through which a series of canvas buckets are carried on an endless band. The sluice boxes are then strung out in position, the slope and length depending upon the character of the gold, the available grade, and the means of the miners. As a general rule, the larger the string of boxes the more thoroughly is the gold saved. The riffles are then put into the sluice boxes. All then being in position, water is admitted into the sluices, the pump is set in motion, and the process of shovelling in the sand and gravel goes on. The latter is carried through the sluices by the force of the water, and goes off as tailings, while the gold and heavy black sand settle into the riffles, from which it is removed at stated intervals, usually at the weekly clean up. The process of working a shallow dry placer is much the same, save that, as water is absent, enough to supply the sluice must be brought by ditches, and the wing dam is unnecessary.

Mining laws in British Columbia limit the size of placer claims, which can only take in 100 feet in length of stream, in the case of creek and bar diggings, and 100 feet square in bench and dry diggings. Where a new stream is discovered these claims, as above are staked off and if the ground is shallow it is worked as has been described. If, on the other hand, the ground is deep, as is usually the case in the old channels and also in many of the modern streams, such methods would be too expensive to employ, and in such cases deep placer mining by hand is resorted to. This consists essentially either in running a drift or bed-rock flume to strike the bed rock, or in sinking a shaft at the side of the stream in solid ground, and drifting out to strike the bed rock, in which the shaft goes down through the rim rock forming the banks of the stream, and at the lower end of the claim. When the miners think they are deep enough a trial drift is run out to strike the bed rock of the present stream or old channel, as the case may be; and when this is struck the gravel is hoisted through the shaft to the surface, and washed in sluices as before. These underground workings require to be heavily and securely timbered, for the life of the miner to a great extent depends upon this. Powerful pumps are also required to keep the drifts clear of water. The hoisting and pumping gear is usually actuated by water power obtained from water wheels, and if the height to which the water has to be lifted is too great, flumes from one claim to another, the expense of which is shared by the various companies, require to be built. A better plan, when practicable, is to run a tunnel, with sufficient slope for drainage, to strike the bed rock at the required place; the sluices are then set in the tunnel, if water can be admitted; if not, at the mouth of the tunnel, and washing goes on as before. Bench claims being in dry ground, and often high above the level of the streams, are easier to work. The main difficulty there is to bring water to the ground; to do this, long ditches are often required. Water wheels are utilized when practicable, one such wheel on Quesnelle River being 60 feet in diameter. In the vicinity of Clinton, in a piece of ground where water was difficult to obtain, it was brought across the Fraser River in rubber hose. We can thus see that much ingenuity is exercised by the miner in accomplishing his end.

Such methods as the above are utilized when the diggings are shallow or reasonably so, and when they are rich enough to bear the expense of such costly work. When this is not the case, or when the richer ground has been exhausted, the ground can only be profitably worked by hydraulic power. In view of the fact that much of the mining ground now left in British Columbia is of this character, I propose to give a more detailed description of this method of mining, from which, in the course of the next few years, much in the way of development can reasonably be expected.

In such cases small claims, as specified above, could not be profitably worked; and to encourage the industry leases of mining property are given as follows:—

In dry diggings, 10 acres.

In bar diggings, unworked, ½ mile in length along high water mark.

In bar diggings, worked and abandoned, 1½ miles in length along high water mark.

In creek claims on abandoned streams, 1½ miles.

In bench lands adjoining unworked or abandoned streams, 160 acres.

Hydraulic mining is that process of extracting gold from auriferous gravel by means of water under great pressure, discharged through pipes and nozzles against the bank. Or, in other words, the same agency which originally buried and concentrated the gold in the gravel is by this method forced to strip and separate it again.

It is absolutely necessary that there should be:—

(1) A plentiful supply of water under pressure.

(2) Good facilities for grade and dump.

The richest deposit of gold is found usually in a stratum eight to ten feet thick immediately over the bed rock of the old channel; and if this is slate, as is generally, though not necessarily, the case, it also penetrates into the crevices, seams and holes; so that such bed rock is more likely to be rich than smoother and harder rocks. Such a deposit being suspected or known, it is first necessary, or at all events desirable, to explore the ground by means of shafts and drifts to learn something about the depth, extent, character and richness of the deposit. A plentiful supply of water must also be provided for, and brought to the ground by ditches, flumes, or pipes.

The *site of the tunnel* is then chosen, giving due regard to the disposal of tailings, and the grade which should be given to provide for the drainage of the mine and the economical washing of the gravel. The *size of the tunnel* must also be decided. This depends upon the extent of the deposit and how it is to be worked; that is to say whether a single or double line of sluices is to be employed.

The *sluices* and riffles must also be prepared—no small undertaking, when it is remembered that, in some cases, they are over a mile in length. They may range in size from 16" in width and 12" in depth, to five feet or more in width and three feet in depth. They are made from planking, one to two inches thick, securely and tightly put together, and must be strongly mounted on sills and firmly supported by trestle work where necessary, to withstand the great pressure of water. The *riffles* are of various forms, and differ materially from those employed in ordinary placer mining, some of the more common and better forms being as follows:—

Block Riffles are of two kinds, namely *Square Block Riffles* and *Round Block Riffles*. In the first case, the blocks are sawn, good dimensions being 10x10x10 inches, but the size, of course, may vary; these are placed in position, with spaces between, in much the same way as block pavements on our roads are laid. The round block riffles are blocks sawn square off from the trunks of trees and set on end in the sluices.

Rock Riffles are stones laid in place in the same way, and are durable, effective and cheap; but are more difficult to remove when cleaning up. They can be very profitably employed in the lower part of the sluice, where the catch of gold is not so great.

Rail Riffles made from scantling, built in sets usually of about eight feet long; the upper part is protected by strips of iron, and the whole is laid lengthwise in the sluice. Or the riffles, as a whole, may be a combination of the above methods.

The length of the sluice depends mainly upon the disposal of the tailings, for all the coarse gold and a large percentage of the fine gold is found in the first 400 feet of the sluice. The slope given to the boxes depends upon the character of the gold and the gravel in which it is found, heavy material requiring more slope and water than lighter material. If the grade is too great, the sand is apt to pack in the riffles, and a slope of about seven inches to the box of 12 feet generally works well.

Grizzlies and *undercurrents* are also used. A *grizzly* is put in when a drop can be given to a line of sluices, and is especially necessary when cement and pipe-clay are present. They consist essentially of parallel iron bars, such as pieces of railroad iron, set with spaces between, which allows the finer material to pass through, the cement and clay being pulverized by the fall into the sluice or undercurrent below, while the heavy boulders go over the side.

Undercurrents are large settling boxes, say 20x40 feet (the size varies), set to one side of the line of sluice boxes, and with less slope than the latter. They are provided with riffles as in the sluices. The water enters at the upper end and re-enters the sluice at the lower end. Most of the remaining gold is caught in these undercurrents.

These preliminaries having been settled, the work of opening the claim begins as follows: The tunnel, or open cut and tunnel combined, is started with the proper grade to strike the deposit, say 20 feet below bed rock to provide for contingencies, such as holes, etc., and also to make sure of being below bed rock; otherwise, it is money and labor lost. The tunnel is securely timbered as the work progresses, and is carried well into the bed rock under the deposit, curves being avoided as much as possible. A shaft, usually vertical, is then sunk either to strike the tunnel directly, or at a short distance to one side, and, in the latter case, the two are connected by a short drift. The shaft must be securely timbered and lagged throughout to within about eight feet of the surface. The ditches, or sluices, carry the water to a distributing point, usually some high point convenient to the claim, where the pressure box is situated; from the latter it is carried by iron pipes or canvas hose to the claim, nozzles being provided to direct the water against the bank. Good forms of the latter are fitted with ball and socket joints, so that they may easily be turned in any direction. The pipes are made of light sheet iron, and fit into each other like stovepipes; or they may have lead joints, if thought advisable. All being in readiness, water is turned on and washing through the shaft begins. The first washings must be made with care, and all the soil or gravel within as great a radius as possible carefully sloped and drawn toward the mouth of the shaft before the timbering is removed. By this means caves and washes are avoided. As the work progresses, the timbers are removed till bed rock at the bottom of the shaft is reached, and, finally, an open cut in front of the tunnel is made. The mine may then be said to be opened. The bank is undermined, caved, and washed into the bed rock flume, here taking the place of the sluice boxes, and the latter is carried forward as the bank recedes. *Quicksilver* is largely employed, the charging being done at the head of the sluice. It is added at intervals, as required, being regulated by the amount in view in the riffles. The quantity used depends upon the length of the sluice.

Hydraulic mining is a development from California, and it has been largely employed both there and elsewhere in the States, where long and expensive lines of ditches and iron pipes have been built, the latter being provided with automatic air valves, distributing gates, and improved nozzles. Immense dams, forming storage reservoirs for use during the dry season, were also built. By this method, large quantities of gravel, up to nine and ten thousand cubic yards, can be run through the sluices in a single day. The average cost is about six cents per cubic yard; so that gravel yielding only 10 to 20 cents per cubic yard can be profitably worked.

Hydraulic mining is successfully carried on in British Columbia, but in a more primitive and very much less extensive manner than above. The expensive preliminary work is unnecessary, for the process, so far, has been carried on in a small scale in Cariboo and elsewhere, where, from previous workings, the ground is known to be at least rich enough to yield fair returns; water is also plentiful. Against these advantages we have the shortness of the season to contend with.

The disposal of such quantities of gravel is a serious question; streams become choked up, and bottom lands are buried under the rush, and in many parts of the States it has become illegal to mine in this way. But we need never fear that this will be the case, at all events in the northern parts of the province; and the successful operation of mines by this method will, there is no doubt, open and develope parts of the province otherwise useless, and foster and encourage an industry furnishing a livelihood and independence for many miners.

VEIN MINING.

For convenience I have classified the various discoveries of minerals in British Columbia under the above heading. The term is not strictly accurate, notably so in the case of coal and iron, and is adopted for description only, for it is beyond the scope of this paper to speak of the treatment of ores and methods of mining as the industry is in its infancy still. I purpose, therefore, merely to give a brief account of some of the more important discoveries of minerals in the Province.

As has been stated before, the placer miner is, so to speak, the pioneer of the quartz miner, it is only reasonable to suppose that in the case of rich placer deposits surmises should be made as to the origin of the gold, and if the latter is found to have a coarse unworn appearance with fragments of quartz adhering, we may safely take it for granted that this source is not far distant; and when in addition to this, fragments and nuggets of other minerals, such as silver, copper, lead, platinum, etc., are found in the sluice boxes we know, with a fair amount of certainty, that rich discoveries are likely to be made. This has been the case in British Columbia, and such discoveries of ledges and veins, of quartz and minerals as above were made in many localities shortly after the discovery of the placer deposits, and though such finds, from the remoteness of the localities have, up to the present time, not been tested, still they are valuable and interesting as indications of future developments which are bound to come.

As may be noticed in every case, almost without exception, where placer deposits have been worked, promising ledges and veins have been discovered, and this over a mountain district extending from the International Boundary on the south, to the Youkon River and beyond in the north, a distance of over 1,400 miles, and there is little reason to doubt but that as the country becomes opened up, the mineral deposits of this vast region will become extremely valuable.

I purpose for convenience to divide this region into districts as follows:—*Southern, Cherry Creek, Kamloops, Yale, Kootenay, Lillooet, Cariboo, Omenica, Cassiar*, and

to give brief notices of each. In some of these districts, from their accessibility, or from other favoring circumstances, more development work has been done than in others; such localities I propose to treat more in detail, not because they are likely to prove richer, but simply because in such cases results may be submitted to you.

In the *Southern Division* I include all that country to the south and in the vicinity of Okanagon Lake. In this district a great number of promising locations have been made at the following camps and places:—

Camp McKenney, about 12 miles from the placer mines on Rock Creek, and not far from the boundary. A working test from a quantity of ore sent to San Francisco from these mines gave returns in gold of $62.00 to the ton.

Camp Fairview, on Okanagon River.
Copper Camp.
Boundary Creek.
North Fork of Kettle River.
Tulemeen River.
Wolfe Creek.
Keremeos.
Amelia.
Maple Leaf.
Bear Creek.
Toad Colley.
Newton District, near Granite Creek.

In all of these localities promising ledges have been discovered, and a considerable amount of development work done with satisfactory results so far as they go, but the district is out of the regular line of travel, and the mines are not being developed as they would be were the country made more accessible by the building of railroads or waggon roads.

Cherry Creek Division.—In this locality we find two ledges upon which a considerable amount of work has been done. One is silver bearing, and crosses Cherry Creek near the placer mines. Assays from this mine show it to be extremely rich, one made by myself yielding 1205 ounces of silver to the ton, and a working test from two tons of ore sent to San Francisco giving 625 ounces to the ton. The other ledge, known as the McIntyre ledge, is situated about 12 miles further on, on Monashee Mountain, and shows gold visible to the naked eye. A quartz mill has been erected at this mine, and both localities reached by a good waggon road.

Kamloops Division includes the Nicola Mines and those claims situated at Jameson Creek and vicinity, and elsewhere on the North Thompson River.

The Nicola Mines are situated about 30 miles south of Kamloops, in the vicinity of Stump Lake, and on Idaho Mountain. A good waggon road connects them with the above place. The principal mine owners are as follows:—

Nicola Mining and Milling Company (English Capital).
Star Mining Co., Patterson & Henderson.
Mary Reynolds Co.
Wright & Fletcher.
Silver King Mining Co., and others.

A company was formed about 1882 to prospect these claims. About 1886 they sold out to the Nicola Mining and Milling Co., an English syndicate, who have expended a large amount of money in a systematic and business-like manner, principally on three of their claims, known as the King William, Joshua, and Tubal Cain, which claims the company are testing thoroughly preparatory to erecting extensive reduction works. These mines deserve special mention, for the amount of work done by this company far exceeds that done by any other company in the province. They employ a large force of men, are using improved machinery, have run, including drifts and shafts, up to 1890, some 3400 feet, and the future of the camp as a whole depends to a great extent upon their developments, with which they have so far been well satisfied.

The *Star Mining Company* have also done a considerable amount of work on their claims, and have also erected a small concentrating plant, and shipped some 16 tons of ore to San Francisco, yielding $75 per ton.

Other mine owners, as above, have also prospected their claims, and are well satisfied with the results. The principal minerals are lead, sulphides and carbonates, rich in silver, and also carrying a percentage of gold.

Many claims have also been located in the vicinity of Jameson Creek, which, from surface indications, promise well, as do other claims located further up the North Thompson and Clear Water Rivers. But as yet little development work has been done to prove the future use of these claims.

Yale Division.—By this is meant that section of country in the vicinity of Yale, Hope, North Bend, and Siwash Creek. In this division a number of claims have been developed to a considerable extent. Some of them are known to be rich, such, for instance, as those south of Hope, which have been known for a number of years, and upon which difficulties regarding ownership have prevented development.

The ore on two of these claims, known as Eureka and Van Bremer, is described as being principally argentiferous grey copper and silver chloride, and assays varying from $25.00 to $2,400 to the ton in silver are obtained. Promising indications are also obtained from other claims, but, as in other localities, lack of means prevents development.

Kootenay Division is traversed by the Canadian Pacific Railway, and important water stretches, such as the Columbia and Kootenay Rivers and Lakes, also exist, so that prospectors have been able to travel about in the mountains, and the result of their labor is shown by the large number of rich and promising ledges discovered in the following localities:—

Illecillewaet,	Deception Creek,
Field,	Windermere,
Fish Creek,	Big Bend,
North Arm of Arrow Lake,	Bugaboo Creek,
Toad Mountain,	Horse Thief Creek,
Eagle Creek,	Toby Creek,
Hot Springs,	Otter Tail,
Hendryx Mines,	Findlay Creek,
Spillemcheen Mountain,	Copper Creek,
Jubilee Mountain,	Bull River.
McMurdo District.	

Of these localities I can only speak briefly, referring more particularly to those which have developed to the greatest extent.

The *Illicillewaet Mines* are situated near the station of that name on the Canadian Pacific Railway, and are within a short distance of the track. The Selkirk Mining and Smelting Company own a number of claims, and have erected sampling works, offices, boarding houses, etc., and have also built roads to their mines. They shipped, in 1887, some 300 tons of ore to smelting works in Omaha, the average value being 70 ounces of silver and 44% of lead to the ton. This company is now confining itself chiefly to developments in the Lanark Mine.

Corbin & Co. also own a number of valuable claims, upon which they have expended a large amount of money in developments. Mr. McKinnon holds the Maple Leaf Mine, adjoining the Lanark, at $80,000. Claims at Cariboo Creek are said to be equally rich.

At the *Field Mines*, close to the Canadian Pacific Railway station Field, a large amount of development work has been done; ore houses, offices, etc., having been built, also a tramway along the vein and down to the railway track. They have shipped a large amount of ore to smelting works. The ore is lead carbonate, and a low grade, but as it is easily smelted, and conveniently situated on the railway, the mines are certainly valuable. To the other localities, I can give only passing notice, confining myself mainly to giving working tests on shipments of ore made from various mines.

At McMurdo's we find galena ores, rich in silver, and apparently in well defined veins. Two car loads of ore shipped from the Wells, Pollock, and Aylmer property averaged 100 ounces of silver and 63% of lead to the ton.

There is also a well defined gold belt which is said to average about $20.00 to the ton. A stamp mill is now at Golden awaiting shipment in the spring to this field.

The *Spillemcheen and Jubilee* districts also promise well, and are conveniently situated near the Columbia River. The ore bodies are enormous, and are chiefly sulphides of copper and lead, which, however, are of a low grade character.

The *Hot Springs* are situated on Kootenay Lake, about 30 miles from Nelson. The parallel lodes exist in tiers on the mountain side, the lower ones being low grade galenas, which become richer as the mountain is ascended till the summit lodes are reached, where we find rich carbonates and sulphides of lead containing Wire and Ruby Silver.

Hendryx Mines are just on the opposite side of the lake from Hot Springs. Development work is being vigorously pushed on by means of an Ingersoll drill. The lode is said to be a mass of galena, 86 feet wide, which assays about 20 ounces of silver and 23% of lead to the ton. Perhaps the best way to convey an idea of the richness of these claims is to give the following milling tests from various mines in 1889:—

No. 1 claim..	146 tons.	87	ounces of silver per ton.		
Little Donald.	85 "	90	"	silver 35%	lead per ton.
Silver King..	40 "	299	"	" 20%	copper "
" ..	30 "	230	"	" 20%	" "
Spokane	65 "	40	"	" 70%	lead "
Delia	20 "	120	"	"	"
Skyline	15 "	225	"	"	"
Gallagher ...	14 "	119	"	" $14	in gold "
Krao	12 "	95	"	" 50%	lead "

Or altogether 427 tons, yielding 50,393 ounces of silver.

Big Bend Mines are situated on the bend of the Columbia River, and are gold bearing, though galena is also found. From the richness of the placer deposits, there is every reason to suppose that they may be valuable. But as the region is inaccessible, and as little development work has been done, it is impossible to say much about their future. For the same reason little can be said about the other localities mentioned in the list, excepting that good assays are obtained and the surface prospects are promising.

Lillooet Division.—In this division the principal discoveries have been made in the vicinity of Cayoosh Creek, where a great number of claims have been staked off. The ledges are gold bearing, and the gold seems to be uniformly distributed through the quartz in a fine condition, as colors can be obtained almost everywhere. The average assay value is said to be about one ounce to the ton. These veins are undoubtedly the sources from which the rich placer deposits of this locality obtained their gold, and there is therefore a strong probability that they will prove remunerative in the future. Ledges have also been discovered in the vicinity of Seaton and Anderson Lakes, that at Anderson Lake being described as a strong lode of quartz carrying galena assaying $46.00 in silver and $14.00 in gold to the ton. In a few of these claims a considerable amount of prospecting work has been done, but in the great majority we find nothing beyond assessment work.

Cariboo Division, from the richness of its placer deposits worked in early days, has always been looked upon as a locality from which much in the way of developments in quartz might reasonably be expected. Many ledges were known even in these early days, from which in several instances $3.00 to $5.00 a day per man was made by washing the decomposed and oxidised rock matter at the surface of the veins. We accordingly find that in 1877-8, companies were found to operate mines here; but from exaggerated ideas of the richness and erroneous views regarding the methods and cost of working the ores, these efforts failed, and quartz mining received a severe check. Within the last few years, however, attention has been again turned to these ledges with what now appears to be a fair chance of success. From what is known of the district, it is clear that a great number of well defined quartz ledges exist, from which good prospects are obtained. As is well known, much of the gold obtained from quartz is contained in sulphurets, which on the surface has become oxidised, allowing the free gold to escape, and on several of the veins such bodies of sulphurets have been discovered. The government has established a small testing plant in this neighborhood, to assist the development of the mines, and several small stamp mills have also been erected. From the Black Jack Mine, two lots of ore have been worked as follows: No. 1 of 100 tons yielded $523.00 in free gold and 12 tons in sulphurets, worth $24.00 to the ton; No. 2 of 202 tons, yielding $4.50 in free gold and $13.00 in sulphurets per ton. By means of these stamp mills and testing works, the miners will be able to realize from their ores, and thus obtain money to go on with development of their mines, and there is every hope that in a short time they may be able to prove the value of their own claims, and with them assure success in quartz mining in the district as a whole.

Omenica Division.—The remote situation of this district will for the present prevent the development of vein mining, but there is no doubt that it is rich in minerals. Its placer deposits would seem to indicate the existence of both gold and silver bearing ledges. On Vital Creek, ⅞ of the metal found was arquerite or silver amalgam. A large number of ledges containing highly argentiferous galena ore in large bodies are also known to exist, which assay from 30 to 130 ounces of silver to the ton. A number of these claims were at one time taken up, but have since been abandoned. When taken in connection with discoveries in more accessible regions, he probability is that nothing will be done to develop this district till it can be reached in a more convenient manner than it now is.

Cassiar Division.—Almost the same remarks may be applied to this district, in which many well defined ledges are known to exist, on which surface indications are promising, and from some of which rich assays have been obtained, indicating in connection with the rich placers which have been worked that the district in the future will become valuable from the mineral deposits in its veins and ledges. As regards its situation it could be made accessible with a comparatively small outlay.

The vast *Youkon District* to the north is apparently equally rich in mineral deposits.

