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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY . . . . . R. T. A. BELL.

OFFICES:

Victoria Chambers, 140 Wellington Street,

OTTAWA.

Vol. XII. JUNE, 1893. No. 6.

THE OFFICIAL ORGAN

—OF—

THE GOLD MINER'S ASSOCIATION OF NOVA SCOTIA.

THE UNITED MINING SOCIETY OF NOVA SCO

THE ASBESTOS CLUB, QUEBEC.

THE GENERL MINING SSOCIATION OF QU EBEC

THE following Resolutions of Council indicate beyond a peradventure the status of THE REVIEW as the exponent of the Canadian Mineral Industries:—

The Gold Miners' Association of Nova Scotia.

"At the annual meeting of the Gold Miners Association of Nova Scotia, held at Halifax on 6th March, 1889, THE CANADIAN MINING REVIEW was adopted the official organ of this Association.

(Signed), B. C. WILSON, *President.*
G. J. PARTINGTON, *Secretary.*

The Mining Society of Nova Scotia.

"Moved by Mr R G Leckie, seconded by Mr. C. A. Dimock, That the thanks of the Society be tendered to Mr. B. T. A. Bell for his kind offer placing the columns of THE REVIEW at the disposal of the Society; and that THE CANADIAN MINING REVIEW is hereby appointed the official organ of the Society."

(Signed), H. S. POOLE, *President,*
H. M WYLDE, *Secretary.*

The Asbestos Club, (Quebec.)

"Resolved That THE CANADIAN MINING REVIEW is, by authority of the Members and Council, hereby appointed the official organ of the Asbestos Club."

(Signed), D. A. BROWN, *President.*
A M EVANS, *Secretar.*

The General Mining Association of the Province of Quebec.

At a meeting of Council held at Montreal on Friday, 6th May, 1891, it was moved by Captain Adams, seconded by Mr. R. T. Hopper, and resolved That THE CANADIAN MINING REVIEW be the official organ of the Association.

(Signed), GEORGE IRVING, *President.*
R. T. A. BELL, *Secretary.*"

The Lake View Mining Syndicate Ltd.

Our article under the above heading in the May issue seems to have hit hard in an unexpected direction.

The purpose of that article, as clearly stated, was to call the attention of the directors of the Syndicate to some matters that we thought should be looked into before asking the public to subscribe.

It seems, however, from articles which have appeared in the Halifax *Chronicle*, *Herald* and *Critic* that a little clique of interested parties with headquarters in Halifax, have taken great offence thereat, and consider themselves personally attacked. The statements published all show such a similarity of thought and language as to warrant the belief that this clique is quite small, probably three or four in number.

We fancy we know the source of inspiration, and we know that the pecuniary interests and mining speculations of this clique are not likely to be benefited by having the REVIEW's search light turned upon any of their schemes, or on the methods they employ. The REVIEW has no fear of, and asks no favors from the promoters of any wild cat enterprise, and if the article referred to has made some such promoters uneasy, it is because they have knowledge that their methods cannot stand impartial scrutiny.

Any mining company or mine promoter that takes offence, and publishes angry paragraphs, full of vulgar adjectives, because we call attention to inconsistent and misleading statements, or make pertinent inquiries as to facts and methods, is accusing itself or himself of trying to foist upon the public that which will not bear investigation.

The REVIEW believes in honest and legitimate mining, in promoting the mining industries of the Dominion in all lawful ways, and one of those ways it conceives to be—fearless and impartial criticism, based on *facts*. In all that has been written on the REVIEW's article, we note nowhere any attempt to controvert its facts or to answer its questions.

The use of such words as "malicious," "unfair," "jealous," "rival, &c., *ad libitum* is easy, but it is neither refutation nor argument.

The public in Nova Scotia is so used to the vaporings of the *Critic* that anything emanating from that source calls for no reply. The *Herald* had the grace to publish a retraction in its very next issue, and to state that its article should have appeared as the contribution of an interested party; it also had the manliness to say that it knew nothing whatever of the merits or demerits of the case and that the article might be published in the best interests of Nova Scotia mining for aught it knew. But we are surprised that a reputable journal like the *Chronicle* should endorse a scheme of which it knew nothing except (like the *Herald*) what had been communicated to it by "an interested party."

We ask the *Chronicle* if it has carefully read the prospectus of this syndicate and compared it with the facts? and if so if it is prepared to approve the statements therein contained as true, fair, and in nowise misleading?

Will it endorse such a scheme as one likely to prove a benefit in any way to the shareholder, the mining industry or the fair name of Nova Scotia?

Does it endorse the past management of the Lake View Co. as successful? as efficient? as economical?

Will it kindly say how, when or where the REVIEW has in any way attacked the personal reputation of Mr. A. A. Hayward? and will it please say what there is in his record as a mine manager, or in the record of any mining property he has ever been connected with that any person could be jealous of?

In view of the fact that the REVIEW's article made no attack whatever upon Mr. Hayward's