In addition to the minerals enumerated above, many others are also to be found, such as molybdenum, mercury, antimony, plumbago, bitumen, asbestos, mica, platinum, coal and iron.

The *platinum* is found associated with the gold in placer mining in many localities throughout the province; but its principal source is Granite Creek, where, since 1885, some 4,000 ounces have been collected. It is the most important field for this mineral which has been discovered in North America.

The deposits of *coal* in the province, as is well known, are of vast importance. The mines on Vancouver Island were mined before the discovery of gold in the province. They are important, both from their extent, quality and favorable position. The output for 1889, from the various mines in operation, were as follows:—

	Tons.
Nanaimo Colliery	223,870
Wellington Colliery.....	273,383
East Wellington Colliery	51,372
Union Colliery.....	31,204
Total tons	579,929

The total output of coal for the Province, up to the end of 1888, was 4,358,221 tons.

These coals are of cretaceous formations, and they are now admitted to be superior to any other coals on the Pacific Coast.

In addition to the above, we find tertiary deposits scattered throughout the Province, both along the coast and in the interior. The tertiary area in British Columbia is estimated to be 12,000 square miles.

Deposits of iron also occur in many places in British Columbia. At present only such as are situated on the coast are available; but, as the country becomes developed, the others will also be valuable. In some cases they occur as clay ironstone in the coal series; but principally in the form of magnetites. Little attention, as yet, has been devoted to this branch of mining. The only ores being worked are those of Texada Island, which is magnetite of excellent quality. The mines are most favorably situated, either for shipment or smelting, as the Comox coal fields are only about twenty miles distant. The following shipments have been made: 1885, 190 tons; 1886, 3,941 tons; 1887, 1,410 tons; 1888, 7,300 tons. Similar deposits occur elsewhere along the coast, also favorably situated as regards shipment.

As may be seen from the foregoing, the Province possesses important mineral deposits in many different localities, and extending over a vast extent of country. It may very reasonably be asked, then, how so little has been

done towards the development and working of these deposits?

Want of capital and the inaccessibility of the country have been and still are, the principal reasons. The completion of the Canadian Pacific Railway has opened the Kootenay District, and witness the developments and discoveries which have been made since that time. The discoverers, almost without exception, are poor men, and development of quartz mines requires capital; for, in most cases no returns can be obtained, even when valuable ore is lying in the dump: the great hope, then, is that moneyed men may be induced to invest and help in the development. In many cases the miners are themselves to blame—they give exaggerated values to their properties, based upon fictitious results obtained from picked assays, or hold undeveloped property at fabulous prices. This is more likely to do harm than good, and is bound to delay developments. Average results are what are required, and if these can be obtained from a quantity of ore, they give undoubted proof as to the value of the mines. But, in the absence of capital, these working tests can only be obtained under favorable circumstances, both as regards situation and richness of ore, which has usually to be packed for long distances to the nearest shipping points. Low grade ores cannot be tested in this way, except when reduction works are near, even though such deposits are equally as valuable as the richer ores. The following examples will give an idea of the present cost of shipping ore from mines which are favorably situated: Silver King Mine, Toad Mountain to Nelson, a distance of seven miles, by pack train, $10 per ton, and from there to Butte, Montana, including smelting, $47 per ton; in all, $57 per ton. The cost of transportation from Hot Springs to the same destination, including smelting charges, $40 per ton. This does not include the cost of packing from the mine to the water edge, which, of course, varies with the distance. The erection of such reduction works in the Province, then, is of great importance: First, because it allows miners to receive some returns from their ore, and thus aids them in going on with development; Second, the erection of such works by experienced men is a direct proof that the importance of the deposits is recognized. It is not out of place, therefore, to show what has been done in this way.

In the Cariboo District, stamp mills have been erected as follows:—

Island Mountain Mining Company—One ten-stamp mill, operated by a fifty-horse-power engine, with the view of working a larger number stamps as required.

British Columbia Mining and Milling Company, Stout's Gulch—One ten-stamp mill and engine (on the ground, but not erected).

Black Jack Quartz Mining Company—A one-stamp test mill, capable of working 1½ tons of ore per day, operated by water.

Nason & Co., Conklin's Gulch—One four-stamp mill, worked by water.

In addition to the above, the Government, with the view of encouraging and assisting the miners, has erected a small testing and chlorinating plant, with a capacity of about three tons per day.

NEW WESTMINSTER DISTRICT.

At Vancouver a smelter and sampling works, with a capacity of 50 tons per day. Through some faults in construction, not working at present.

KOOTENAY DISTRICT.

At Golden, a smelter, 20 tons capacity per day, with roasting furnace, 14 tons capacity per day.

At Revelstoke, a smelter, owned by the Revelstoke Smelting Syndicate, capacity 60 tons per day; also, sampling works, having a capacity of 100 tons per day, operated by a fifty-horse-power engine.

At Summit of Toad Mountain, the Collingwood Gold Mining Company has two Huntingdon Mills of five tons capacity each, and two Frue vanning concentrators.

At Eagle Creek, one ten-stamp mill and four Frue vanners, capacity 15 tons per day, operated by a Pelton water wheel.

A stamp mill now at Golden, awaiting shipment to mines in the spring. Its capacity I am unable to give.

In addition to the working tests already given, some 205 tons of ore were also tested, yielding 69,530 ounces of silver; or, say, on an average, 340 ounces of silver to the ton.

In many of the localities the success of the camp, as a whole, depends to a great extent upon the successful development perhaps of single claims, where owners are more fortunate as regards capital and means to prove the value of their claims.

Another reason which has retarded actual working developments and erection of reduction works, is the fact that a large amount of preliminary work is necessary, both to ensure a constant supply of ore, and also to determine the methods by which it is to be worked, for in many cases the character of the ore changes after a certain depth is reached. As the coarse gold of the placer deposits is derived from ledges in the immediate vicinity, we might fairly assume that these ledges would be gold-bearing. If this were the case it would simplify matters considerably, and at the same time materially assist in the immediate development of mines throughout the Province, for ores, if free milling, are worked by machinery—inexpensive when compared with the cost of reduction works required for the treatment of silver ores when associated with the baser metals. When a portion of the ledges is destroyed, the gold, from the fact that it is acted upon by few agents in nature, is left, while the more alterable associated minerals, copper, lead etc., are destroyed and carried away. In this way, in many cases, the gold of the placer deposits may be robbed from ledges which will in all probability turn out in many cases to be silver-bearing, the principal associated minerals being copper and lead, with the probability that silver-bearing copper ores will be more plentiful than silver-bearing lead ores, though surface indications show the latter more abundant.

Next in importance to the mines themselves are the ways and means of reaching them.

The Columbia and Kootenay Railway is now under construction, and will, I am told, be ready to carry ores next summer. If so, in connection with steamboats now built and operated on the Columbia River, miners will be enabled to ship ores direct to the smelters at Revelstoke and Golden, at a comparatively small cost, and there is no reason to doubt that these smelters will be kept steadily at work, and in a short time prove inadequate to treat the amount of ore coming in. In the Kootenay District at least, then, we may look forward to important developments in a very short time. Elsewhere throughout the country railroads, waggon roads, etc., for reaching the mines, are badly required.

This paper has assumed dimensions far beyond what I had intended. It has been impossible to mention individual claims, except where, from more important developments, I have been warranted in doing so. You will therefore understand that this has been avoided, not because they were unworthy of mention, but simply because space will not allow me to give it. From the accessibility of the Kootenay District I have given it more space and attention, probably at the expense of other districts equally as promising and valuable, but at present not so favorably situated. This is simply because, in this district, as a whole, more developments have been made, affording me more tangible proof to present to you.

Mining in British Columbia has now reached that stage when examination of its mines is courted and invited. Let us hope, then, that with the completion of the Canadian Pacific Railway, and improved facilities for travel, capitalists will visit the country and judge for themselves.

Let me state, in conclusion, that the existence of rich, valuable and extensive mineral deposits within the boundaries of British Columbia, is now admitted, and that it is only a question of a short time till this will be definitely proved. The development and working of these deposits will create a vast and permanent industry, supporting a large population. Important towns and mining centres will spring up at various points; railroads will be built; and British Columbia, I venture to say, will become one of the richest, if not the richest, and most valuable province of our Dominion of Canada.

Cost of Sinkings for Coal.

(COLLIERY GUARDIAN).

Estimated cost of sinking two shafts of 14 ft. diameter each, 120 ft. apart. Depth to the main seam 410 yards from the surface. No. 1 is the engine shaft; the sinking in it is kept in advance of No. 2, chiefly on account of draining the latter.

The sinking of shafts is usually taken under contract prices, and a specification by a professional man, who, besides giving advice, provides experienced men for sinking, walling, putting in tubbing, wedging cribs, putting in and changing pumps, etc. Besides personal superintendence, his men from long experience would perform the work more systematically than others, and in consequence with more economy and expedition, especially when technical difficulties occur. The changing of rods and pumps for sinking and standing sets (depending so much on the quantity of water met with) and the cost of materials are not included in contracts, but sinking gear, kibbles, trams, running platforms, and similar appliances might with advantage be found by the contractor.

NO. 1 SHAFT.

	£	s.	d.	£	s.	d.
Temporary headgear, pulleys, and gin	90	0	0			
Temporary smiths' and joiners' shop, sinkers' lodge, and storehouse	150	0	0			
Sinking to the stone-head in clay 30 yards, at £6	180	0	0			
Sinking 380 yards in coal measures to the main seam, at £7 10s. per yard	2,850	0	0			
Sinking 10 yards further for sump, at £7 10.	75	0	0			
30 yards of cribs, 1 in. backing deals, props, and stringing deals through the clay, at £3 10s	105	0	0			
30 yards of walling in the clay, including walling crib, at £5 10s	165	0	0			
30 yards of temporary cribs and backing deals where the stone is weak, at £3 10s.	105	0	0			
150 yards of walling in the coal measures, at £6	900	0	0			
120 yards of cast iron tubbing, including backing, wedging, and sheathing, at £24	2,880	0	0			
Six wedging cribs, 60 cwt. each, at 7s. 6d., putting in £6 each	171	0	0			
430 yards of main brattice, including labour in fixing, at 35s	752	10	0			
Four cast iron ring cribs, including fixing	50	0	0			
Main and tail crabs £120, ground crabs £80, cradle crab £40, and two gins £80	320	0	0			
Engine for drawing stones	440	0	0			
Main crab rope 12 in., ground crab rope 7 in., gin ropes 5½ in., cradle rope 8½ in., and machine ropes during sinking	1,600	0	0			
80 in. main engine, condensing, and boilers	4,600	0	0			
House for engine, boiler seats, chimney, and woodwork in the house	1,400	0	0			
				6,000	0	0
Permanent winding engine, 100 horse power, and boilers	1,980	0	0			
Engine house, boiler seats, chimney and woodwork in house	1,300	0	0			
				3,280	0	0
Two pairs of flat ropes, 120 and 240 fathoms, = 156 cwt., at 42s				327	0	0
Counterbalance apparatus for winding engine, including rope, chain, and 40 yards of staple	320	0	0			
One pulley, 12 cwt., at 10s	6	0	0			
				326	0	0
Shear legs for pump shaft	140	0	0			
Sheaves for crabs and gins, with axles	50	0	0			
Shaft frame of wood	160	0	0			
Two 10 ft. pulleys, 33 cwt., at 10s	16	10	0			
Axles for pulleys, 3 cwt. at 36s.	5	8	0			
Labour in erection	20	0	0			
				391	18	0

There are four lifts of pumps, the three upper are forcing lifts, each 120 yards in length, 15 in. rams, the lower a lifting set from the bottom of sump, its length is 60 yards, 15 in. bucket. As the water will be raised from the bottom only, the capacity of the pumps is the same in each lift.

The first set of pumps at the top—						
Snorehole pipe, 19 cwt. at 11s	10	9	0			
H-piece, bored, clack seat and doors 48 cwt., at 11s	26	8	0			
Chamber for ram and gland, bored, 30 cwt., at 15s	22	10	0			
Ram gland, turned, 22 cwt. at 15s	16	10	0			
15 in. hoop for ram, 49 lb. at 4½d	0	18	0			
Brass bushes for ram, bored, 197 lb. at 2s.	19	14	0			
2 clacks, turned, 2½ cwt. at 20s	2	10	0			
Bolts, clack falls and shackles, 660 lb. at 4d	11	0	0			
31 cast iron pumps, 19 cwt. = 589 cwt. at 7s	206	3	0			
Bunton for set to stand on	40	0	0			
Cistern at top of the set, 15 cwt. at 20s	15	0	0			
Labour, fitting up ram, clacks, etc	15	0	0			
				386	2	0
Second set of pumps, same as first				386	2	0
Third set of pumps, same as first				386	2	0
Fourth set, lifting from the sump—						
Snorehole pipe, 19 cwt. at 11s.	10	9	0			
15 in. working barrel, bored, 30 cwt. at 16s	24	0	0			
Two Y-plates and box, bolts and nuts, each 850 lb. at 5d.	35	8	4			
Bucket and clack pieces, 58 cwt. at 11s	31	18	0			
15 cast iron pumps, 19 cwt. each, 285 cwt. at 7s	99	15	0			
Buckets and clacks, 6 cwt. at 28s	8	8	0			
Doors, cross bars, swords and keys	5	10	0			
4 clack bows, 1 cwt. each, 448 lb. at 5d.	9	6	8			
3 hoops for buckets, 90 lb. at 10d	3	15	0			
Wood buntons for set to stand on	13	0	0			
				241	10	0
Sundries.—Sinking gear, £66; drawing sets, putting pumps in, £240; flannel for sinkers, £100; clacks and buckets, bolts, iron, nails, rope, &c., £594				1,000	0	0
1,080 ft. of Memel rods, 12 in. square, for forcing sets, including dressing, at 3s.	162	0	0			
60 ft. ditto, low set, 6½ in., at 3s	9	0	0			
Ground spears, 6 in. square	45	0	0			
Spear plates, 18 pairs, 31 cwt., at 20s	31	0	0			
Sheaves, sheave cases, bottom rods for ground set, bolts and clams	72	0	0			
Collarings for pumps and rods, bolts and scaffolds at doors.	58	0	0			
Water-boxes, deal, including putting in boxes, nails and spikes, 150 yards at 2s. 6d.	18	5	0			
Rod plates for the forcing sets, 104 cwt., at 22s	114	8	0			
Bolts and nuts for plates, 39 cwt., at 37s. 4d	72	16	0			
Plates for the lifting rods, 15 cwt., at 22s	16	10	0			
Bottom rods for four sets, 38 cwt., at 38s	72	4	0			
				671	13	0

Enginemen and firemen at the engines, smith, grather; oil, tallow, leather, &c., = £20 per week. At 4 yards sinking per week is £5 per yard; 400 yards at £5				2,000	0 0
Cutting out balance-beam chamber at 300 yards depth, 36 ft. × 12 ft. × 18 ft. high = 288 cubic yards at 7s		100	16 0		
Masonry, walling and arching.		79	0 0		
Cast iron beam of 8 tons, at £12		96	0 0		
Balance-box and weights, 30 tons, at £4		120	0 0		
Gudgeons and pins, carriages and bolts		90	0 0		
Connecting straps to main rod, £24, parallel motion and straps, £70		94	0 0		
				579	16 0
Under level drift from the bottom of sump to the dip workings, 130 yards, at 30s.		195	0 0		
Arching the drift, 130 yards, at 12s. 6d		81	5 0		
				276	5 0
Shaft fittings, including buntons, guides and labor, 420 yards, at 30s				630	0 0
Three cages				54	0 0
120 wood tubs, 8 cwt. capacity, at £3 each.				360	0 0
Rails				260	0 0
Metal plates for top and bottom of the shaft, 4 tons at £5 10s				22	0 0
Pit-frame, 4 coal screens, small coal apparatus and walling for heapstead				1,200	0 0
120 chaldron wagons, at £16 each				1,920	0 0
Cost of coal, including railway charge during sinking operations				990	0 0
Other railway charges				110	0 0
Reservoir for engine water, 120 × 90 ft. and 6 ft. deep = 2,400 cubic yards, at 9d.				90	0 0
Drifts, pipes, masonry, and securing the sides of pond				80	0 0
Four horses—purchase price, £40 each		160	0 0		
Keep for three years, at £42 per year		504	0 0		
Gears		40	0 0		
3 carts £40, 1 wagon £22		62	0 0		
3 men's wages, and 3 laborers' during sinking		780	0 0		
				1,546	0 0
1 smith and 2 joiners' wages, three years				499	4 0
Smiths' shop, 60 × 26 ft.; joiners' shop same; fitting shop, 60 × 26 ft.; and storehouse 26 ft. square				580	0 0
Engine, 10-horse power, for driving saw mill, lathes, &c				200	0 0
Saw mill, boiler, chimney and engine house.				280	0 0
Bellows £45, anvils £24, smiths' tools £60, vices £22				141	0 0
Lathes, fitting tools, joiners' benches				300	0 0
Yard wall and gates				98	0 0
Office and furniture £100, and 2 agents' houses £400				500	0 0
8-stalled stable, granary above				260	0 0
40 workmen's cottages at £60				2,400	0 0
Damaged ground rent, 3 years at £60				180	0 0
Army during sinking—					
Cashier		150	0 0		
Viewer		150	0 0		
Enginewright		100	0 0		
				400	0 0
Cost of No. 1 shaft				£40,186	2 0

No. 2 Shaft.

The sinking of No. 2 shaft is estimated to be done without the use of pumps. In place of this a drift will be driven from the engine pit, and a borehole put down to meet it at the required level.

	£.	s.	d.
Temporary headgear, pulleys and gin	90	0	0
Sinking to the stone head in clay, 30 yards at £6	180	0	0
Sinking 380 yards in coal measures to the main seam, at £7 10s. per yard	2,850	0	0
Sinking 10 yards further for sump, at £7 10s	75	0	0
60 yards of temporary cribs for securing shaft in clay and in weak stone, including backing, stringing deals, and props, at £3 10s	210	0	0
30 yards of walling in the clay, including walling crib, and taking out cribs and deals, at £5 10s	165	0	0
150 yards of walling in coal measures, at £6	900	0	0
120 yards of cast iron tubbing, including sheathing, backing, and wedging, at £24.	2,880	0	0
6 wedging cribs, 60 cwt. each, at 7s. 6d., and putting in at £6 each	171	0	0
Four cast iron ring cribs, including fixing	50	0	0
Temporary brattice, 120 yards, at 18s	108	0	0
Engine for drawing stones	440	0	0
Permanent winding engine, 100-horse power, and boilers	1,980	0	0
Engine house and woodwork, boiler seats and chimney	1,300	0	0
Two pairs of flat ropes, 120 and 240 fathoms, = 156 cwt., at 42s	327	12	0

	£	s.	d.		
Counterbalance apparatus for the winding engine, including rope, chain, and 40 yards of staple	320	0	0		
One pulley, 12 cwt., at 10s	6	0	0		
				326	0 0
Headgear of wood £160, erecting £20	180	0	0		
Two 10 ft. pulleys, 33 cwt., at 10s.; axles, 3 cwt., at 36s.	21	18	0		
				201	18 0
Drivings in coal between the shafts for ventilation, 141 yards, at 10s				70	10 0
Driving drift between the shafts in stone, 36 yards, 4 ft. wide, 5 ft. high, at 30s. per yard	54	0	0		
Boring to the drift from bottom of No. 2 pit, to run water into the engine shaft at second set	120	0	0		
				174	0 0
Sundries: Sinking gear £80, boring gear £30, flannel for sinkers, £70, iron, nails, rope, etc., £350				530	0 0
Enginemen and firemen at the engines and stores				620	0 0
Cradle crab £40, cradle rope, 8½ in., 36 cwt., at 42s. = £75 12s., two sheaves £6 10s				122	2 0
Shaft fittings; including buntons, guides, and labour, 420 yards, at 30s				630	0 0
3 cages				54	0 0
120 tubs of wood, 8 cwt. capacity, at £3				360	0 0
Rails, underground				260	0 0
Metal plates for top and bottom of the shaft, 4 tons, at £5 10s				22	0 0
Pit frame, 4 coal screens, small coal apparatus, and walling for heapstead				1,200	0 0
120 chaldron wagons, at £16 each				1,920	0 0
Cost of coal, including carriage, during sinking				690	0 0
Railway charge for materials				70	0 0
Sidings on the surface for the colliery				660	0 0
Damaged ground rent				180	0 0
Cost of No. 2 shaft				19,817	2 0
Cost of No. 1 shaft				40,186	2 0
Total cost of the shafts				60,003	4 0

Mine rents are not included in the cost of sinking; the payment of certain rents should be deferred for two or more years, a reasonable time being allowed for sinking, according to circumstances.

Second Annual Meeting of the Asbestus Club, Black Lake.

The second annual meeting of the Asbestus Club was held in their rooms at Black Lake, Que., on the 9th inst., Mr. L. A. Klein in the chair. The minutes of the last meeting were read and confirmed and the following new members elected: Messrs. T. H. Crabtree, John Hammer, J. M. Johnston; Mr. Edgar Ingram of Montreal was also accepted. It was decided that the by-laws of the club should be altered so as to permit of two vice-presidents and seven councillors holding office, and also that the regular monthly meetings be held in Black Lake and Thetford. The election of officers for the ensuing year was then proceeded with, resulting as under:—

President—L. J. Frechette, M.P.

Vice-presidents—M. Penhale, Black Lake; A. Ward, Thetford.

Secretary-treasurer—A. M. Evans, M.E., Black Lake.

Assistant secretary-treasurer—Robert Strather.

COUNCIL.

L. A. Klein, chairman,	American Asbestus Co.
Thos. Sheridan,	Bell's Asbestus Co.
R. T. Hopper,	Anglo-Canadian Asbestus Co.
Col. Ward,	Ross, Ward & Co.
J. J. Penhale,	United Asbestus Co.
H. J. Williams,	Beaver Asbestus Co.
Ben. Bennett,	King Bros.

The twelve regular meetings to be held on the last Thursday of each month; other meetings, subject to call, to be held at Black Lake.

The accommodation of the Club House was then discussed. It was thought by a majority of the members present that the present location was a little out of the way and rather inconvenient, and a committee consisting of Messrs. M. Penhale, L. A. Klein and A. M. Evans, was therefore appointed to report at the next general meeting on the selection of rooms better adapted for the general convenience of the club.

The question of a telephone service between Thetford and Black Lake, with a view to securing connection with Sherbrooke, was next taken up, but in the absence of a representative of the Sherbrooke Telephone Association, and Dr. La Rose of St. Julie, matters were postponed until a called meeting, which will be at an early date.

A hearty vote of thanks was then passed to the retiring officers for their services of the past year, and the meeting adjourned.

The members of the club are determined that its possibilities shall be in every way developed and realized this year. All that is needed is the hearty co-operation of the Thetford and Black Lake mining men. With the growing mining interests of the district there is no reason why the Asbestus Club, properly managed, should not become a power in the land. It is the intention of the club to secure men of known ability to deliver lectures on mining and social matters during the coming twelve months. The first meeting of the second year will be held in Thetford on the 28th instant, when a paper will be read by Mr. H. J. Williams on "First Impressions of the Electric Drill;" this paper will no doubt be of a very interesting character.

Uses of Feldspar.

The use of feldspar in pottery depends upon the fact that it will fuse at a very high temperature. The best porcelain consists of a mixture of infusible clay and feldspar; by subjecting this to very powerful heat the feldspar fuses, and forms a cement for the clay. When feldspar is used in this way it is said to form a part of the "body" of ware. The amount of feldspar so mixed with the body of porcelain is only sufficient to hold the clay firmly together. The mass is porous, and requires a smooth coating of some fusible substance called a "glaze." The best substance for such a glaze is feldspar, because it forms a smooth surface which is very hard, and resists the action of all substances exceedingly well. It is used as the glaze for the best kinds of porcelain, such as that made at Sévres. It would be used generally except for the high temperature necessary for its fusion, and there are many other kinds of glaze that will fuse more readily. Feldspar is used in less quantity than any other constituent of pottery, particularly in this country, and the proportion varies according to the exact nature of the clay employed. The proportion used by each manufacturer depends upon some recipe which he has found most suitable for the temperature and other conditions under which he works. Besides the use in porcelain manufacture, feldspar is also used in more common grades of pottery, and here also a manufacturer always clings to some arbitrary proportion which he has found valuable. With the present increasing tendency to manufacture better grades of pottery, as shown by the new kinds of porcelain made at Trenton, Baltimore, and Cincinnati, and the use of higher temperatures in these potteries, it seems probable that the consumption of feldspar will increase markedly within the next few years.

Large Charcoal Blast Furnace.—The largest charcoal blast furnace on the Continent of Europe, has recently been blown in at Vayda-Hunyard, Hungary. Its annual capacity is about 15,000 tons.

CORRESPONDENCE.

The Analysis of Phosphates.

SIR: Supplementing the notes on the analysis of phosphates, which I had the pleasure of sending your REVIEW some time ago, the following "*Alcohol Method*" for the determination of oxide of iron and alumina will perhaps be acceptable to many of your readers.

Phosphate sellers know too often to their regret how unsatisfactory are the results of the analyses for iron and alumina when made by different chemists who do not employ the same method of analysis. This "alcohol method" was first proposed by Eugene Glaser in 1889, and is sometimes termed "*Glaser's Method.*" It has been adopted by the German chemists, and is finding favor with the English chemists for the commercial analyses of phosphate fertilizers.

It would be well therefore to employ this method for phosphates to be sold in Europe on guarantee.

J. LAINSON-WILLS.

OTTAWA, May 26th, 1891.

DETERMINATION OF FERRIC OXIDE AND ALUMINA IN PRESENCE OF PHOSPHORIC ACID BY THE ALCOHOL METHOD.

Five grms. phosphate are dissolved in the usual manner in 25 c.c. nitric acid of sp. gr. 1·2, and about 12·5 c.c. hydrochloric acid of the same sp. gr., and made up of 500 c.c.; 100 c.c. of the filtrate (one-fifth of the sample), are placed in a ½-litre flask, with the addition of 25 c.c. sulphuric acid of 1·84 sp. gr. The flask is let stand for five minutes, shaking occasionally; about 100 c.c. alcohol (95 per cent.), are added; the flask is cooled, filled up to the mark with alcohol, and well shaken up. After standing for half an hour the liquid is filtered. 100 c.c. of the filtrate (0·4 grm. of the sample), are evaporated down in a platinum capsule until the alcohol is expelled. The solution is then mixed with 50 c.c. water in a beaker and heated to a boil. Ammonia is added to the solution until the reaction is alkaline, but not whilst boiling, to avoid a violent effervescence. The excess of ammonia is boiled away; it is let cool, filtered, the precipitate washed with hot water, ignited, and weighed as ferric and aluminium phosphate. On trying this method the author obtained results which agree with those of calculation. The precipitate obtained was pure, consisting entirely of ferric and aluminium phosphates. This "alcohol method" was formally accepted at the Congress of German Experimental Stations, held on September 18th, 1891. (See Zeitschrift Anal. Chemie., xxx., p. 9).

MINING NOTES.

[From our Correspondents.]

Newfoundland.

A new concern, the Pyrite Company (limited), has been incorporated in England, with a capital of £300,000, to work a property on the south-eastern part of Pelley's Island, Notre Dame Bay, Newfoundland, twenty miles from Little Bay and about two hundred and forty miles north-east of St. Johns. Steamers from New York make fortnightly calls at the island during the open season. In close proximity to the mines is a fine harbor, capable of holding a large fleet of vessels, channels to which are all buoyed from 7½ to 15 fathoms of water. The shipping season extends from about the beginning of May to the end of December. There is erected at the harbor, and within three hundred yards from the shafts—by which the mines are now being worked—a substantially built wharf, connected with the mines by a well equipped tramway, at which steamers of any capacity can be loaded. An addition is now being made to the wharf, and when this is completed it is claimed that 1,000 tons of ore can be put on board steamers in twenty-four hours. The lode which is being worked is a strong one, running east and west, and dipping south at an angle of forty-five degrees. It is composed of a solid mass of pyrites, varying in width from 50 feet at surface to 94 feet at No. 1 level, and at the No. 2 level to a discovered width of 123 feet. No. 3 level, at a depth along the foot wall of 248 feet, is not as yet greatly extended. The workings along the vein are about 500 feet in length, and the mining work which has been done on the property has laid open a very large extent of ore ready for extraction, which is estimated at about 500,000 tons. The ore is said to contain about 52% sulphur, and 46·80% of iron. It is proposed to put large air compressors and drills into these mines, along with extensive improvements which will greatly facilitate the handling of the ore and increase the output.

Nova Scotia.

Beaver Dam District.

The mill at this place is working continuously and satisfactorily. The mine is reported as being very wet, but as looking as well, if not better than usual.

Caribou District.

With the exception of the mine worked by Dixon & Co. there is very little doing here. The once famous Lake Lode is in a state of innocuous desuetude, and it is difficult to imagine its revival. Mr. Whidden is still in charge of the prospecting work of the Halifax Mining and Prospecting Company, and Messrs. McDonell & Co., have begun some work preliminary to opening up their property next month.

Fifteen Mile Stream.

The Egerton Company have received the second Matheson compound engine, which will be used to drive a belted Blake air compressor. The company have ordered four Sergeant rock drills, 2¾ inch air cylinder, from the Ingersoll Rock Drill Co. of Canada, and hope to get their new equipment in operation by mid-summer.

The clean up last month at the Egerton mine gave 200 ounces from about 350 tons of quartz crushed. Considerable additions are being made to the plant. Another ten stamps are being added to the fifteen already at work, and an air-compressor for the drills is being put in, together with a four-ton boiler and an additional compound engine of about forty horse-power for hoisting and pumping, leaving the other for the batteries. The deepest shaft is now down 200 feet. A new shaft is being opened on what is supposed to be the Serpent lode. Some fifty men are now employed, and the prospects for the season appear bright. It is intended to do some development work about the 1st of June.

On the Stanley property there is little or nothing doing, as they are waiting for the water to dry up. Two shafts are down about 90 feet and a good deal of tunnelling has been done, but at present the only work being done is in the ten-stamp mill, where they are doing custom crushing. About twenty men are employed. It is intended to prospect this year as soon as the weather permits.

Work is progressing on the old Hudson claim, under the management of Mr. M. G. McLeod, with a force of twelve men. Their quartz is crushed at the Stanley mill.

Darr's Hill District.

The returns from the Dufferin Gold Mining Co. for April were smaller than for some time, owing to the lack of miners, and consequent reduced output. The quartz obtained came chiefly from the north vein, which, at the present time, has a clear width of twenty-five feet. The western end of the South Lode is looking well, some very rich ore having been uncovered there.

Gay's River District.

During the last few weeks there has been a flood and ebb tide of prosperity here, and now comes the report that the Coldstream Company are to resume operations and once more make the district blossom as a rose. The official returns of the company have thus far shown a return of only 17¾ ounces from 210 tons, an average of 1½ dwts. per ton, or about $1.61.

Some of the "know-all's" claim that this return does not represent the amount of gold present in the material milled, but that the new plates were "hungry" and absorbed an abnormal amount. As the amalgamator making the test-run was a man probably without a superior in the Province, and as the Gay's river gold is all, technically, speaking, "coarse" it is fair to assume that the sworn return above alluded to, represents the economic value of the material crushed. Whether a judicious sorting of material and selection of ground would materially raise this average can be answered only after making the test.

Stormont District.

The property of the North Star Co. is looking exceedingly well. The North Star lode maintains its size and yields in excess of one ounce to the ton. The Burke lode is also showing good ore. No hand drilling work is doing at present in the North Star, only the air drills are working. It is the intention of the company to add to its plant an additional compressor and four drills, and the manager, Mr. Fisher, is considering plans for a re-arrangement of the existing plant and the erection of a mill near the head of the main incline.

South Uniacke.

Messrs. Neily & Co. are still sinking and have faith in their prospects.

Messrs. Thompson and Quirk reached the streak in the new shaft the first of last month, and found the roll as good and as large as in their western workings. A yield of 276 ounces from 19 tons is reported.

The Witherow mine has also had a dividend the past two months, and is in good shape for an increased production.

Mount Uniacke District.

The Phœnix Co. are reported to have struck a high grade streak in their 360 ft. cross-cut. The best of lodes here is over 40 feet in width, and the quantity of low grade ore exposed is very large.

The property of the Montreal Co. here is under bond to a New York syndicate, and an examination of the mines will be made this month.

Waverley District.

The Sophia Gold Mining Co. is the name of the concern which is now operating the property of T. J. Wallace under a lease. Mr. Levy, the resident manager, has patched up the old Bürkner water mill, and has been crushing quartz coming from the "Nigger" lode, on the southern dip of the district. The returns from this lode have not been up to expectations nor reputation, and the lode is somewhat smaller going west. The company have started work preparatory to unwatering the Tudor lode.

Ground for the mill of the West Waverley Co. was broken on the 11th inst. This mill will be designed and erected for 20 stamps, but only 10 will be put in until the mine development warrants more. The shaft on the Union lode has been straightened for 225 feet, and retimbered, and the skip track is laid ready for use. Active mining operations will be commenced in June.

Pictou County.

The New Glasgow Iron, Coal and Railway Company have commenced a branch line from Eureka to connect with their furnace at the forks of the East River, and with their mines at Springville. They have continued opening and testing their large and valuable properties.

Iron ore was mined by this company at Brookfield. Mr. R. G. Leckie, of Londonderry, tested a promising deposit near Pugwash, and discoveries were reported from various localities.

Cumberland County.

Operations have been steadily pursued by the Londonderry Iron Company, both at their mines and their furnaces. Calcining furnaces have been built, and large amounts of Spathic ore have been burned. This process greatly increases the per centage of iron in the ore, and makes it more fusible.

A very interesting event took place at the Londonderry Iron works on Saturday, April 25th. The new blast furnace which has been under construction for some months, was put in operation, the ceremony of "lighting up" devolving upon Miss Florence Leckie, daughter of Manager R. G. Leckie. As the torch was applied to the last tuyere hole, three cheers were given by the crowd assembled. Shortly after, the engines operating the blast were set going by Mrs. Perrin, wife of C. P. Perrin, under whose superintendence the construction and the operation of starting the furnace have been successfully conducted. The new furnace is seventy-five feet high and nineteen feet in diameter of bosh. It is expected the output of iron will reach 100 tons a day.

Cape Breton.

No. 3 shaft at the Coxheath Copper Mine is a perpendicular shaft sunk in the middle of a large surface ore, showing for the first 50 feet the shaft was in rich ore on all sides, the width of the vein not being determined. The latest advices from the mine state that at 53 feet in depth a strong foot wall has developed, dipping towards the north, to vein B; the ore which, for a few feet back, had been somewhat lean, has again improved in quality. The hanging wall has not yet been cut, showing the ore body to be one of considerable width.

A company is being incorporated with New York capital to ship ore from the Moseley leases at East Bay, Cape Breton. The ore is a red hematite, associated with Laurentian limestones, and so far as exploratory work has been carried, appears to be uniform in quality and to be present in quantity.

The sales of the Bras d'Or Lime Co. for last year are reported at 44,000 lbs., shipped mainly to Boston and New York.

The total coal sales for this county, officially reported, were 916,994 tons, against 751,997 tons in 1889, and 738,250 tons in 1888.

The home sales were 223,732 tons, compared with 200,182 tons during the preceding year.

The sales to Province of Quebec were 480,462 tons, against 381,074 tons in 1889.

The production and sales of the various Cape Breton collieries during the year 1890 were as follows:—

	Raised.	Sold.
Bridgeport	28,223 tons.	28,692 tons.
Caledonia	156,174 "	145,373 "
Franklyn	723 "	723 "
Glace Bay	111,472 "	108,490 "
Gowrie	141,099 "	124,641 "
International	143,091 "	133,076 "
Ontario	9,049 "	8,387 "
Reserve	155,906 "	139,777 "
Sydney	181,571 "	160,468 "
Victoria	90,930 "	77,367 "

The operations at the various collieries during last year are thus described by Mr. P. Neville, Deputy Inspector, in his report to the Commissioner of Mines:—

Gowrie Mines.—Work has been carried on in its usual way, levels extended on both sides of the low lift and rooms broken off. On No. 1 lift, west side, the levels have been driven about nine hundred feet parallel to the stone troubles; it is found, as they advance, that the coal is dipping slightly to the southwest, so that the course of the levels are now going more northerly, gaining more grip on the seam. The management say it is their intention this winter to drive through and come out on the opposite side of the basin. The slant road mentioned in last report on west side has been completed and gives good satisfaction. On bank a new tubular boiler of sixty horse power has been put in place, in addition to the others.

Ontario Mines.—During last winter pumps were placed below No. 1 level for the purpose of drying the dip workings. The water was lowered by the 10th of June a distance of 200 feet to No. 2 level, and up to the last of September it was lowered to No. 3 level, a distance in all of 460 feet. From that date the pumps seemed to be getting out of order and the water raising. Finally work ceased on the 31st of October and pumps and pipes removed to the surface. The coal mined here during the season was taken from No. 2 section, north side, between No. 1 and No. 2 levels. A few pillars have been drawn and split in No. 3, north side; also six rooms were worked at the face of the solid coal, below No. 1 level, south side.

Caledonia Mines.—Work has been brisk at this mine during the last season. The main deeps have been driven down 300 feet; No. 2 levels, above this, have been extended on the west and east sides, and rooms broke off and worked. A slant road has been driven from this east level coming out at the east side of the pit, for the purpose of drawing coal from that section. A small section of pillars have been drawn and split in the east side rise workings. A new double engine has been imported and placed on surface east of the hoisting shaft for the purpose of drawing the coal from the deeps. Also, preparations are being made to put a double furnace where the single one is now.

Little Glace Bay.—The operations at this colliery during the year have chiefly been the extension of rooms already gained and worked off the levels. The rooms south of the 1,800 foot headway have been worked, and some of them drawn up to the Harbor pit workings. In the month of June, as the weather became calm and warm, the air was found dull on the west side of the pit upper workings. The management erected a cupola over the old furnace shaft at the Harbor pit, in order to make an upcast there, and have two separate returns. This did well for a while, until the weather got cool and blowy; and as it was found, owing to the tenderness of the roof, too expensive to build a furnace there, it was abandoned and a steam jet placed at the bottom of the pump shaft. This, with the heated pipe to the Cameron pump, sufficed for the time being. However, I am glad to report that Mr. Rigby has ordered an eight foot Murphy Ventilator Fan, which he says will be in operation in the early part of next summer.

International Mines.—The pit bottom has been retimbered; the back deeps have been driven, connecting No. 9 landing; laid and worked No. 3 and 9 landings. No. 6 section has been driven seawards to the barrier and stopped; south side drove and laid angle deeps, from pit bottom level to No. 1 landing on incline deep. This was

done to cut No. 1 and No. 4 landing from north side engine and do away with the haulage of eight railroad horses there, and bring the coal into the opposite side of the pit bottom. The Lidgerwood engine, which had been used to bring the coal along the level, is now used for this purpose. The bankhead is 2,000 feet from the engine, and a tail rope is used along the level—the rope uncoupling automatically; the trip runs down the deep by gravity. On the surface a new nut screen and elevator have been erected, and another modified Rigg screen put in. Blowers were put in under the boilers, and fire-grates adapted to using fine slack coal These have given every satisfaction. An air shaft has been sunk, intended for an inlet. Mr. Hudson informs me that another shaft is to be sunk this winter, and a new fan and engine put in operation by the spring.

Reserve Mines.—During last winter the east slope was driven down and a new lift of 600 feet gained, and levels turned off east and west. The west levels were driven three chains, and the east eight; back deeps were also driven and rooms broke off and worked parallel to the level. A new travelling road has been made up the back deep on the east side. The barrier between No. 2, east side level, and No. 6, west side, has been pierced for the purpose of letting off the water from that section, which had been filled for a number of years. This done, it was found that the pump on the east side was not equal to the task, and a new pump has been placed at the bottom of the west slope to dry No. 6. The management say that it is their intention to extract and split pillars in that section next season. Ten pair of miners were employed drawing pillars west of this slope during the working season.

The Emery Mine, which had been idle for a number of years, and full of water, has this year been pumped out and a pump placed below the bottom of the pit, by which the water is pumped up the shaft to the surface. This shaft has been repaired, and slides and cages put in. The coal is raised to bank in half-ton boxes. A bank-frame and engine-house have been erected, and an engine and boiler placed therein; also a branch railroad of 400 yards has been built, connecting with the Reserve road. The levels in the west side of the pit have been driven about 700 feet, and headways driven towards the rise; rooms broke off and worked; these rooms are eighteen feet wide; pillars eighteen feet thick; cross-cuts twelve feet, and sixty feet apart. On the east side, the old levels and rooms have been extended, and a pair of dip-slants is being driven, in order to gain a lift of 600 feet.

Old Bridgeport.—Levels and rooms have been extended on the south side of the pit. No mining has been done during the year north of the furnace headway. The band of the shale, spoken of in last year's report, was found to be quite thin in the levels or low rooms, and consequently it was taken down with the top coal, which made the seam about nine feet thick. However, as the levels advanced it was found again to thicken, and the management thought it more profitable to timber and keep it up than take it down. A section of pillars have been drawn from south of mine headway.

Gardner Mines.—This property has been acquired by Messrs. Burchell Brothers. This property has been closed down since 1879, previous to which it was worked by the Gardner Coal Company. It was thoroughly equipped with the best machinery, some of which is still in excellent condition. Work commenced there in the latter part of the summer, getting everything in order to be ready for shipping at the opening of navigation next spring. Engine houses and miners' cottages are being repaired. A substantial pulley frame of some sixty feet high has been erected. The old boilers have been replaced by new ones. The water is being pumped from the mine by two double-acting sinking pumps, one a Knowles and the other a Dean. In a few more days the pit will be dry. I am informed that the seam is to be worked on the long wall system, or on the same principle that Gowrie mines seam is, having the rooms thirty feet in width. This may suit well, as the roof is so strong and regular.

Victoria Mines.—Work has been carried on at this mine in its usual steady way during the year. The east dips have been extended, and a lift of 600 feet gained; this lift being free from water is completely dry; levels have been turned off east and west and driven 150 yards. A balance was driven upon the east side and rooms broke off. The levels on No. 2 lift are still being extended, in driving up the balance. Three places are put up instead of two as formerly. This gives a better opportunity of ventilating places, and leaves safe travelling roads on each side of the balance. There are only nine rooms working on the west side, and I am informed that the men are to be removed to the east side by the latter part of January, where the seam dips less. A new Knowles pump has been put in place of the Blake pump mentioned in last year's report. The coal that was supposed to be lost by the falling in of rooms on the west side of the fault has been regained by driving rooms from the east, coming west through the fault. The management say that it is their intention, this winter, to place a double engine in the fan-house, and a new fan of larger dimensions than the one already there.

Sydney Mines.—I am glad to state that a great improvement has been made in this pit during the year for the safety of men's lives. New travelling ways have been made on the south side, a distance of 1700 yards. On engine and incline planes, where the roadway was found narrow, additional manholes have been driven between the ones there already, according to law. On the north side bankhead landing, where the road was narrow, the place has been made wider for three hundred feet, so that there is now ample room to pass the standing or moving trips. No. 3, or pump deep, has been working since the 27th of May last. This is one of the submerged districts. The deeps have been extended 300 yards in solid coal, and rooms broke off right and left and worked. Electric signals have been placed from them to the engine house, at pit bottom, a distance of 1200 yards. A double line of wire enables signals to be given from any point of the road. Shinner's level district has been stopped for the present. The new angle deeps have not yet gone through the stone trouble. On surface three multitubular boilers have been put in place of as many of the old egg-end boilers.

At the mines of the Eastern Development Co. the following official report of the operations during the year has been issued. The No. 2 shaft was sunk to the 250 feet level, and a cross cut was driven 134 feet to the north cutting the main, or B. vein, which was found to be 32 feet wide, and to yield a considerable proportion of smelting ore assaying from 10 p.c. to 20 p. c. copper, with a little silver and gold. On the new vein lying south of the present workings a shaft has been sunk 50 feet in paying ore, and on the surface it has been traced 1,000 feet. No. 1 shaft was unwatered and repaired, and the drill plant prepared so that a drift would be run into vein B, lying a short distance to the south. The additional drills and compressors alluded to in a previous report have been added to the plant, giving it a strength of ten drills, with two in reserve; and some 3,000 feet of piping has been laid to connect shafts 1 and 3 with the plant at shaft No. 2. On the Argyle area the westward extension of the veins has been further tested, and a point has been selected for a new shaft. About 1,000 tons of ore were extracted and banked.

The quarries of the Bras d'Or Marble Co., at Marble Mountain have been equipped with an excellent plant, including Wardwell Channeller, Gadder, portable engine and boiler, derricks, etc., and work this year will be actively prosecuted. As is well known, the marble deposit is extensive and of the finest quality, some of the white being pronounced by experts equal to the best Italian for statuary, while the colored and mottled varieties are very beautiful and in demand by the trade.

Dr. Edward D. Peters, jr., the eminent copper metallurgist, has gone to the Coxheath copper mines under contract from the Eastern Development Co., limited, to complete plans and specifications for a full plant to hoist, concentrate, calcine and smelt into matte a daily output of 200 tons of ore. Latest advices from the mine state No. 2 shaft down 258 feet, with vein B still holding 22 feet in width. No. 3 shaft down 50 feet and timbered. The company has bonded an additional two square miles of mining rights covering the strike of the large vein in No. 3 shaft and is putting on a surface prospecting force of 100 men to trace that vein on the new areas.

Quebec.

Lievres River.

The General Phosphate Corporation made their first shipment of the season this week, 600 tons of high grade to Hamburg. An important discovery of a bedded deposit of phosphate has been made on the river side of Ross Mountain, and is now being worked with good results. Some 150 men are now at work on the various properties. The plant is not yet completed, but further additions will before long be made; among others an air compressor will be put in.

The boiler-house at Little Rapids was destroyed by fire last week. The new shaft is opening out well, some 3 men taking out from 6 to 10 tons phosphate per week.

The development work on the asbestos property situate on lots 15 and 16 in the 5th range of Portland West, owned by Mr. W. A. Allan, is proceeding satisfactorily. Some promising veins of fine silky fibre are being uncovered.

Eastern Townships.

The Eustis Mining Company, of Capelton, is not at present operating its smelting plant, but is confining itself exclusively to the shipment of ores of various grades and suited for various purposes. The smelting plant at the mine is maintained more for the purpose of taking care of any surplus ores that may not be saleable; but owing to the high price of brimstone, and the consequent quick demand for pyrites that have ruled of late, all the ore mined has been fully sold up, and it is therefore probable that the smelting works will not be operated this year. The ores that are being mined are substantially the same as in former years. They are chiefly low-grade iron pyrites carrying more or less copper and silver, and ores occasionally running high in both. It is a class of ore that requires the utmost economy in its working and treatment, and can ill bear any tax such as the 3 per cent. royalty.

The next monthly meeting of the Asbestos Club will be held at Thetford, on the 28th instant, when Mr. H. J. Williams, superintendent of the Beaver Asbestos Company, will read a paper on the Electric Drill.

Templeton District.

The MacGregor Lake Phosphate Company have struck a fine deposit in their main pit, at a depth of 25 or 30 feet. The phosphate is a rich pale green color. About 25 men and boys are steadily employed.

Messrs. Lomer and Perkins have opened up lot 18 in the 8th range, recently worked by Messrs. Lomer and Higginson, and are stripping some nice shows.

Rev. Curé Forget, of Perkins Mills, has some 16 men opening up his asbestos property near the Goldering mine.

The Netherlands Company are now working on some fine deposits recently struck, and anticipate a good season's output.

The Phosphate Corporation shipped 300 tons by barge through the Blanche river to Montreal on Saturday last from the Murphy mine.

Mr. Thomas Fee is pumping out the old Swamp pit, Jackson Rae mine, and commences working steam drill and hoist this week.

Mr. Koenig, of the Templeton Asbestos Co., is putting in improved iron dump cars at the Ferrans asbestos mine, and is pushing work rapidly.

At the old Blackburn mine great difficulty is experienced in getting pit men and cobbers. Sixteen teams are hauling steadily to the Blanche dump. Shipments by barge commenced about two weeks ago. In about three weeks the water will be too low to barge out of the Blanche, when delivery will be made by the Ottawa river.

The McRae mine, on 5th range, turned out 120 tons last week. Their big show is now 27 feet wide with a 9 foot face, and apparently solid on the bottom. The Edison electric drill and hoist will be shipped from New York this week. Messrs. McRae & Co. intend commencing the improvements at High Falls early in June and expect to have the power ready by the end of that month.

Messrs. McLaurin & Co., East Templeton, and McRae & Co., Ottawa, have, it is understood, purchased the telephone line owned by C. Lionais & Co., and purpose extending the service immediately. This line runs from East Templeton Village to Perkins' Mills, and from thence to the Wallingford property, a distance of some sixteen miles. The new owners will build it a further distance of four miles, giving all the mines in the district this connection.

The ocean freight on phosphate from Montreal to Liverpool and London by regular lines is 7/6 per ton in full. Tramp steamers a shade less.

Great difficulty is being experienced at the mines in the back parts of Templeton in procuring men. The wages now offering for ordinary pitmen are $20 and board; foremen, $25 to $28 and board; boys $8 to $10 and board.

McRae & Co. have commenced opening their phosphate property on lots 5 and 6, in the 2nd range of Masham. Seven men are employed stripping. The ore will be shipped over the Gatineau Valley Railway from the Peche village.

Owing to the high price of oats, teamsters are getting from $3.00 to $3.75 per day, or $2.50 per ton hauling from the Blackburn mine to the river front; from the Mackintosh mine $2.00 per ton.

Dynamite (40% grade), is now being offered delivered at the mines at $16.00 per 100 lbs. in quantities. The Hamilton Powder Co. intend erecting a magazine at Jerry Ferrand's, under the agency of Messrs. J. M. McLaurin and Co., of East Templeton. There are now three companies offering.

Ontario.

Sudbury District.

Geo. Herbert Harrison of Stourbridge, Eng., one of the members of the Iron and Steel Institute, who visited Canada in the fall, is making an extended tour of the Sudbury district for Birmingham and London people. He is after nickel.

A. C. Campbell, of Toronto, formerly the *Globe* representative in the Dominion House, is spending a few weeks in Sudbury.

Mr. R. J. Tough, the well-known owner of mineral lands is about to leave for British Columbia. He will seek the Kootenai district by a route which will take him through some of the great mining regions of the American west and south-west. Should he find conditions to his liking in Kootenai he will make that district his headquarters.

Mr. Emil Michaud, of Paris, France, collaborateur with the celebrated Garnier in some important inventions relating to nickel, is at present at Copper Cliff carrying on experiments with the Sperrylite or platinum ore which is found at the Vermillion mine. There are problems in the treatment of this new mineral still unsolved, but with further experiments it is hoped that a process will be discovered which will yield rich results.

This week the Dominion Mineral Co. paid off about twenty-five men. These were wood-choppers and prospectors. The season for the former is at an end, and the company has given up prospecting for the present. There are now employed at the Blezard mine three hundred men. A consignment of five hundred tons of matte has just been made to Liverpool, and monthly consignments are made to the United States.

Mr. John Ferguson, manager of the Dominion Mineral Co., has been appointed vice-president, and will remove from the Blezard mine when his successor is appointed. As vice-president he will be general overseer of the work of the company. Negotiations are in progress with several parties to fill the position of manager including one from the Calumet and Hecla. On leaving Blezard mine Mr. Ferguson will make his headquarters in North Bay, where he has considerable interests.

A fact which has never before been made public, but which goes to show the tremendous value of the nickel finds made in this region is, that two-thirds of the ore turned out at the Worthington mine is packed and sent direct to the refinery. It is so rich that it cannot usefully be treated in the ordinary smelters. The copper and nickel mix but little in the ore, so that it is possible to select large quantities to be handled by the refineries. Thirty-five men are now employed at the Worthington mine.

Those who contended that the new mining law will kill off prospecting in this district and confine activity to lands already patented, have the mournful satisfaction of knowing that they were right. At this time last year there were a large number of men in the bush looking for new locations. To-day, so far as anybody in this region can learn, there is not a man thus engaged. Many well known prospectors are at home or engaged in connection with claims already secured. Some have already gone to British Columbia or the United States.

Among the recent visitors to Sudbury is Prof. J. C. Jackson, of Chicago, mineralogist and chemist. Prof. Jackson, according to the Duluth *News* of May 3rd, has just returned from a trip to Grand Marais, Minn., on the north shore. He went there in company with Henry Darlington, of Armour & Co., and other millionaires to inspect a copper mine owned by the syndicate. Prof. Jackson went out on the Soo branch to look after some property of the Chicago Nickel Ore Co. On Thursday Prof. Jackson went to examine property owned by Mr. D. O'Connor in the interest of Chicago capitalists who have bonded the lot. He goes thence direct to Chicago.

Mr. T. E. Johnson, formerly of Parry Sound, now of San Jose, Cal., arrived in Sudbury on Tuesday, accompanied by a gentleman from Chicago. Mr. Johnson has made the trip from California specially to look after some nickel property in Denison, which he owns in conjunction with Mr. Henry Lowndes, of Messrs. Flett, Lowndes & Co., of Toronto. Negotiations are in progress with an English syndicate for the sale of the property and development work will be at once begun. The gentlemen who are inquiring after the property are already engaged in mining, and if they purchase they will undoubtedly begin work upon a large scale. Mr. Peter McGregor will be in charge of the development work.

The new analyst at the Copper Cliff mine, succeeding Mr. Sperry, is Mr. David H. Browne, formerly with Messrs. Andrews & Hitchcock, of Youngstown, O.

Port Arthur District.

A report is current that the Crown Point silver mine has been sold to New York people for a sum of $600,000.

Manitoba and North-West Territories.

The output from the mines of the Alberta Railway and Coal Company is now over 1,000 tons per day, about 400 tons of which is consumed in Canada, the balance going to the various business centres in Montana. The company has been engaged in sinking shafts for some time, and it is anticipated, will have an output of 2,000 tons per day before very long, if transportation facilities will admit. There will be no difficulty as regards a market.

No mining has been done at Anthracite for a considerable time. It is understood, however, that the company to which these mines belong has been reorganized with fresh capital, and will recommence operations both here and at some of its Canmore properties.

The Canada North-West Coal and Lumber Syndicate is opening up the Brinkerhoff claim at Canmore. The output from this mine has been about 80 tons per day, but a tunnel is being constructed which intersects four seams of coal, enabling them all to be worked, and materially increasing the output. These seams are of various qualities, so that a variety of requirements can be met. The company intend, it is stated, to open coking ovens, this coal being valuable for the production of coke and gas. Their mines at Cochrane are not now being worked.

A large number of claims for petroleum have been staked out in Townships 1 and 2, Ranges 29 and 30, west 4th Meridian, but nothing has been done in the way of development; and this is not likely to occur unless some combination of interests should be made, as the average claim holder has not sufficient capital to undertake the necessary explorations,

British Columbia.

Kootenai District.

A careful estimate of the men likely to be employed this year in the mines in the Toad Mountain district, says the *Miner*, places the number at 300. Within a month men will be steadily employed on the Silver King, Dandy, Iroquois, Grizzly Bear, Jim Crow, Poorman, Whitewater and Wild Cat, to say nothing of the men at work on the placers on Hall creek and on the gold prospects on the south side of the river and the copper and galena prospects on the north side. Last year the number so employed was less than 75.

The Revelstoke Smelting Syndicate are prepared to purchase all ores of Trail Creek camp, and in fact all ores mined in the district, and Dr. Campbell and Mr. Boyle were at the mines last week to make arrangements with the mine owners for the output of their properties.

Work is to be commenced at once on the road between Nelson and the mines on Toad Mountain.

In sinking on the Democrat, a claim in the Iroquois group, a vein carrying peacock copper ore was struck at a depth of twenty-five feet.

The first dust from the Hall Creek placers was brought to Nelson in the beginning of this month, and is good looking coarse gold. Owing to the snow, no sluicing has been done on any of the claims, but good headway has been made in drain ditches and other preparatory work. It is claimed that these diggings are good for an ounce a day per man.

The Highland, Daniro, and [illegible] W. R., three claims in Hot Springs district, have [illegible] surveyed for Crown grants. In surveying the Highland, a three-foot ledge of carbonate and galena ore was discovered. The new discovery makes the Highland a valuable property, and its owners, J. C. Rykert & Co., are greatly elated

Reports from Goat River district are very encouraging. Several new discoveries have been made lately, chief among which is one by C. C. Sproule and George Long, at a point above "Jap" King's Alice. The owners of the Alice have done considerable work this spring in making trails and roads. Mr. King said that he had been prospecting for a good many years, and for the first time he has got hold of a property (meaning the Alice) that he is not afraid to work or let anyone else work.

At the Silver King the tunnel is in 40 feet beyond the old cross cut and is still in ore. There are now five shifts at work, and preparations are being made to sink a shaft near the intersection of the cross cut and the tunnel. It is rumored that $2,000,000 has been offered for the property, and the proposal is now under consideration by the Hall and Atkins Estates interests.

The terms of the Dandy sale are now on record at the mining recorder's office in Nelson. The price paid for the Kelley and Fox interests—seven-eighths of the whole—was $172,500. Of this amount $50,000 was paid in cash, the deferred payments to be made as follows: $5,000 on June 10th, 1891; $5,000 before October 7th, 1891; $112,500 by April 7th 1892. The Cook interest—one eighth—was purchased for $4,000; $500 cash, $1,000 by June 1st, and $2,500 by August 1st. The price paid for the Dandy is therefore $176,500. A. M. Esler, who purchased the property, will be on the ground as soon as he can get in machinery, and expects to have development work commenced in earnest by July 1st.

A half interest in the Ollie, a claim which joins the Dandy on the west, has been sold to A. H. Kelly; the consideration in the bill of sale being $10,000.

Owing to a scarcity of supplies little is being done in a mining way in Hot Springs district, and little is likely to be done until the snow goes off so as to make it practicable to pack supplies to the mines.

An eighth interest in the Boulder hydraulic claim on Forty-nine Creek, together with interest in several undeveloped prospects, was sold this week for $900—$700 of the purchase money being cash. N. Riopel and J. P. Lamotte were the purchasers and Edward Barker the seller.

Vancouver Island.

The hydraulic mining machinery which will be used on the South Forks of the Quesnelle River, has partly arrived. It is manufactured by the Joshua Hendy Machine Works, of San Francisco.

The following shipments of coal are reported for April:—

New Vancouver Coal Co.	35,181 tons.
Wellington Colliery	16,521 "
East Wellington	4,515 "
Union Colliery	8,700 "

The coal-cutter at the Union mines is giving great satisfaction, so much so indeed that the management contemplate installing additional machines.

CANADIAN COMPANIES.

The Lyndhurst Lead Mining Company of Ontario—Application for incorporation under Ontario laws will be made by the above company for the purpose of exploring for, mining, smelting and manufacturing lead, silver, copper, nickel and other ores and metals, in the county of Leeds. Head office, Lyndhurst, Ont. Capital stock, $100,000 in 100,000 shares of $1. Applicants, H. L. Barker, Lyndhurst; J. B. Perkins, A. W. Petrikin, A. A. Clough and L. A. Clough, Denver, Col., the first four of whom are to be the first directors.

The Leeds Copper Company (Ltd).—This company has been formed to acquire the Leeds copper mines, originally the Harvey Hill mines, at West Broughton, Que. It is virtually the reconstruction of the Excelsior Copper Company on a new basis. The capital stock is £450,000 in £1 shares, which are credited with 18s. 6d., the remaining 1s. 6d. being assessed. The old shareholders have taken up 250,000 shares in London, and of the 110,000 held in Canada 60,000 have been subscribed for. The new board of directors is as follows: J. Armitage J. P., Bradford, chairman; R. Brown, Leeds; R. P. Gould, London; Geo. Bathison, London. No Canadian directors have yet been appointed. The head office is at 19 Broad Street Avenue, London, E.C.

Western Consolidated Mining Company—This company has been incorporated under the laws of the State of Washington, and will be registered for work in Canada, principally in British Columbia. Its objects are the purchase and ownership of mines, mining claims and real estate in Canada and the United States, to acquire water rights, erect plant, reduction works, etc., to mine and dispose of minerals, and generally to carry on a mining and milling business in all its branches, with other customary powers. Head office, Spokane, Washington. Capital stock, $1,000,000 in 1,000,000 shares of $1 each, one-half or $500,000 of which is set aside for development and purchase of other properties. Officers, C. M. Parker, J. B. Sargent, W. H. Lynch, N. A. Parent; secretary, A. J. Lynch, Spokane, Washington.

The Bonanza Nickel Mining Company of Sudbury (Ltd).—Letters patent have been granted by the Ontario Legislature incorporating the above company for the purpose of acquiring, selling, and disposing of mining lands in the province, carrying on mining operations, etc. Head office, Toronto. Capital stock, $150,000 in 6,000 shares of $25 each. Those incorporated are: O. J. Wells, G. B. Foster, T. W. H. Leavitt, W. B. Stephens, Toronto, and J. J. Carberry, Fond-du-lac, Wis.

Anglo-Canadian Asbestos Company.—The *Financial News*, under date of the 18th ult., has the following: "It is pleasant to be able to note that there is one Canadian asbestos company other than Bell's which is doing well. There was a meeting of the Anglo-Canadian Asbestos Company—which our readers may remember was reconstructed some 18 months ago—on Thursday, when the directors were able to recommend a dividend at the rate of 20 per cent. This very satisfactory result is due to careful and efficient management of a valuable property, and there is every reason to hope and believe that if prices remain at anything like their present standard the earnings of the company for the current year will be even more substantial than for the year just closed."

Anglo-Canadian Phosphate Company (Ltd.)—At the annual meeting of this company, held on the 21st ult., the directors' report and balance sheet were adopted and the retiring director was re-elected. Captain R. C. Adams, the managing-director, was present and explained the difficulties that had been experienced during the year. It was decided to continue working on the same lines as last year.

The Alberta Railway and Coal Company.—A Special General Meeting of this company will be held at 37 Old Jewry, London, on Monday, June 15th, at 3 p.m., for the purpose of electing a director.

The Anglo-Canadian Electro-Storage and Supply Company.—This company is applying for incorporation under Dominion laws for the purpose of manufacturing, selling and leasing secondary batteries and all kinds of electric supplies and appliances, also to supply light, heat and power, with authority to construct, operate and maintain systems for transporting materials and passengers by electric power.

Victoria Gypsum Mining and Manufacturing Company (Ltd).—This company will apply at the next session of the Nova Scotian Legislature, for an act to amend its act of incorporation, viz: to fix a mode of procedure for taking and appraising land, where the same may be required, for the purposes of said company and defining certain properties and works as to exemption from taxation. Solicitor for applicants, F. G. Forbes, 37 Sackville street, Halifax, N.S.

Malaspina Red Granite Quarry Company.—A meeting of the shareholders of this company was held on the 28th ult., at Nanaimo, B.C. This quarry was located last year by Major Downie, from whom the company acquired it, the Major retaining ten shares in the concern. The following officers were elected: Mr. J. H. Pleace, president; Mr. W. H. Morton, secretary; Mr. J. Ganner, treasurer, and Messrs. E. Pinbury, L. Manson and Major Downie, trustees. The company was formed with a capital of $10,000, being 20 shares at $500 each.

Eastern Development Company (Limited)—At the annual meeting of the Eastern Development Co. (Ltd.) held at Boston, Mass., May 4th, the following Management was elected: Captain Isaac P. Gragg, president and general manager; Col. Albert A. Pope, Vice-President; M. F. Dickinson, jr., Auditor; Hon. W. E. Barrett, Marcus Beebe, with Thos. Wair, Secretary and Treasurer. 101,000 shares out of 127,000 outstanding, were represented. Treasurer's report showed $31,000 cash on hand, bonded indebtedness, $349,000. Directors have authorized an issue of $1,000,000, 7% twenty years gold bonds; American Loan & Trust Co., of Boston, Mass., Trustees. $350,000 will be issued in exchange for those of the present issue outstanding. An additional $350,000 offered at par, with 50 shares of stock, is a bonus with which to erect works to mine and treat 200 tons of ore per day. Estimated cost of works, $300,000. Balance of $300,000 of Bonds to be reserved subject to action of Directors. Messrs. Irving A. Evans & Co., brokers, at Boston, have undertaken to place the additional bonds. A contract has been made with Dr. E. D. Peters, jr., M. E., to complete plans for full plant, and he left for Coxheath mines on the 7th inst. Col. Brownell Granger, mining captain, reports No. 2 shaft down 270 feet, the main vein on the 250 feet level still holding over 20 feet wide, both breasts in fine ore; Shaft No. 3 in new vein down 60 feet and timbered, new horse chain and shaft buildings completed. This vein promises to be a large one; the 11 x 7 shaft being in ore on all sides, it will be cross-cut at 100 feet depth to ascertain full width and dip.

General Mining Association of London, Eng., (Ltd.)—The ordinary half-yearly general meeting of the proprietors of the General Mining Association (Limited), was held at the offices of the Association, Bloomfield House, London Wall, E.C., on the 24th ult. Mr. James Duke Hill presided, and in moving the adoption of the report and accounts, said the chief feature in the report was a good year at their principal mine of Sydney, in Cape Breton. But unhappily there had been a decidedly bad year at their other mine, Victoria, and the unfortunate results of the operations there had undoubtedly caused a great disappointment to the directors, and had no doubt prevented them from paying an increased dividend. The cause of this was a totally unforeseen one, for no one could anticipate the shortness of labor which occurred, and which was the reason of the diminished output at this mine. He could congratulate the shareholders on the satisfactory results of the operations at Sydney. They had had an increased demand for their coal, and the reduction in the freight had enabled them to have their coal conveyed at a considerably reduced cost. They had also had a lengthened shipping season, and had they been equally as fortunate at Victoria, there could have been no doubt but what the operations would have been in every way satisfactory. Although he did not care to prophesy, still the prospects for the present year were most favourable. They were looking forward to a very considerable increase of coal both at Sydney, and more particularly at Victoria. To grapple with the difficulty of shortness of labour they had made up their minds to send out colliers from Scotland, and 35 men were now on their way. With the aid of these, Mr. Brown, the manager, hoped to materially increase the result of the operations at Victoria during the year. They were aiming at doubling their output at Victoria, for a large output was the life and soul of a colliery. In order to effect this a large number of men was necessary, and to attract labor the Association was doing everything in their power. Sales of coal from the Sydney mines were 156,042 tons, as against 131,751 tons in 1889, and from the colliery worked by the Low Point, Barrasois and Lingan Company 78,033 tons, as against 91,835 tons in 1889. The profits on the year's trading were £8,624, and with £1,566 brought forward, the available balance is £10,191, out of which the directors propose a dividend of 6s. per share, leaving £1,950 to be carried forward. Mr. W. S. Cunard seconded the motion for the adoption of the report and accounts, and this was agreed to unanimously. The retiring directors and auditors were afterwards re-appointed.

Tilt Cove Copper Co. (Ltd.)..The annual meeting of this Company was held in London on the 30th ult. The accounts showed the value of the ores raised in the year ended March 31st to have been £21,764, and after including debenture interest, the debit balance brought forward was raised from £15,575 to £25,991. Smelting furnaces had been erected immediately upon the Cape Copper Company taking over the work, and three were put in operation late in the year, but were soon closed owing to the weather. The experience of the past has shown that it is necessary to smelt their own ore and to mine it economically. These conditions are now being fulfilled. The chairman said that there was a great deal of ore in sight at the East mine, and he was certain that when they had driven Boden's level, situated about 350 feet below the upper workings, and which is progressing at the rate of over 54 feet a month, they would come across a good vein of ore, as the quality improved with the depth. At the West mine he had no doubt but that they would strike some rich pockets of ore, such as were met with in former workings. They had very large deposits of low grade ore also, previously untouched, which would be valuable for flux for smelting purposes, as would also the refuse dumps, which contained a fair percentage of copper. One of the directors stated that the company now saw its way to bringing home the regulus at 7s. 6d. per unit, which they would be able to sell at 9s. 9d. per unit. The combination with the Cape Copper Company, which has leased the mine, seems likely to prove an excellent one. The report and accounts were adopted and the meeting adjourned.

The Canada Chemical Manufacturing Company (Ltd).—Application will be made by the above company for incorporation under Dominion laws. The purposes of the said company are to be the manufacture, purchase, and sale of chemicals and dye stuffs; mining, prospecting, developing, working, buying and selling of minerals, mineral ores and mineral lands; reducing, crushing and smelting iron or copper pyrites and other minerals and mineral ores, selling and disposing of the products of such mines, minerals, mineral ores and manufactures, either in crude or other form, throughout the Dominion of Canada and elsewhere, with other customary powers. Head Office, London, Ont. Capital stock $80,000 in 1,600 shares of $50 each. Applicants, W. Bowman, T. H. Smallman, Eden Smallman, J. H. Bowman, J. B. Smallman, all of London, Ont., all of whom are to be the first directors.

The Tulameen Improvement and Hydraulic Company (Ltd).—The above company is applying for incorporation, under the British Columbia Act, for the purpose of constructing hydraulic or other processes of mining: to own and construct ditches, flumes or other systems of water-ways; to purchase, own, operate and sell mines, minerals, water and water-ways; to build, operate, and own mills, machines or other processes for the reduction of ores, and to sell the same, with other customary powers. Head Office, New Westminster, B.C. Capital stock $60,000 in 60,000 shares of $1 each. Applicants, A. Ewen, J. C. Armstrong, J. A. Laidlaw, New Westminster; J. Wilson, Revelstoke, and T. R. McInnes, Victoria; of whom J. Wilson, J. C. Armstrong and A. Ewen are to be the first directors. The time of existence of the company is to be fifty years.

The Port Haney Brick, Tile and Terra Cotta Company (Ltd).—Application will be made by this company for incorporation, under the British Columbia Act, for the purpose of purchasing and carrying on the brickyards owned by Messrs. Beckett & Co., and T. F. Sinclair & Co., respectively, situate at Port Haney, B.C.; to acquire and work any other brick yards; to purchase, charter, and use steamboats, lighters, scows, etc., and to erect buildings, put up electric plant, etc., with all other customary powers. Head office, New Westminster, B.C. Capital stock, $50,000, in 500 shares of $100 each. Applicants, W. Wolfenden, A. G. Gamble, C. E. Woods, New Westminster, B.C.; H. R. Beckett, Port Haney, B.C.; and T. F. Sinclair, Victoria, B.C.; all of whom are to be the first directors.

Prevost Island Company (Ltd).—Application will be made for incorporation, under the laws of British Columbia, by the above company, in order to purchase and lease lands on Prevost Island, B.C., and other adjacent islands; generally to work, manage and dispose of the same, and the mineral rights, with other powers. Head office, Victoria, B.C. Capital stock $15,000, in 30 shares of $500 each. Applicants, M. W. Tyrwhitt Drake, J. Peters, H. E. Croasdaile, H. Dumbleton, and H. Abbott, all of Victoria, B.C., all of whom are to be the first directors.

E. Broad & Sons (Ltd).—Notice is given in the *Canada Gazette* that application will be made for the incorporation of the above firm. The object of the company is to manufacture edge tools and tools of any kind made of iron or steel or of both iron and steel, and to manufacture handles of wood and any other goods deemed advisable. Head Office, St. Stephen, N.B. Capital stock $40,000 in 400 shares of $100 each. Applicants, W. Broad, St. Stephen, N.B.; J. L. Gilmour, E. Arnoldi, W. B. Gilmour, Montreal; H. S. Burritt, Ottawa, all of whom are to be the first directors.

The Albion Mines Savings Bank.—Notice is given that application will be made at the next session of the Parliament of Canada, to further continue in force the Act incorporating "The Albion Mines Savings Bank" as amended and extended by Acts of the Parliament of Canada passed in the thirty-seventh and forty-eighth years of Her Majesty's reign, and respectively intituled "An Act respecting the Albion Mines Savings Bank," and "An Act to continue an Act respecting the Albion Mines Savings Bank."

Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	—	
Nicola, Limited, £35,000 fully-paid shares of £1	—	
Shuniah Weachu, Limited, £09,888 fully-paid shares of £1	—	
Silver Wolverine, Limited, £68,165 fully-paid shares of £1	—	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	—	
Ditto, £80,000 5½ per cent. debentures	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3¼	3¾
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31 · principal 1904	—	
Ditto, £149,500 fully-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	2⅞	3⅛
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	—	
Ditto, £25,000 fully-paid deferred shares of £10	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	10	10¼
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	—	
Ditto, £5,000 fully-paid founders' shares of £10	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—	
Ditto, £99,850 fully-paid shares of £50	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June 1890, 4. Debentures, £60,000.

North Western Coal.—The deferred shares receive no dividend until 15 per cent per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887 S and 1888 9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos. Reconstructed in 1889. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos. Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on.

The Construction of Details for a Modern Lixiviation-Plant.*

By C. A. Stetefeldt, San Francisco.

A modern lixiviation-plant for the treatment of silver ores with hyposulphite solutions differs so materially from its ancestors, that a critical description of the improvements recently carried out and proposed, will not be without interest to metallurgists. While the general arrangement of such a plant depends upon local circumstances, its details of construction are more or less constant and can be described from a general standpoint.

The plant consists of wooden tanks in which the ore is treated and solutions are accumulated; apparatus for elevating and transferring solutions, and for creating a vacuum below the filters of ore tanks; filter presses and drying chambers for handling precipitates; apparatus for manufacturing sodium sulphide, etc.

§ 1. Wooden Tanks.

Construction.—Tanks should be made of clear, well-seasoned lumber. In the United States, Oregon pine is the best material for this purpose. The staves, from 3 to 4 inches thick, according to size of tank, should be ordered cut to sweep of radius, and from 9 to 10 inches longer than the inside depth, but not "gained" for the bottom. The gaining of the staves, 1 inch deep, is done by hand, leaving a chine of 6 inches below the bottom. In all tanks the staves stand perpendicular to the bottoms. The bottom pieces, 3 to 4 inches thick, are cut to a diameter of 2 inches greater than that of the finished tank; they are grooved and joined by a tongue. All joints must be fitted with precision. White lead should never be put between the staves, but may be used in inserting the tongues between bottom pieces. The understructures of substantial timbers, placed on a solid foundation, should be sufficiently high to allow access to the bottom in case of leakage. The bottoms rest on joists, 3 to 4 inches wide and 10 to 12 inches deep, placed about 2 feet 6 inches apart, so that the staves are left entirely free. Hoops are made of round iron, ⅞ to 1¼ inches diameter, the threaded ends, with hexagonal nuts, passing through forged or cast iron lugs, giving preference to the former. In order to get the full strength of the rods, the threaded ends are taken ¼ inch larger than the diameter of the rod. For tanks of large diameter, each hoop is made in two or three sections; this is necessary to effect a more uniform closing of the stave joints by tightening the nuts in two or three places.

After finishing, the tanks are painted on the outside, staves and bottoms, with three coats of white lead.

Dimensions. Formerly, the dimensions of lixiviation-tanks were taken quite small: Ore tanks not larger than 12 feet diameter and 3 to 4 feet deep; precipitating tanks, solution sumps and storage tanks of corresponding dimensions. In recent works, however, ore tanks of 10 to 20 feet diameter and 8 to 9 feet depth; precipitating tanks, solution sumps and storage tanks of 12 feet diameter and 8 to 9 feet depth are put up. As can readily be seen, the care and attention required to finish a charge in an ore tank, or to precipitate a solution in a precipitating tank, are independent of the size of the vessel: hence, the great advantages of large sizes.

The capacity of an ore tank for twenty-four hours depends upon the specific gravity of the ore, the quantity of first and second wash water, and of stock solutions required for treatment, but principally upon the rate of lixiviation. Capacity increases in proportion to diameter, but remains nearly stationary so far as depth is concerned; that is, the same number of ore tanks will be required whether their depth is 9 feet or only 4 or 5 feet, in order to treat a stipulated quantity of ore per day. In fact, should the rate of lixiviation increase with reduced depth, the same number of shallow tanks would put through in twenty-four hours more ore than deep ones. The principal advantage of increased depth consists, therefore, only in reducing the number of charges treated.

Sluicing Tailings.—Where water is abundant, tailings are now removed by sluicing, and great depth of the charge is no disadvantage. Even where water is scarce, and tailings have to be removed by hand, deep tanks should be used. It is only necessary to provide mechanical means for moving above the tanks large buckets into which the tailings are shovelled.

Filters for Ore Tanks.—The false bottoms for the filter and the latter itself, are prepared as follows: Wooden slats, 1¼ inches high and 1 inch wide, and separated 1 inch from each other, are fastened to the bottom. This has, so far, been done with iron screws, bedded in white lead; I would suggest pins of hard wood. The inside of the slats, next to the bottom, is cut out in many places, ¾ inch deep and 3 inches wide, so that a free passage of the solution below the filter is established. Between the ends of the slats and the staves a clear space, 1½ inches wide, is left. A strip of wood 1¾ inches high and one inch wide, previously cut with a saw in many places, and well soaked in water, so that it will bend easily, is now fastened round the slats, leaving an annular space ½ inch wide between the strip and the staves. One thickness of stiff matting, covering the slats and the circular strip, but not the annular space, forms the foundation of the filter cloth proper. The latter, No. 10 canvas duck, is cut to a diameter 6 inches greater than the inside of the tank, so that the ends can be pressed into the annular space described above, and kept in position by forcing down a half inch rope.

Sluice Gates.—A gate for sluicing tailings is illustrated in the *Trans.*, vol. xv., p. 350. The discharge opening should be 18 to 20 inches wide and 8 to 9 inches high. The door is covered with a sheet of rubber, and should be suspended by a counter-weight when removed. For very large ore tanks, say 18 to 20 feet diameter, it is desirable to have two sluice gates diametrically opposite to each other. The bottom of the gate should be flush with the filter.

Solution Outlets for the Ore Tanks.—These are made of 2 inch, 6 ply rubber steam hose, which is inserted in the following way: A piece of clear plank, 3 or 4 inches thick, is fastened to the bottom of the ore tank with wood screws, and a hole, having the exact size of the outside diameter of the hose, is bored through the bottom and the plank, at a flat angle of about 30°. Through this hole the hose is forced. All joints are made with thick white lead, the wood screws being also bedded in this material. A pin of hard wood is finally driven through the end of the hose into the wood. If the solution hose is permanently connected with a Montejus (see § 6) for producing a vacuum below the filter, and leaching with water from below the filter, is desirable, a second hose should be inserted in the bottom of the tank and connected with the water pipe. Finally, a third outlet may be provided and connected with a Koerting ejector or a geyser pump (see § 7), if circulation of extra solution is necessary.

Launders for Solutions in front of Ore Tanks.—These launders, 6 inches wide and 8 inches deep, are made of clear 1½-inch lumber, and painted inside and outside with asphalt varnish. They are placed level, and should be held together with properly constructed braces. Connection with precipitating-tanks is made by 3-inch, six-ply rubber hose, which is inserted in the same way as the hose in the bottom of the ore tanks, but the hole is not bored slanting.

Launders are needed as follows: One for silver bearing wash water, one for waste water, one for solution, one for weak solution. If it is desirable to treat ore at different periods with cold and hot solutions, and to keep these solutions in rotation separately, a fifth launder must be added. Launders are either placed a short distance below the ore tanks (from bottom of staves to top of launders, about nine inches), and above the precipitating tanks (about 6 inches from bottom of launders to top of precipitating tank); or 5 to six feet above the top of precipitating tanks, and below the upper floor round ore tanks. The first position is taken, if no artificial means are used, to increase the rate of lixiviation; the second if the rate of lixiviation is increased by a Montejus with vacuum. (See § 6). The high position in the latter case is necessary to give sufficient head to the discharge through the 3-inch hose of the launder, when the solution is suddenly pressed up from the Montejus.

Boxes for Chemicals.—Solutions introduced to the ore tanks are first conducted to a wooden box or barrel, with holes in the sides, standing on top of the charge. This prevents stirring up of the ore by a strong current of solution. These boxes also receive the copper sulphate and sodium hyposulphite for making extra solution in the ore tank.

Tail Races.—If tailings are discharged by sluicing, proper attention should be paid to the construction of tail races. Their inclination depends, of course, on the specific gravity and coarseness of the material; it should never be less than ¾-inch to the foot.

Precipitating Tanks.

Stirrers.—For stirring by hand, an oar of ash, 16 feet long, is used. Mechanical stirrers are, however, far superior to hand-stirring. The best form of a stirrer is a propeller screw of about 2 feet diameter, making 120 revolutions per minute. The screw revolves about 1 foot above the bottom of the tank. Since the lower end of the propeller shaft can not be very well left without a guiding bearing, and at the same time should be protected against the corroding influence of the solution, it is enclosed in a heavy glass tube, held in position by rubber nipples and iron washers. The guiding bearing is made of *lignum vitæ*.

Stirring solutions with air, as described in the catalogues of the Koerting Bros., is very effective. Some trials have recently been made with air stirring at the Marsac mill; but it remains to be seen whether this method decomposes sodium hyposulphite in perceptible quantities or not.

Decanting Pipes.—The decanting of the clear solution, after precipitation, is done by a swinging 2-inch gas pipe, working through a stuffing box. An illustration of this arrangement is found in the paper of Mr. Daggett, *Trans.*, xvi., 446. The pipe is marked there 4 inches, which is too large. When a propeller stirrer is used, the pipe moving up and down cannot pass through the center of the tank, but must be shifted 18 inches away from it.

Outlet for Precipitates.—Precipitates are discharged by a 2-inch asbestos-packed angle cock, inserted close to the bottom of the tank through the staves.

Launders.—In front of the precipitating tanks are launders, leading the decanted solution to the solution sumps, and running decanted wash water or weak solution to waste. If cold and hot solutions are kept in rotation separately, two launders must be placed in front of the silver precipitating tanks, one leading to the sump for cold, the other to that for hot solution. The launders at the back, conveying precipitates to the storage tanks for sulphides, wash water precipitate and lead carbonate, should be inclined, with a fall of about 4 feet in 100 feet. These launders are constructed in the same way as those in front of the ore tanks, but need not be so large.

Storage-Tanks for Precipitates.

These are made about 10 feet in diameter and 3 feet deep. A 2-inch rubber hose forms the outlet for precipitates through the bottom. A 1-inch decanting-pipe for solution is inserted through the staves about 1 foot above the bottom. Both outlets are connected with the press-tank.

Solution-Sumps and Storage-Tanks.

These should be made of the same diameter as the precipitating-tanks, but about 1 foot less in depth. Two of each kind should be provided, especially where solutions are heated, and hot and cold solutions are kept in rotation separately.

§ 2. Precipitating-Tanks for Wash-Water.

If it is desirable to precipitate silver and copper from the water by scrap-iron and sulphuric acid, the process is best conducted in the apparatus described and illustrated in my book, "The Lixiviation of Silver-Ores," page 159.

§ 3. Sodium Sulphide Tanks.

The sodium sulphide mixing tank is made of cast iron, 3 feet diameter and 7 feet deep. Its great depth is necessary because the concentrated lye foams considerably while adding the sulphur. The bottom is covered 1 inch deep with lead, to prevent its wearing out where steam is admitted for heating the lye. The two sodium sulphide storage tanks, receiving the diluted solution, are made of ⅜-inch boiler iron, about 6 feet in diameter and 5 feet deep. All the tanks are provided with 1½-inch asbestos-packed cocks. It may be desirable to increase the contents of sodium hyposulphite in the solution by rapid oxidation. For this purpose a gas pipe coil, perforated by numerous small holes, is placed on the bottom of the tank and connected with an air compressor. The air is then forced in small bubbles through the solution. Material and size of tanks for Solvay soda solution are not of importance.

§ 4. Apparatus for Heating the Stock Solution.

Apparatus for heating stock solution can be placed either in the solution sumps or in the storage tanks, depending on the most convenient location of the boilers. Coils of lead pipe, through which steam is conducted, are very effective, but unfortunately, not sufficiently durable to warrant their cost. Although lead is not attacked by a pure hyposulphite solution, the stock solution contains sulphates and chlorides, and these may form lead sulphate and chloride, both soluble in hyposulphite salts. Besides, we have to consider that the stock solution is never entirely free from silver, and copper.

At the Marsac mill, heavy cast iron pipes one foot in diameter have been substituted for lead coils with satisfactory results regarding durability and cost.

I suggest giving to these heaters the shape of large, round, hollow disks, for a more economical utilisation of steam.

Either heaters should be provided with steam traps, or the escaping condensed water and steam should be conducted to the feed water tank for the boilers.

(To be continued).

*Trans. Am. Inst. of Mining Engineers.

Handling Pig Iron.—A method of removing pig iron from the pig-beds, has been designed by Mr. J. L. Bogert, and is intended to dispense with manual labor. The apparatus consists of two grappling devices, of four hooks each, suspended from trolleys running on a traveller which spans all the pig-beds. The grapples are driven by steam pistons, and are worked by a man and a boy. They take up several pigs at once, and can remove the iron as soon as it is cool enough to retain its shape.

MACHINERY MECHANICS & INVENTIONS

Suspension Cableways at the Tilly Foster Iron Mines, Tilly Foster, N.Y.

The great rock and ore excavation at Tilly Foster, N.Y., has attracted an immense amount of interest among engineers and contractors. Through the courtesy of the Lidgerwood Manufacturing Company, the prominent hoisting engine manufacturers of New York, Chicago and Boston, we are enabled to present in this issue several interesting sketches, made by them, illustrating this property, and the working of the suspension cableways—a superior system of hoisting and conveying.

Fig. 1 is a general view of the mines looking south-west.

Fig. 2 is a plan showing the location of the cableways and railroad tracks. The plan shows an opening 450 feet long by 300 feet wide on the top; the depth of the pit is about 300 feet.

In Fig. 3 we have a view of a number of workmen filling the skip in the pit. It will be noticed that however rough the floor of the pit the skip may be landed equally well, and the workmen in filling it do not have to lift rock higher than 16 or 18 inches.

Fig. 4 shows a cross section of the mines directly under the incline cableway No. 1.

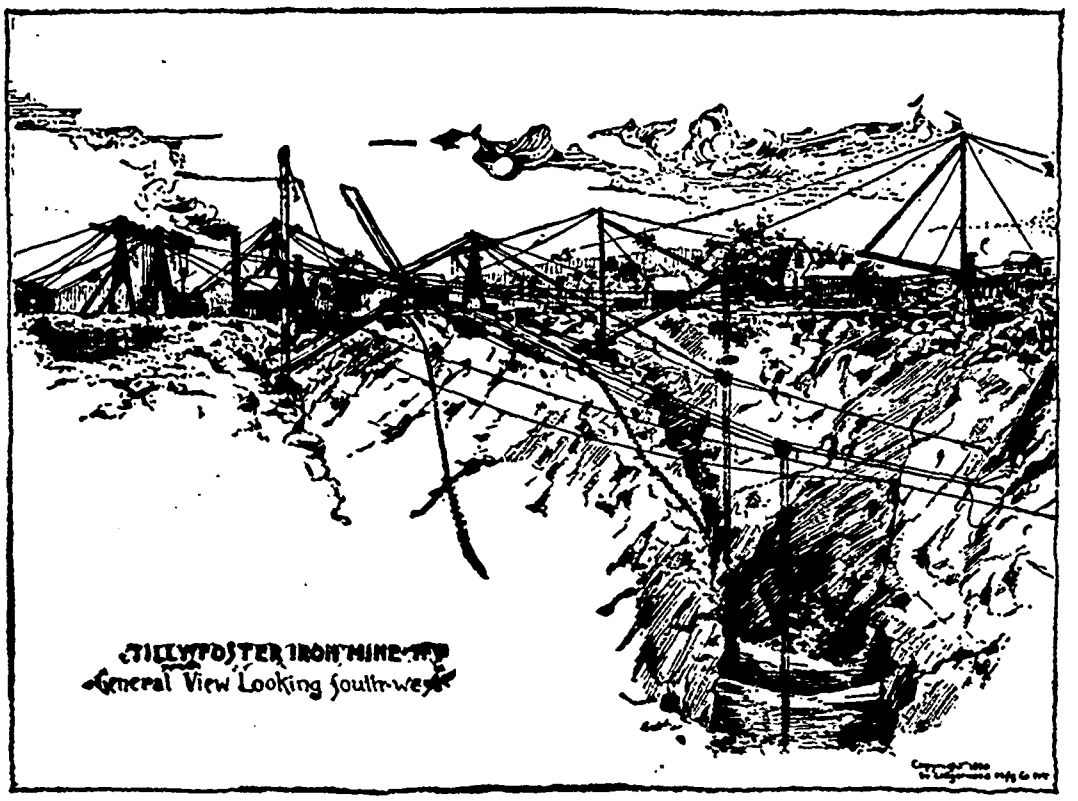
The cable carriage is shown at the top of the pit in the act of delivering a skip to the flat car on the railroad track.

Fig. 5 shows a cross section near the incline cableway No. 3, and the horizontal cableway No. 4. A year ago the No. 3 cableway was remodelled with the Miller patent, and its working is much improved. The invention refers to the device which supports the hoisting or fall rope. It is shown in the smaller sketch, and consists of a simple wood and iron carrier which follows the carriage down the incline until stopped by a small steel button secured to an auxiliary rope placed above the main cable. A second carrier stops at a larger button further down the incline.

Fig. 6 is a good illustration of the carriage and the two fall rope carriers, one having just been stopped by a button too small to show in the drawing.

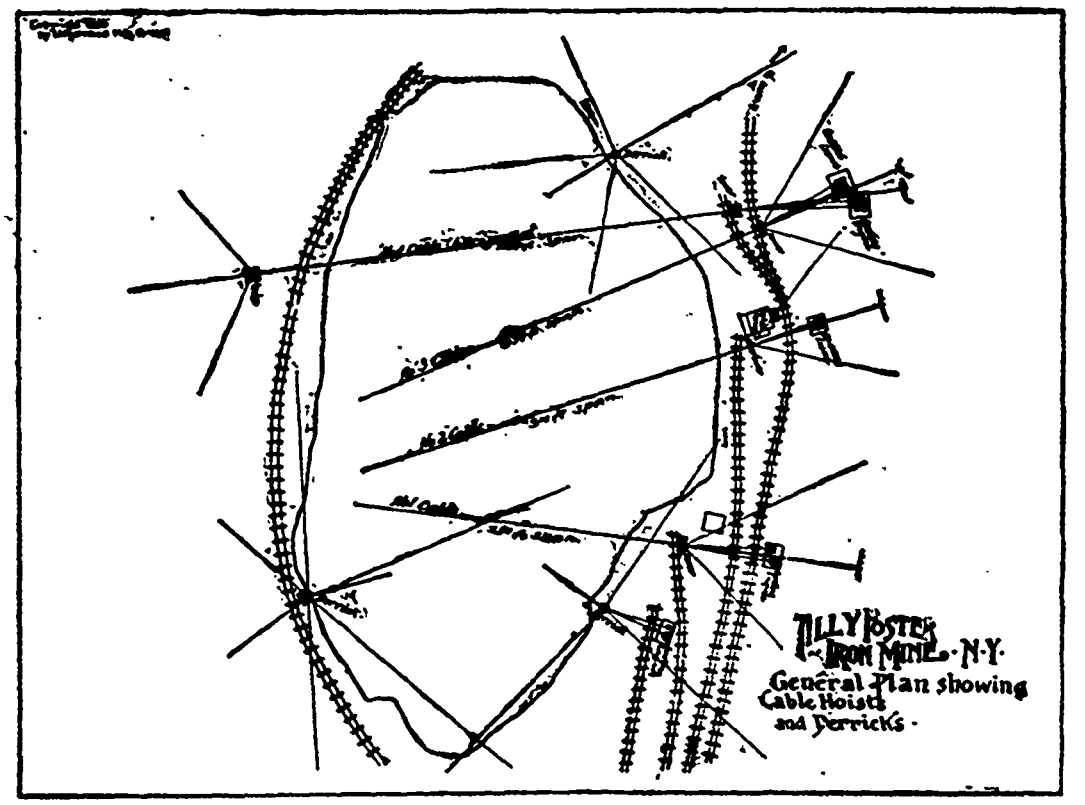
The cost of operating these cableways is something less than eight dollars per day, in the course of which an average of 150 trips can be made. Each load being about a cubic yard, makes the entire cost for hoisting, conveying and delivering, 5 cents per ton. In this work there are employed by the contractors, Messrs. Stephens and Arnold, about a dozen Lidgerwood hoisting engines of the latest improved pattern; in fact with one exception, the Lidgerwood engine is used to the exclusion of every other kind.

The cables were made by at least three different wire rope makers. All the cableways, however, are under patents controlled by the Lidgerwood Manufacturing Company. The illustrations were drawn by one of the Lidgerwood Manufacturing Company's staff of draughtsmen, and are copyrighted.



Practical Care of a Boiler.

The conditions most essential in a steam boiler are safety, large capacity, economy of fuel, durability, facility for inspection, cleaning and repair, compactness, and a first cost as low as compatible with these conditions. Some of these conditions may not be compatible with all the rest. When this is found to be the case the purchaser must decide which one he wants most, and those which he must sacrifice. It is most important that a boiler should be properly set. When a boiler refuses to draw well, or when the gases of combustion escape up the stack without losing much of their heat, it is safe to assume that the boiler is not properly set. The evidence that a boiler is properly set will be seen in the proper performance of its duties. That is to say, its capacity will be as great as it should be. Further evidence of proper setting will be dryness of steam, comparative coolness of gases of combustion as they enter the stack, and freedom from excessive deposit of sediment in places.



The water in a boiler should never be allowed to get too low; very often the first indication of dangerously low water in a boiler is the explosion of the boiler. Sometimes the earliest indication is a rupture of the whole shell, or rupture of the tube, or collapse of the flue without any explosion, or the indication of the water being dangerously low, may be sudden increase of pressure, red hot places on the shell, or bulging out, or coming down of part of the bottom.

The best place to connect the feed water pipe to a boiler is where the water in the boiler is the coldest. In this position the connection is less likely to leak and danger will be avoided.

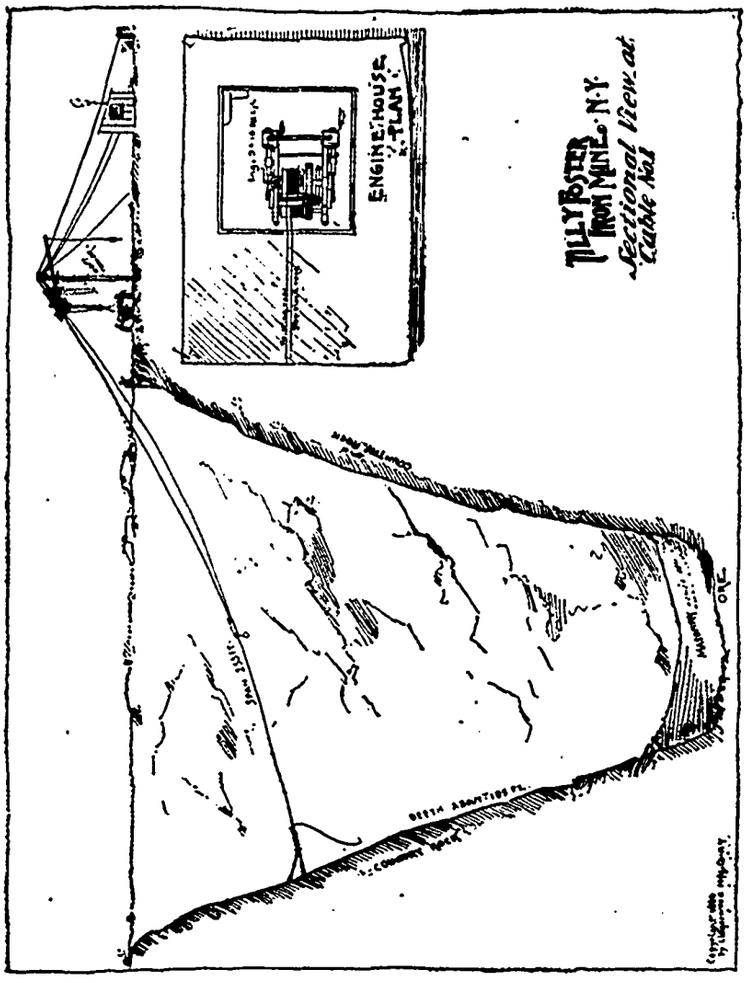
The life of a boiler may be greatly prolonged by a careful avoidance of over-pressure, over heating, and corrosion, as these are the most detrimental influences to which a steam boiler is subjected.

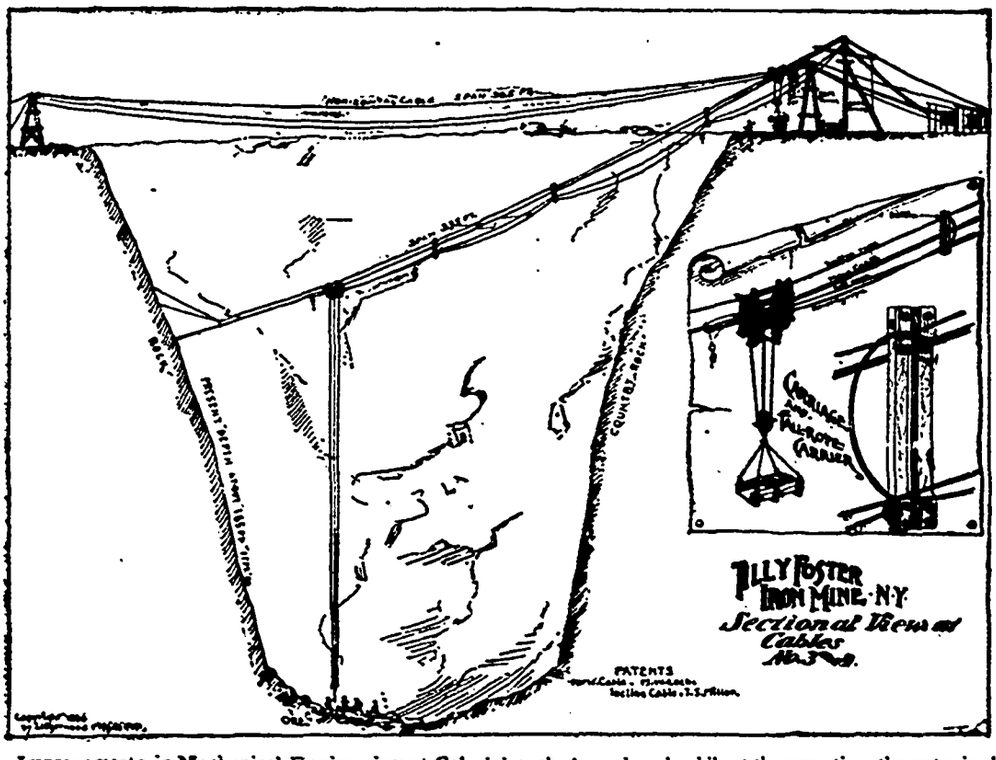
A boiler that has been out of use for some time should not be entered with a light without having first had the air which it contains driven out by a fan jet and a hose, or some other means.

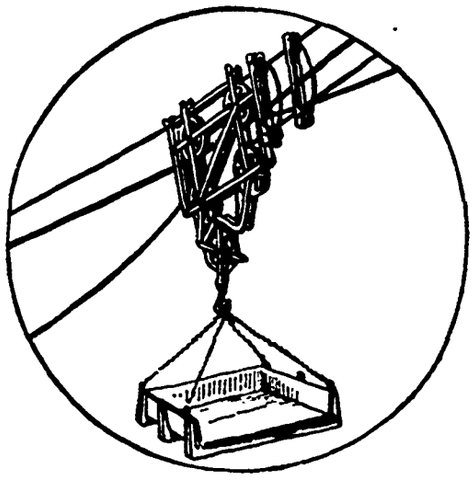
An engineer should be careful to ascertain that the steam gauge is recording the true pressure of steam carried on the boiler; he should test this with another gauge known to be correct, or with a steam gauge indicator of known accuracy. An engineer asked how he could prove that his boiler was not overtaxed with pressure. Well, the fact that it did not blow up was, in one sense, a proof that it was not overtaxed. But the best thing to do is to keep the pressure below the limit guaranted by the maker, and then such proof will not be necessary.

Some boilers explode, while others burst; yet explosion is only one way of bursting. Explosion is bursting with noise and violence, while rupture is bursting without either.

Minute inspection will tell what care a boiler has had, and it is important that means should be taken to ascertain that a steam boiler is being properly cared for. This inspection should show the interior free from deposits of sludge or scale and from fitting and corrosion; the exterior should be free from corrosion and bleeding; there should not be any great quantity of soot or ashes deposited in flues or water tubes; and the water itself should not bear any sign of having taken from the boiler any of its substance. The brickwork should be sound and in good shape, not falling down or even bulging, and not having any air leaks between the bricks. All pipe joints should be tight, and no leaks or fissures should show themselves. The best means should be used to prevent corrosion. Rust or discoloration may be readily removed by a wire brush and paraffin oil, but that cannot restore the metal which has been corroded away.







Improvements in Mechanical Engineering at Collieries.—The following is taken from a paper on Recent Improvements in the mechanical Engineering of Collieries, read by Mr. Emerson Bainbridge, before the English "Institution of Mechanical Engineers." "The trouble of travelling pumps in a sinking shaft has been avoided in a new winning in Yorkshire, by using a new pump devised by a Salford firm. It is suspended in the shaft by capstan ropes. The pump consists of a vertical steam cylinder with two hollow plungers attached, one on each side. The plungers are enclosed in two sliding barrels passing in the one piece downwards into one pipe of about double the diameter, which forms another hollow plunger with valve at the top. These barrels are connected to the piston of the steam cylinder above. The barrel into which the lower plunger works has a suction valve at the bottom of it, and is connected to the steam cylinder by tie bolts. The pump acts thus: As the piston and lower plunger rise the water follows the latter through the suction valves into the lower barrel, while at the same time the water in the two upper barrels is forced up the rising main. On the down stroke the water in the lower barrel is in turn forced through the delivery valve into the upper barrels, and thence to the rising main. Six of these pumps have been put into two sinking shafts near Doncaster. Together they are capable of raising 5,000 gallons of water per minute through a height of 300 feet.

"Steel rail guides in shafts at Nunnery Colliery are considered not successful. Counterbalancing in winding does not appear to be much considered in fitting up winding plants. Scroll drums seem presently the favorite device, but their great weight in a measure counteracts their effect. One of these at Ynysyhwfi Colliery varies in diameter from 18ft to 33ft, and coal is drawn therewith from a depth of 500 yards in 35 seconds. At a colliery in Derbyshire 170 yards deep, the speed of winding and changing is such that three cage loads are raised per minute.

"At Nunnery Colliery a Priestman oil engine is pumping 40 gallons of water per minute through 1,700 yards of pipe and a vertical height of 400ft. The quantity of oil used is from 1¼ to 1½ pints per actual horse power per hour. In another case the cost for labor and petroleum is 1¼d. per horse power per hour. To mi[illegible] the danger from fire the rising main is connected with four of Grimmell's sprinklers in the engine room, which act if the temperature reaches 155° Fahr

"Springs are in use at Nunnery Colliery to reduce the shock of the cages landing in the pit bottom. Four spiral springs are used to each cage, and at the landing they yield about two inches, the compression diminishing by half as the cage rests, and increasing again to two inches as the load is placed upon the cage. These springs also decrease the strain at the commencement of the winding.

"Elliot's lubricator for hutch axles consists of a layer of felt within a cap of steel. The felt is said to be capable of absorbing sufficient oil to last for three months."

New Feature in Mine Prospecting and Development—The Sullivan Diamond Drill Operated by Electricity.

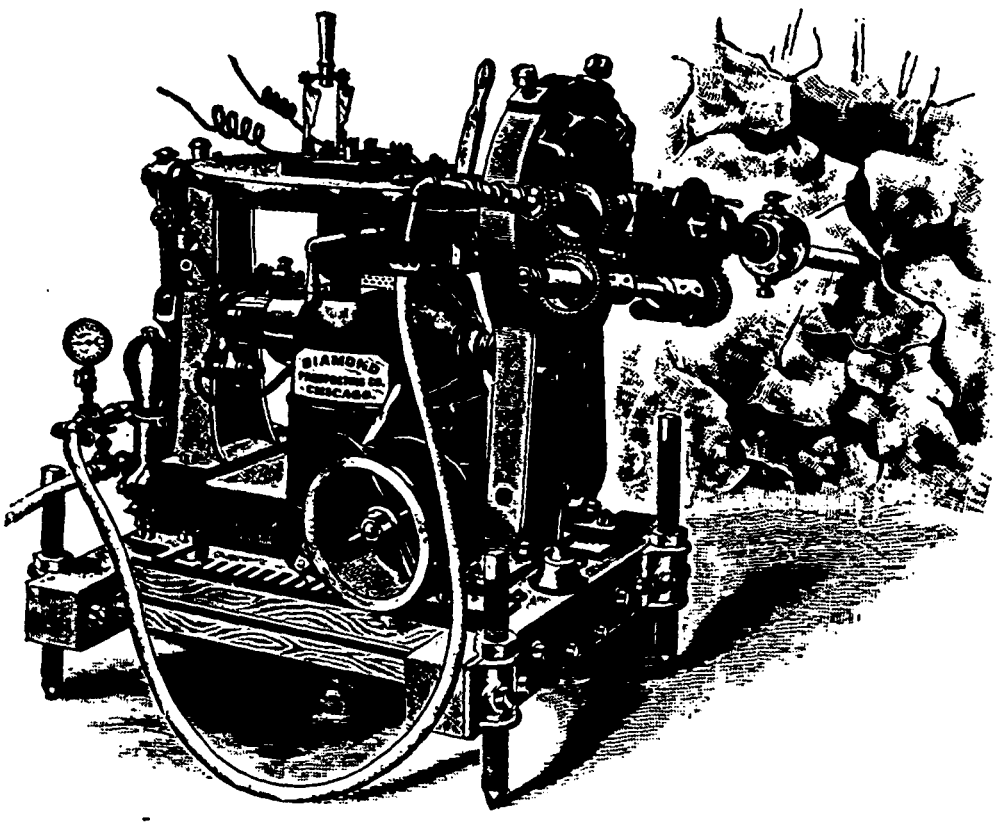
The increasing employment of electricity in mining operations has opened a new field for the diamond prospecting drill. This drill has for a number of years been widely used, driven by steam or compressed air, and sometimes by hand or belt power, in nearly all the mining regions of the country. Its use brings to the surface a solid core of all the rock and mineral formations, showing accurately the depth of the mineral deposit, its quality and thickness. The most recent improvement in this class of machinery consists in adapting the diamond drill to be run by electricity.

The electric diamond drill manufactured by the Diamond Prospecting Co., 15 and 17 North Clinton street, Chicago, has been mentioned in the scientific papers in the course of its development. The engraving presented herewith represents the perfected type of this drill, which has been in practical use for some time.

One of the difficulties in the way of the use of the diamond drill underground, and in rough mountainous localities, has been to get power to the machine, as the nature of the surface of the country may make it impracticable to get heavy boilers and machinery close to the mine opening. Even where this can be done, there still remains the great difficulty and expense of getting fuel to the boilers, if the mine opening is located, as often happens, on a mountain top and where timber is scarce; and a further difficulty arises where compressed air is not used as motive power, from the fact that the use of steam underground, besides being unsatisfactory for power and uncomfortable for the men, is often a source of great expense owing to damage caused by the action of the exhaust steam on the mine timber and rock.

The Electric Diamond Drill avoids all difficulty in these respects, and will permit core drilling to be undertaken to advantage in places where it has hitherto been impracticable. The dynamo can be located near an engine or water wheel at any distance, and the power carried easily and inexpensively to the drill, which can be on a mountain top, in a deep shaft, or in any part of the mine. Any constant potential electric current of sufficiently low voltage for safe use underground and of sufficient capacity to deliver three horse power at the drill motor, can be used. The current for running the drill can be taken from an electric plant already installed for lighting, hoisting or other mining operations; or if no electric plant is in use for such work, a small dynamo and water wheel or engine can be put in purposely for the drill at slight expense.

The device for feeding the drill bit forward in this machine is a combination of the ordinary gear-feed, with a friction clutch intervening, which not only avoids danger to the diamonds, but also results in the most efficient and economical drilling.



All parts of the machine, including motor, drill, pump and hoisting drum are conveniently arranged on a single frame, which can be mounted on trucks for moving about the mine. Switches, resistance box, etc., are provided for safety and convenience.

The Sullivan Electric Diamond Drill is the first and only electric diamond drill that has been put into practical operation; and that it has been successful in the new field is demonstrated by the following letter, which will be interesting to managers of mining companies who are now considering the advisability of introducing an electric power plant:—

FRED. G. BULKLEY,
Gen'l Manager, Aspen, Colo.

J. G. WHEELER,
President, 64 Wall St., New York.

THE ASPEN MINING AND SMELTING CO.

ASPEN, COLO., March 2nd, 1891.

THE DIAMOND PROSPECTING CO.,
17 N. Clinton Street, Chicago, Ill.

Gentlemen:—We have been using for several months one type "R" Sullivan Diamond Drill, the first one manufactured, (at the request of the writer) and find that it does satisfactorily all the work required of it.

The drill is operated by a three-horse power Thomson-Houston Electric Motor, and is used for prospecting the country rock adjoining old drifts, levels and stopes, so that considerably more time is lost in moving the drill from place to place and setting it up within the confined limits of mine workings, than would be the case were we operating upon the surface. We use two bits giving us either a 15-16 inch core, or 1 and 15-16 inch core as we may desire.

The rock penetrated consists of rather hard limestone, containing in places bands of very tough siliceous rock, while at other points it is badly shattered and intersected with clay seams. The progress made varies from 6 to 28 feet per shift of 8 hours; 15 feet per shift, including all time lost in moving, setting up and drawing cores, being the average. We are sending in holes at every angle with the horizon but seldom penetrate to a depth greater than 100 feet.

During the month of February last ou[r] [dri]lling work was conducted intermittently, the total a[mount] drilled being 577.5 feet, progress being made at the [rat]e of 1.66 feet per hour, loss in carbon amounting to 1 and 41-64 carats, and the exact cost including all expenses being 68 cents per foot; of course, much more time is taken up in moving and setting the drill, and in drawing cores, than in actual boring operations.

Upon two occasions we have found rock so badly shattered and intersected with large clay seams and "vugs" that the drill could not be operated to advantage, but under all ordinary conditions we are enabled to penetrate the rock, the only difficulty being that the core comes out in very small fragments and is sometimes difficult to save. With the 15-16 inch bit, core fragments vary from two to fourteen inches in length. With a larger bit much longer fragments are obtainable.

We feel entirely satisfied with the information gained by the use of the machine, which has more than paid its cost, while some discovery of ore has made the undertaking profitable.

Yours very truly,
FRED. G. BULKLEY, General Manager,
The Aspen Mining & Smelting Co.

Fireless Locomotives for Mines.—C. Rolland has constructed a fireless locomotive for use in the collieries of Mons, Belgium. It is provided with a tank holding 19½ cubic feet of water heated to 205° C.; that is to say, at an absolute tension of 16 atmospheres. The heating is effected by means of steam jets in a boiler at the surface. This suffices for an ordinary run of 1½ to 2 miles. By the employment of this superheated water, a considerable amount of work may be stored in the form of heat in a comparatively small space, and this heat gradually evaporates the water required for driving the engine. The reservoir has a capacity of 19.43 cubic feet, the locomotive works with 6 horse power at a speed of 6½ feet per second. Thus, working day and night, one locomotive takes the place of 12 to 18 horses, and also renders a number of workmen unnecessary. According to an estimate for a mine 600 yards in depth, with a haulage distance 600 yards in length, the cost of haulage with the fireless locomotive is £196 annually, whilst that with horses is £440. Thus there is an annual saving of £224. Besides the direct economy, there are other advantages accruing from the use of the fireless locomotive in collieries. These are: (1) absolute safety from the dangers and discomforts of fire and smoke; (2) preservation of the mine in hygienic condition on account of the absence of horses and their stables; (3) absence of all the incidental expenses associated with horse haulage; and (4) low consumption of of steam, and good ventilation caused by the movement of the air current created by the locomotive. The lightest type of locomotive built at the Hohenzollern works for this use is 9,920 lbs. The author's locomotive only weighs 6,610 lbs. For a track with a gauge of 23.62 inches, the breadth of the engine is 32·29 inches, and its length 9 feet 10 inches. An automatic steam pressure regulator is provided, and also means whereby the driver can control the working. In conclusion, the author proceeds to calculate the efficiency of the engine.

A Smoke-Consuming Appliance.—Among the more recent appliances for the mitigation of the smoke-nuisance is one recently invented and now being brought into the market by Mr. John Payne, manager of the firm of George Wright & Co., Rotherham, Eng., ironfounders. The appliance consists of a simple arrangement on each side of the furnace which reduces the space for the consumption of fuel, and forms a channel along which air passes into a hollow bridge, where it is discharged in a heated condition. This heated air, intermixed with the smoke and gas as it leaves the furnace, converts it more or less into a flame, thereby increasing the heat-power acting on the boiler producing steam. The inventor claims that fuel to the extent of 20 per cent. is saved, that there is a thorough consumption of smoke, and that the appliance has the advantages of inexpensive fixing, which may be adapted to existing boilers, whilst no special skill is required on the part of the men employed in firing. The appliance has been patented, and already considerable orders have been received by the firm for its manufacture. The firm are exhibiting it in actual use at their works.

Coal-Washer.

M. Max Evrard† describes a modification of the ordinary piston or hydraulic jigger having an arrangement for scraping the surface and removing the top of the washed layer of material under treatment. A rectangular sieve 10 by 3½ feet is fixed on a pyramidal hutch, and has a plunger-box on one side, and a continuous, adjustable discharge opening on the other. The plunger is circular and smaller in area than the sieve. It is worked by an adjustable eccentric. A scraper-frame receives a slow forward and quick return motion by means of a counterweighted lever and cam. The frame is larger than the sieve, and is connected with the slide which closes the feed-hopper, so that the fresh material is fed at the beginning of the stroke. The length of stroke is 20 inches, and the teeth on the forward stroke drag the finer parts of the material forward, and disturb the material six times during its travel along the 10 foot sieve. The suspension rods are arranged so that the scrapers are lifted clear of the material during the return stroke, unless very dirty material is being treated.

The dirt from the hutch is discharged at intervals through pipes in the bottom. When unclassified coal is treated, the washed material is subjected to a final screening, giving lump coal and slack with 10 per cent. of ash. The fine coal, raked off by the last and deepest teeth of the scraper, is pushed over a draining-apron into wagons.

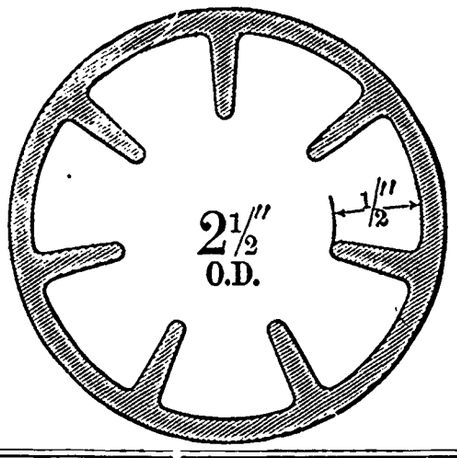
These machines are worked at 43 to 45 strokes per minute with the expenditure of 4 to 6 horse-power per double machine, and average 15 tons per hour. This plant has been or is being adopted at six collieries in France, four in Belgium, and three in Spain.

The Biggest Stationary Engine in the World.—At the Friedensville Zinc Mines, six miles south of Allentown, Pa., there is in operation the largest stationary engine in the world. During the past few months it has pumped dry, by under-ground drainage, nearly every ore pit, spring and small stream within a radius of five miles. The engine is known as the "President." is of 5000 horse-power, and is run by 16 boilers. At each revolution of its ponderous wheels a small stream is thown out, the number of gallons raised every minute being 17,500. The driving wheels are 35 feet in diameter and weigh 40 tons each. The sweep-rod is 40 feet long. The cylinder is 110 inches in diameter, while the piston-rod is 18 inches in diameter and makes a 10-foot stroke. The engine has a ballast box capable of holding 60 tons, and to feed the boilers 28 tons of coal are required daily. On the engine is the largest nut in the world. It is hexagonal in shape, and weighs 1,600 pounds. To tighten or loosen this nut 20 men are required, while the wrench that fits it is 20 feet long From the end of the walking beam of the engine to the bottom of the shaft the distance is 300 feet. The masonry on which the engine rests is 108 feet deep, some of the foundation stones weighing five tons. The engine operates four pumps, three of which are 30 inches in diameter, and the fourth 22 inches.

† Bulletin de la Societe de l'Industrie Minerale, vol. iii. p. 317.

Serve's Patent Ribbed Boiler Tubes.

Below are appended the results of tests made at Elizabethport, N.J., of Serve's ribbed boiler tubes, with comparisons with the ordinary plain type. These show that there is a decided economy in their use as far as stationary boilers are concerned. A very significant fact noticeable in the data is that the temperature of the chimney is very much reduced. With natural draft the average temperature of the chimney gases where plain tubes were used was about 682°; on the other hand, when the ribbed tubes were employed, this temperature was reduced to 396° on one day's test, and 492° on another. In the first of these two days the natural draft was for some reason or other less than usual, and therefore the passage of the gases was slower, and that probably accounts for the discrepancy of nearly 100° which is found in the figures for the two days. When a draft of one-half inch of water was used, the average temperature of the smoke box gases for two days' run with plain tubes was about 830 Fahr., and with the ribbed



tubes the temperature averaged about 454°. With a forced draft of ⅞ in. water the temperature of these gases when plain tubes were employed rose to an average of 956°, whereas, with the ribbed tubes and the same forced draft the average temperature of these gases was but about 511°. It will thus be seen that there was a decided saving by the ribbed tubes when a moderately forced draft was employed. There seems to be no good reason why a similar economy, differing only in degree, should not be obtained with the more severe forced draft common in locomotive service.

The records of fuel economy show the ribbed tube in the same favorable light. The pounds of water evaporated per pound of coal with natural draft and plain tubes averaged 5.07½ lbs., whereas, with ribbed tubes under the same conditions it was 7.37 lbs. With a forced draft of ½ in. of water and plain tubes it was 5.99 lbs., and with ribbed tubes 7.55 lbs., and when the forced draft was increased to ⅞ in. of water the average for plain tubes was 4.68 lbs., and 6.75 lbs. for ribbed tubes, the average economy of all the tests being about 30 per cent. in favour of the Serve ribbed tubes.

	Date of trials, April, 1891.	Draft in inches of water.	Average temperature of chimney gases per pyrometer.	Average temperature of feed water.	Pounds of feed water evaporated during trial.	Pounds of coal fired during trial.	Pounds of ashes and unconsumed coal on grate and in ashpit at end of trial.	Pounds of picked out unconsumed coal in this.	Pounds of ashes in ashpit and on grate at end of trial.	Pounds of ashes per 100 pounds of coal.	Pounds of combustible consumed during trial.	Pounds of water evaporated per pound of coal fired.	Pounds of water evaporated per pound of combustible.	Pounds of combustible consumed per square foot of grate in trial.	Weather.	Barometer.	Outside temperature.
PLAIN TUBES.	6	⅛	679.05	191.03	4230	855	194				676	4.95	6.28	12.05	Clear day, very light breeze.	29.91	42°
	7	⅓	685 15	189 54	4475	861	210½	119	91½	9.05	665	5.20	6.73	11.87	Clear day, still.	29.98	42°
	8	½	800 6	186 72	8325	1388	239¾	97¼	142½	9.27	1162¼	5.997	7.16	20.17	Clear day.	30.23	48°
	9	½	856.4	186.60	8380	1400	259¾	107½	152½	9.84	1154¼	5.985	7.26	20.61	Clear, very light breeze.	30.46	51°
	10	1⅜ ÷ 3½	990	187 30	8460	1777	298	143	155	7.99	1493	4.76	5.66	26.67	Dull, no rain.	30.53	44°
	11	⅞	922.73	186.75	8190	1780	369½	173	196½	10.15	1425	4.60	5.74	25.44	Rainy day, coal wet, ashes damp.	30.17	53°
RIBBED TUBES.	15	⅛ less 3½	395.6	198.11	5025	745½	266¼	183	83¼	9.3	493¾	6.74	10.10	8.80	Fair.	29.78	73°
	16	⅛	492 45	194.27	5250	655½	164	75¼	88¾	11.01	505½	8.01	10.38	9.02	Fair.	29.98	60°
	17	½	468.78	186.3	10830	1487	325½	141¼	184¼	11.25	1176	7.28	9.21	21.	Clear.	30.09	62°
	18	½	438.22	191.77	11050	1394½	299¾	144	155¾	10.08	1108¾	7.92	9.96	19.80	Clear.	29.83	59°
	20	⅞	502.	179.1	12180	1808¾	375¼	172¾	202½	10.34	1447½	6.73	8.41	25.84	Clear.	30.15	63°
	21	⅞	519 68	181	12200	1800	350	123½	226½	11.60	1464	6.77	8.33	26.14	Cloudy.	30.36	53°
	23	1⅛	742 73	183 21	13935	1879½	339	114½	224½	11.037	1554½	7.41	8.32	27.57	Clear.	29.56	70°
	25	1⅛	678.33	170.	14000	2144½	342¾	160¾	182	7.93	1815¾	6.52	7.71	32.41	Fair.	29.58	52°

THE RESULT CONDENSED.

Pounds of coal consumed per 100 pounds of water evaporated.			Economy of Coal, %	Increase in steam generated.	Increase by Serve's tubes over plain tubes.	Total evaporation.	Evaporation per pounds of combustible.	Extreme evaporation in 8 hours.	DURATION OF TRIALS.	Pounds of feed water evaporated in both tests		Average temperature of feed water.		Pounds of coal used in both tests.		Pounds of water evaporated per lb. coal.	
Draft.	Plain Tubes.	Ribbed Tubes.								Plain Tubes.	Ribbed Tubes.	Plain Tubes.	Ribbed Tubes.	Plain Tubes.	Ribbed Tubes.	Plain Tubes.	Ribbed Tubes.
Natural Draft ⅛	19.72	13 65	30 83%	18.03%	Natural Draft ⅛	18.03%	57.54%	8460 lbs. For Plain Tubes.	Two 8-hr. tests with natural draft, ⅛ in. water.....	8705	10275	190.28	196.19	1716	1401	5.08	7 35
									Two 8-hr. tests with forced draft, ½ in. water.....	16705	21880	186.66	189.03	2788	2881.5	5.98	7.60
Forced Draft ½	16.7	13.21	21.08%	30.97%	Forced Draft ½	30.97%	32.68%	14000 lbs. For Ribbed Tubes.	Two 8-hr. tests with forced draft, ⅞ in. water.....	16650	24380	187.02	180.05	3557	3608.75	4.68	6.75
									One 8-hr. test with forced draft, 1⅛ in. water.....		13935		183.21		1879.5		7.41
Forced Draft ⅞	21.37	14 8	30 74%	46.46%	Forced Draft ⅞	46.46%	46.84%	Increase. 65.5%	One 8-hr. test with forced draft, 1⅛ in. water.....		14000		170.		2144.5		6.52

Each day's trial lasted 8 hours. 32.35 lbs. of wood and 150 lbs. of coal were used to kindle the fire and to raise steam to 70 lbs. pressure, after which the trial immediately commenced. Steam was kept at 70 lbs. pressure and the water level at 7 inches in the glass as nearly as possible, and both were at these points at the end of the trial. In trial of 25th alone steam was kept at 100 lbs. pressure in order to obtain the high draft and dry steam. The water level was also about 3 inches in the glass. The soot scraped out of the plain tubes after the 6 days was 2¼ lbs. That scraped from the Serve tubes after the 6 days' trial was 3 lbs. The last 2 days' trial was with ribbed tubes alone, to determine the limit of efficiency in comparison with the plain tubes, which was reached with the latter at ½ inch draft pressure.

The quantities and results are taken as they are marked on the daily logs *without any calculated reductions*. The boiler was a usual upright tubular of 42 inches diameter with 36 inch furnace, 24 in. high and with 63 tubes 2½ in. O. D. × 6 feet long. 7 square feet grate surface. 287 square feet fire surface.

A Progressive Company.—The Jeffrey Manufacturing Company, whose success in the manufacture of mining machinery has been so remarkable, has opened an office and salesroom at 48 S. Canal Street, Chicago, where they will keep on hand a large stock of sprocket wheels, and a full line of roller and detachable chain belting, and all their special appliances for the rapid handling of materials either in package or bulk. Their specialties include all kinds of conveyors and elevators for handling coal, ores, grain, stone, coal pilers and railroad coaling stations. Their detachable chain belt will fit any standard make of wheels. The Jeffrey drill and coal mining machines operated either by electricity or compressed air, are pronounced by mining engineers to be the best machines yet devised for the purpose. The shops from small beginnings now cover five acres and owing to the rapid increase of their business, they have recently purchased three acres adjoining their works, on which, during the coming summer they will erect additional shops. Mr. John H Gregg, who has a wide experience in their special line, is the engineer in charge of the Chicago branch.

The Profits of the Bessemer Process.—Sir Henry Bessemer himself is authority for the following remarkable statement of the profits of the steel process which bears his name. He says:—"Some idea may be formed of its importance as a manufacture, when I state the simple fact that on the expiration of the fourteen years term of partnership of our Sheffield firm, the works, which had been greatly increased from time to time entirely out of revenue, were sold by private contract for exactly twenty-four times the amount of the whole subscribed capital of the firm, notwithstanding that we had divided in profits during the partnership a sum equal to fifty-seven times the gross capital; so that by the mere commercial working of the process, apart from the patent, each of the five partners retired after fourteen years from the Sheffield works with eighty-one times the amount of his subscribed capital, or an average of nearly cent per cent. every two months—a result probably unprecedented in the annals of commerce."

Cage-Props.—Mr. E. B. Clarke, (Proceedings of the Federated Institution of Mining Engineers, vol. i., p.p. 209-211), describes the Strauss system of colliery cage-props which has been in use for over three years in Belgium. During a trial of two months, 78 cages per hour were drawn, and this number was increased to 88 per hour after the adoption of these props. This is equal to from 1,000 to 1,100 tons per day with two deck cages. The prop is pivoted to a link, and rests on a steel block. The link is hung on a fixed pivot and is drawn back by a lever, so as to withdraw the prop when it is desired to lower the cage. The withdrawal can be performed with the whole weight of the cage resting on the prop. The ascending cage knocks the prop up as it passes, and then falls back on it.

IRON STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, May 26, 1891.—During the past month the Scotch pig iron market has fluctuated to a considerable degree, and especially during the past two weeks has been in a very excited state. The comparatively small quantity in public yards enables speculators to control the market much better than they have hitherto been able to do, and the excitement in the present instance is due to a squeeze on the "bears." Almost all the warrants for immediate delivery are in the hands of London speculators, and they have taken advantage of their position, and forced buyers to cover themselves at very high prices. Warrants, which a month ago were selling at about 45/-, have gone as high as 54/3, but the last reports show that a drop has again taken place, the market closing on 25th inst., at about 52/6. That the advance in the price of Scotch warrants is entirely speculative may be seen by comparing them with Middlesbro' and Hematite irons, which have hardly advanced at all during the past few weeks. This movement of the market has injured legitimate trade very much, as ordinary buyers are simply holding off until prices come down to their normal figures. It is expected that the next week or two will see a return to the figures that were current a few weeks ago.

Makers' brands have not changed to any extent, and a steady business has been done, especially on the Continent of Europe. On this side of the Atlantic, however, the demand has been very small and the quantity of iron that has arrived by the first steamers cannot compare with what used to be shipped when buyers in Canada were restricted almost altogether to Scotch iron. The amount of iron in yard or on dock here is limited, and prices have been about as follows: "Summerlee" $21.50, with common brands such as "Carnbrae" and "Eglinton" at $1 to $1.50 less.

American brands have not fluctuated in price to any extent, and Western founders are in the meantime supplying their wants from that source. There is no doubt, however, that prices are abnormally low, and a considerable advance is expected at a very short date. There is no profit at the prices that are now being quoted, and some of the Northern furnaces will be blown out rather than continue to sell at present figures.

Finished iron continues low in price and ordinary bars are selling as before at $2 to $2.15 according to quality. Hoop iron and band iron are also extremely low.

The feature of the local market during the past month has been the extraordinarily low prices of cut nails. We understand this is due to the breaking up of the Association which formerly existed among nail manufacturers. Nails have been sold down as low as $2 per keg, although the ordinary price is about $2.10. It must be obvious that this cannot last long, and it will be better for all concerned if some arrangement was come to to prevent such cutting in future.

Tin plates for immediate delivery are still high in price, but for July and August shipment from England considerably lower figures are now asked. It is understood, however, that several of the tin plate works will close down after their contracts for American shipment are finished in June. They have been running up to their fullest capacity for the past year at exceptionally high prices, and they feel that they can take a rest rather than manufacture at the low prices which will now be current.

Canada plates are held in Montreal at $3 per box, and it is hardly likely that any will be shipped from England before August, when prices will doubtless be somewhat lower.

Business in the other departments of the metal trade continues quiet without very much variation in prices.

London, May 12, 1891.—There is not much change to note in the general situation, but it appears to be a fact that the upward course of Scotch warrants has to some extent stimulated legitimate buying, and has also rendered producers rather firmer in their views. This steadier tendency has been confirmed and emphasised, also, by the considerable decrease in Cleveland stocks, and the continued withdrawals from Connal's stores at Glasgow. The squeezing of the "bears" has gone on very steadily, and on their covering purchases the operators of that ilk have had to pay pretty smartly. The London ring have the keys of the situation, and have "let out" warrants at their own prices. It is asserted that the squeeze will not be over for some time to come—indeed, we have communications from enthusiastic "bulls" predicting much higher figures than those which have yet been reached. This may or may not be correct, but in any case it is obvious that the whole thing is a piece of market manipulation which has but a slight relation to the actual state of the trade. Yet it has to be remembered that these fluctuations *do* affect legitimate transactions, and that the effect, so far, has been to give some stimulus to purchasing. There is rather more being done in many branches, but work is being much hindered in most places by the effects of the influenza epidemic. Pig iron is rather steadier all around, owing to buying by consumers, who are believed to be quite bare of stocks, and the better indications afforded by the Cleveland returns for April. Smelters are holding out for 1s. or 2s. more per ton, and in most cases are obtaining the advance. In the London warrant market there have been considerable purchases by the bears, many of the Glasgow operators having to come here to secure warrants for covering their bear sales. It is understood that one of the largest oversold accounts has been dealt with "by arrangement;" but in other cases it is believed that fuller prices will have to be paid.

Scotch Pig Iron Warrant Market.—Following is our usual statistical table:—

Scotland.

	1891.	1890.	1889.	1888.	1887.
Price of Scotch warrants, May 5	48/11	45/2	44/1	38/1½	41/-
Furnaces in blast in Scotland, May 5	57	87	76	87	81
Quantity of iron in public stores	511820	779283	1029948	977112	869907
Shipments of Scotch pig iron for week ending May 2	5379	9808	9562	8182	6649
Do. since beginning of year	77036	150469	141790	132428	137559
Middlesbro' iron imported at Grangemouth, week ending May 2	8346	2440	8340	6380	7336
Do. since beginning of year	125016	44929	131740	122101	127105

Cleveland.

Price of Middlesbro' No. 3 warrants on May 5	39/9	44/7½	39/-	31/-	33/4½
Furnaces in blast in Middlesbro' district	91	105	103	96	92
Quantity of iron in public stores*	218916	129582	240988	310581	335925
Shipments of pig iron from Middlesbro' for week ending May 2	20100	16990	25924	21484	17166
Do. since beginning of year	271536	230827	339239	316385	267759

West Cumberland and North Lancashire.

Price of hematite M/Nos. warrants	49/6	54/4½	49/-	41/3	42/9
Furnaces in blast in W. Cumberland and N. Lancashire	39	47	47	50	54
Quantity of iron in public stores†	160127	331299	422307	436882	318140
Shipment of hematite iron for week ending May 2	8295	14826	8166	8257	11969
Do. since beginning of year	175925	293944	188463	156252	195337

* Connal's & N. E. Rly. Co's.
† Workington, Maryport, and Barrow.

New York, May 26th, 1891.—Business is in a stagnant condition in the iron market owing to the strike of the foundrymen and house-smiths. No transactions of any importance have transpired, and the whole portion of the trade of which New York is the centre, is at a standstill. There is some prospect however that this state of affairs will not last very long, as the strikers begin to show signs of weakening. The lumber boycott, which has been a strong help to the house-smiths, is already broken, while among the foundrymen, the moulders who went out merely in sympathy, have about made up their minds to return to work. The pig iron market is very quiet, but is also very steady. Prices have shown no signs of weakness since the beginning of the labor troubles here, the only effect having been deferred deliveries. In the case of Southern irons even, there has been a marked stiffening in prices, and it is now impossible to secure any standard brand of No. 1 X iron for less than $17.50. This firmness is due to the increased demand for this class of iron in the West, and the great reduction of stocks at Southern furnaces. Indeed there is said to be scarcely any banked there at the present time. We quote prices as follows: Northern, No. 1 X, $17.50 @ $18; No. 2 X, $16.50 @ $17; Southern, No. 1 X, $17.50 @ $18; No. 2 X, $16.50 @ $17. The volume of business in spiegeleisen and ferro-manganese has been very small, and many dealers report no inquiries. The situation in the ferro-manganese market abroad continues unchanged, and prices here remain at the same level. We quote: Spiegeleisen, 20%, $27.50 @ $28.50; ferro-manganese, 80%, $64 @ $65. Some sales have been made at the latter figure.

Cleveland, O., May 23, 1891.—The reserve stocks of iron in this vicinity have been thoroughly cleaned up and there is an immediate want of available pig metal for conversion into mill and foundry iron necessary for building operations already under way, and some of the furnacemen knowing that the cutting off of any manufactured article carries with it a shrinkage in demand, hope to further stimulate the present demand for pig iron by resuming production, when feasible, even though there may be an actual loss in first transactions, trusting to subsequent business to "even up." It must be said, however, that this impression is by no means general in the market, and that there are a majority of producers who say that they will certainly remain out of blast until iron can be sold at a profit, no matter how long they have to wait for it. Manufactured iron, which a few weeks ago experienced a slump, is up again, bar iron selling at about $1.65. Sales were reported not long ago at $1.55 at the mill, so that the later price is a decided improvement. Sheet iron, which sold as low as $2.70 for No. 24, is also selling more firmly, and there is considerable demand for channels and other forms of combination iron for building purposes and structural work generally. The strike of the ore handlers continues, and there is little prospect of its early settlement. The dock companies, in self-defense, cannot pay more here than is paid at adjacent and competing harbors for the same class of work, and as the difference between employees and employers is about 30 per cent., it will be seen that the prospect of an agreement is very slim.

Copper.—The American copper market has been weakening off, and it is understood that recent sales of Lake copper have been made at 12¾c., and bids for further quantities solicited at lower prices. There seems to be no doubt that the large lake companies, as well as the smaller mines, are very anxious to make sales, and a knowledge of this fact has influenced the market, with the result that lower prices had to be accepted. No large transactions have as yet taken place at the lower figures, buyers appearing to be under the impression that lower prices will be accepted later on, and consequently holding off as much as possible. Other kinds of copper have declined in sympathy, Arizona bars being more freely offered, and Arizona ingots being now obtainable below 12½c. In the London market there has been some advance lately, owing to speculative buying, but the movement was limited to G. M. B. copper. Prices reached £52 12s. 6d. spot, and £53 7s. 6d. futures, but have eased off again to about £52 spot, and £52 10s. for futures. Statistics to hand show a decrease of 3,000 tons for the first half of May, which decline is chiefly due to the withdrawal from warehouse of large quantities of furnace material. We quote: English Tough, £54 10s.; Best Selected, £56 10s.; Strong Sheets, £59 10s.; India Sheets, £57 10s.; Yellow Metal sheets, 5½d.

Lead.—Quite an advance was experienced in New York last week, a sudden demand having sprung up, and 4.35c. has been bid for large quantities, and even 4.40c. for futures. Consumers seem to be badly stocked, and should the trade show any new signs of activity throughout the country, higher prices may rule for some little time. Smelters are offering but limited quantities, and as far as known, large stocks are not in existence anywhere. The London market is somewhat weaker, and late quotations are: English, £12 10s.; Spanish, £12 10s.

The American Iron and Steel Trade.—The annual statistical report of the American Iron and Steel Association for 1890, just issued by Mr. James Swank, contains a great deal of most valuable information. The growth of some of the leading products is set forth in the following table. The tons are of 2,000 lbs., and the kegs of nails are 100 lbs. each:—

Net Tons of 2,000 lbs. (except Nails).

	1887.	1888.	1889.	1890.
Pig iron, including spiegel	7,187,206	7,268,507	8,516,079	10,307,028
Spiegeleisen	47,598	54,769	85,823	149,162
Bessemer-steel ingots	3,288,357	2,812,500	3,281,829	4,131,535
Bessemer-steel rails	2,354,732	1,552,631	1,691,264	2,091,978
Open-hearth steel ingots	360,717	352,036	419,488	574,820
Open-hearth steel rails	19,203	5,261	3,346	4,018
Crucible-steel ingots	84,421	78,723	84,969	79,716
Rolled iron, except rails	2,565,438	2,397,402	2,576,127	2,804,829
Rolled steel, "	902,156	1,201,885	1,384,364	1,829,247
Iron rails	23,062	14,252	10,258	15,548
Pig, scrap, and ore blooms	43,306	39,875	36,260	30,783
Kegs of iron cut nails	3,419,578	2,170,107	1,778,082	1,806,130
Kegs of steel cut nails	3,489,292	4,323,484	4,032,677	3,834,816
Kegs of wire nails	1,250,000	1,500,000	2,435,000	3,135,912
Iron and steel wire rods	.....	313,341	407,513	511,951

The production of pig iron reduced to tons of 2,240 lbs is 9,202,703, which is an increase of 21 per cent. over the total for 1889, and 41 per cent. more than in 1888. The production of Bessemer-steel ingots last year was very much the largest in the history of the American steel trade, being 3,688,871 gross tons of 2,240 lbs., or nearly 26 per cent. greater than the total for 1889. The output of Bessemer steel rails last year was 1,867,837 gross tons, which was an increase of 23 per cent. over 1889. The American production of open-hearth steel is still very far below the English, although it amounted to 513,232 gross tons, which was 37 per cent. over the total for 1889. It is of interest to note, in connection with Southern developments, that of basic steel there were produced 62,173 net

tons, almost wholly by the open-hearth process. The production of crucible steel is set down at 79,716 net tons, or 71,175 gross tons, a decrease of about 6 per cent. as compared with the total for 1889.

Phosphorus in Iron and Steel.—It is generally known that phosphorus is very objectionable in iron and steel, as it makes the iron cold short and the steel brittle. Now, in the manufacture of iron by the puddling process, the phosphorus is eliminated by *liquation* to a large degree, so that iron may be puddled even though it contain from ½ to 2 per cent. of phosphorus. But when M.. Henry Bessemer invented his process for making steel, he found that he could not eliminate the phosphorus because he made the steel in a liquid state, and a liquid cannot be liquated under such conditions, therefore he required iron ores for his process that would not leave more than one-tenth of one per cent. of phosphorus in the resulting steel, and this demand made the Bessemer iron ores of a high-priced class.

A few days since a gentleman came into my office, and said that he had a mountain of the best and purest iron ore in Texas, ever known, and showed me a statement that charcoal pig metal could be made at that point from this ore at a cost of $10 per ton. He said that the analysis showed that it was very low in phosphorus. I replied that I was sorry to hear that the phosphorus was so low, for the iron in his ton of pig metal was only worth three-quarters of a cent a pound, while the phosphorus that was in it was worth 10 cents per pound, more than 13 times as much as the iron. And, although he was pretty well posted in general, he was astonished to hear that we are now in a quiet way making about 1,000 tons of steel per week; this steel contains 67 lbs. of phosphorus in each ton, which is 67,000 lbs. I then oxidize this phosphorus to P_2O_5 by adding the following amount of oxygen, 86,128 lbs.; thus producing phosphoric acid, 153,128 lbs. We then add fresh lime, 612,512 lbs.; which gives us phosphate of lime, 765,640 lbs. We then grind this phosphate and bag it and sell it as odorless phosphate; the price is one cent per pound by the bag, $18 per ton in less than car loads, and $15 per ton in 100 ton lots. The sales will average about $16 per ton at the works. Now, 765,640 lbs. at $16, gives us $6,124.12 per week for the phosphate that we make in extracting the phosphorus out of 1,000 tons of metal.

This phosphate is a new chemical compound, never known until I produced it by the practice of the basic process. It proves to be the quickest and finest plant food ever used, and is now in great demand for fertilizing the orange groves of Florida. It makes the oranges to ripen quicker, and makes them heavier with luscious juices than ever known before. It is also in demand by the grape growers, for they have found that the stinking phosphates, when used on grape vines, give the grapes a flavor not their own, and as the odorless phosphate which I produce from the steel is as odorless as wood ashes and as healthy as a sunbeam, they use it on grape vines so as to secure a more delicate flavor in the grape. It is also now being used largely by the truck gardeners as a fertilizer for vegetables for table use. And people are now beginning to inquire, "are we not carrying bacteria to our tables, and thus swallowing disease germs with our food, when we eat vegetables fertilized with decaying matter."

I gave my Texas expert this and more than this, and he has gone back to Texas to hunt for a phosphoritic iron mine, so that, in dull times like these, he can make a handsome profit by giving the steel at cost, and selling the phosphate for a compensation, together with the satisfaction that he is making the richest, the cheapest and the finest plant food ever known, and warranted free from the deadly bacteria that are so often carried from the slaughter-house to the farm, and then to the graveyard.—Jacob Reese in *Iron Trade Review*.

The Outlook for the Iron and Steel Trade.

American Manufacturer.

The outlook for the iron and steel trade for the near future is by no means a cheerless one. But that the trade should be better and the outlook more promising, will be generally conceded. An analysis of the conditions as they exist and the causes which have brought these about will not be out of place.

At the time of the beginning of the strike in the Connellsville coke region early in February last, and the voluntary shut down of the furnaces in the Mahoning and Shenango valleys, which had taken place in January, it was confidently expected and predicted in the trade that if the strike mentioned proved of long duration, an improvement in prices would take place owing to the scarcity of pig iron, which would result from the shutting down of so many furnaces. But this has not taken place. Of the furnaces in blast in Western Pennsylvania and the Mahoning Valley of Ohio on January 1st, excluding one stack running on spiegel, the weekly production was 50,301 tons; in the same territory, February 1st, 36,575 tons; March 1st, 28,897 tons; and on April 1st it had diminished to 25,187 tons. From these figures it will be seen that for the past three months the production of pig iron in this district has been steadily and rapidly decreasing until to-day it is barely fifty per cent. of what it was at the beginning of the year, yet there has not been a great reduction of stocks, only about 50 per cent.; prices are lower and there is less activity in the trade, and that too at a time when in the natural course of things there should be a good demand for pig iron for manufacture into structural material and supplies.

Noting these facts the question arises, why is there not a better demand for structural material, which would induce a demand for pig iron. We believe the present eight-hour agitation in the building trades is in a large measure responsible for the depression which exists, and until this is definitely settled we do not believe any marked improvement in the iron and steel trade can be looked for. Added to this fact too is another, and that is that there is a comparatively small amount of new railroad building projected for this season, and this of course has its effect upon the steel rail and structural material business.

It is noticeable in this city, and scarcely less so in others, according to reports received, that little new work is being done, and builders stand aloof from making any contracts on account of the uncertainty as to the cost of labor for the coming season. Instances can be pointed out where work has already been begun, but has been suspended pending the settlement of the question of how mony hours shall constitute a day's work. A large quantity of other work, which under ordinary circumstances would have been carried out, is being at least delayed, if not indefinitely postponed, pending a settlement of this matter. The absence of this demand from the ordinary volume of business has made itself felt severely in the iron and steel market, in the want of "tone," which a lack of inquiries is sure to induce, if for no other reason.

If the present agitation continues, and especially if a

Mail Contract.

SEALED TENDERS, addressed to the Postmaster General, will be received at Ottawa until noon, on Friday, 15th May, 1891, for the conveyance of Her Majesty's Mails, on a proposed Contract for four years, six times per week each way, between Winchester and Osgoode Station P.O., from the first June next.

The conveyance to be made in a suitable vehicle via the Post Offices at Ormond, Vernon, Dalweny, West Osgoode and Osgoode Station, and also via the residence of Mrs. John Ferguson, Lot 21, Con. 6, Tp. of Osgoode, three times per week, in the event of a Post Office being established at that point.

Printed notices containing further information as to conditions of proposed contract may be seen and blank forms of Tender may be obtained at the Post Offices of Ormond, Vernon, Dalweny, West Osgoode, Osgoode Station and Winchester, and at this office.

F. HAWKEN,
P.O. Inspector.

Post Office Inspector's Office,
Ottawa, 8th April, 1891.

general strike for an eight-hour day in the building trades takes place, as now seems almost inevitable, the iron and steel trade cannot escape being seriously crippled throughout the whole season. For building operations which consume such a large tonnage of the output of our mills will be either so late in opening, and so many will be held over until next season that the demand for material will be necessarily small in comparison with what it usually is.

It is perhaps well that this agitation, if come it must, come throughout all the trades at once. And when its settlement is effected it may be for all of them. For the past few years the trades have been in a constant state of agitation over the question of hours and wages and union and non-union matters. One has been no sooner settled than another has come up to act as a disturbing element. It cannot be said that, so far as a real settlement of the matter is concerned, what has been done amounts to any more than a skirmish as compared with a well defined campaign. A little has been gained here and there, but no settlement can be said to have been arrived at. About all that has been done is the keeping of all parties concerned in a state of uncertainty and uneasiness so far as the general course of business is concerned.

If a campaign is at hand, it is probable that both sides are as well prepared for it as they ever will be. In the iron and steel industry the conservatism which has characterized operations during the past six or eight months more than at any recent preceding period, has put manufacturers in a position to bear the burden as well as they ever can, and better than at almost any time in the past. And the labor leaders claim to have their organizations so perfected and of such strength that concerted effort can be made.

TENDERS.

SEALED TENDERS marked "For Mounted Police Provisions and Light Supplies," and addressed to the Honourable the Minister of Railways and Canals, Ottawa, will be received up to noon on Friday, 19th June, 1891.

Printed forms of tender, containing full information as to the articles and approximate quantities required, may be had on application at any of the Mounted Police Posts in the North-West, or at the office of the undersigned.

No tender will be received unless made on such printed forms.

The lowest or any tender not necessarily accepted.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party declines to enter into a contract when called upon to do so, or if he fails to complete the service contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller N.W.M. Police.

Ottawa, May 15th, 1891.

NOTICE---A Chemist and Mineralogist of standing will make a professional visit to British Columbia and the Pacific Coast in May or June. Any parties having mining claims they wish to have examined or reported on can communicate with him by addressing "Expert" Canadian Mining and Mechanical Review Offices, Ottawa, Ont.

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 five feet eight 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 do

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

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 Headquarters of the Force Regina N. W. T.

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.
" 10, " " 20.....10c.
" 20, " " 40.....20c.
" 40, " " 60.....30c.
" 60, " " 80.....40c.
" 80, " " 100.....50c.

On Money Orders payable abroad the commission is :

If not exceeding $10..... 10c.
Over $10 not exceeding $20.....20c.
" 20 " " 30.....30c.
" 30 " " 40..... 40c.
" 40 " " 50..... 50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November 1889.

Ontario Mining Laws.

The following is a summary of the chief provisions of the amendments to the Mining Laws of Ontario, passed during the Session of 1891 :

1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

ARCHIBALD BLUE,
Director.

OFFICE OF THE BUREAU OF MINES,
Toronto, May 21, 1891.

This advertisement will not be paid for if published without authority.

PROVINCE OF NOVA SCOTIA.

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

—AND—

PRECIOUS STONES.

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

GOLD AND SILVER.

Under the provisions of chap. 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 cts. 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 lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and 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 the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for 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 for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department 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.

Further Improvements in Mining Machinery will Appear on this Page in Following Issues.

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Both Double and Single Cylinder.

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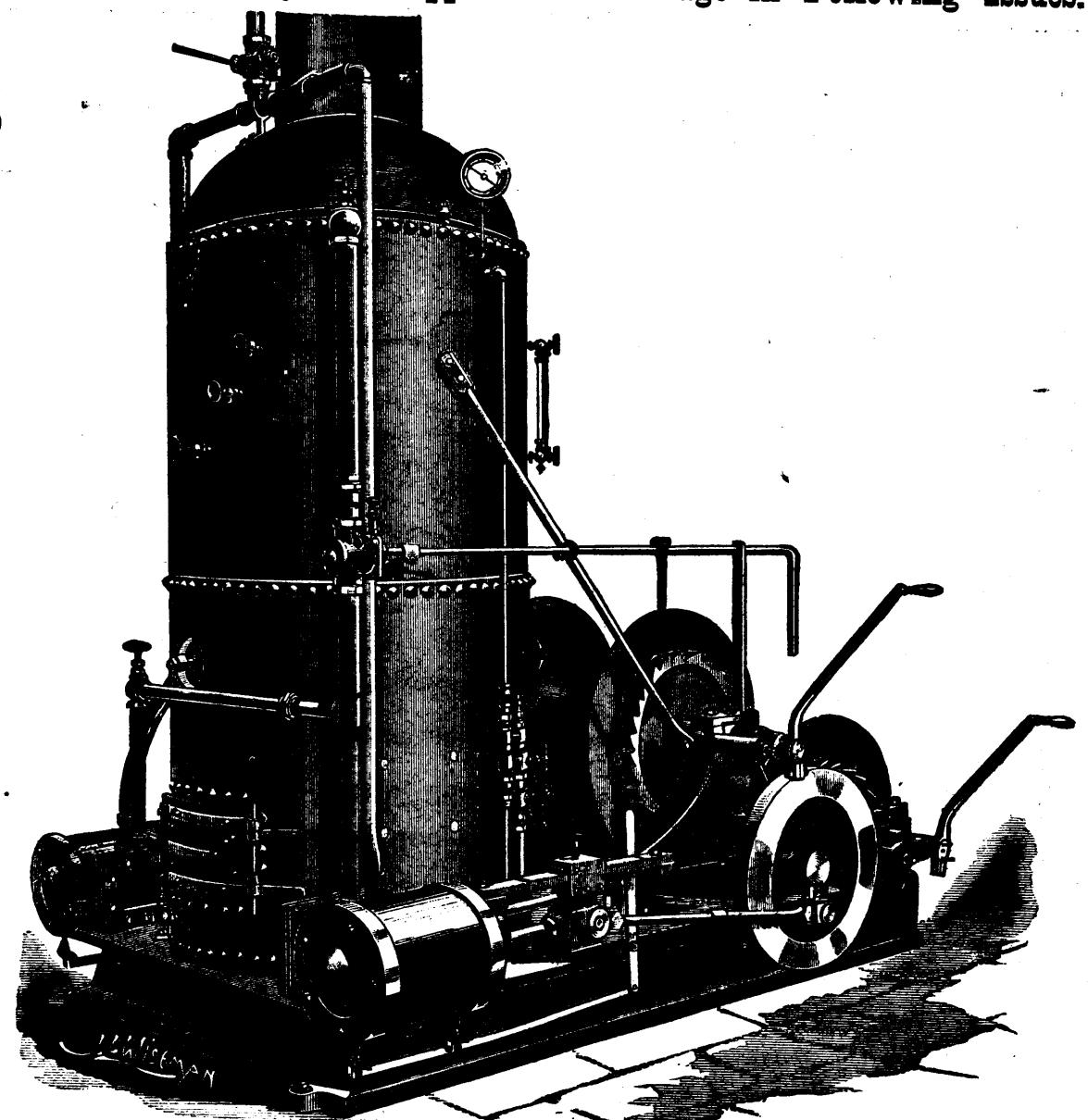

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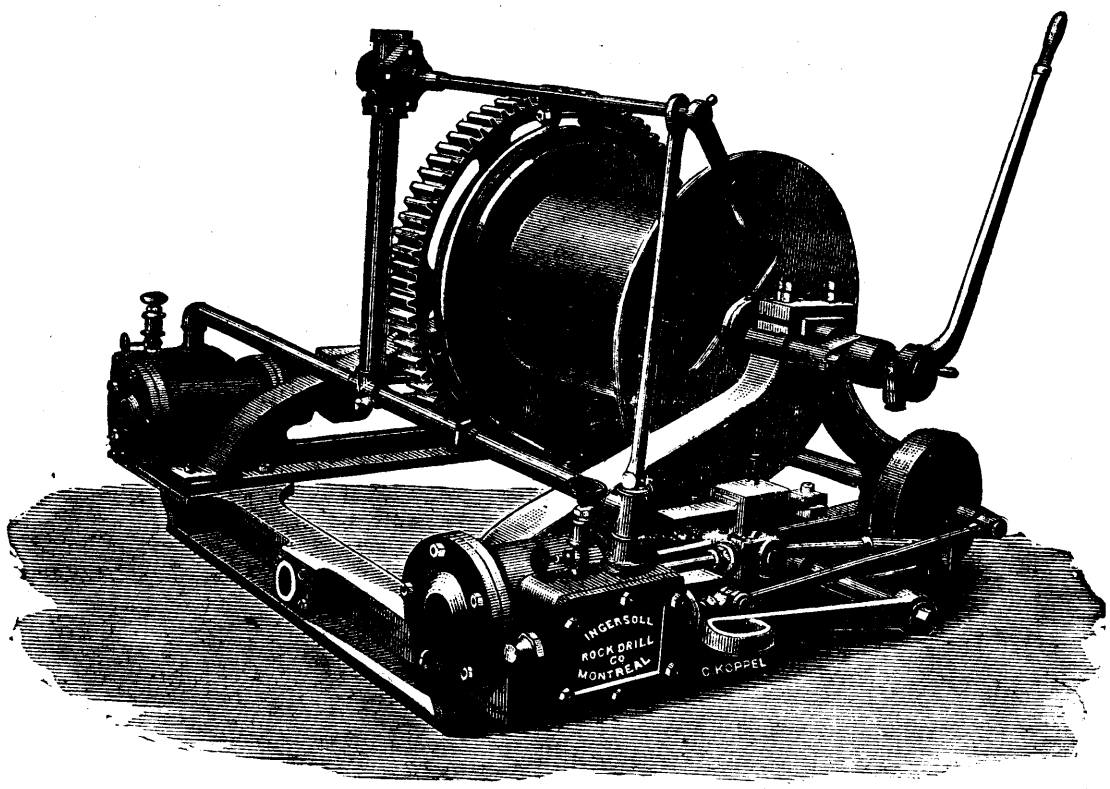

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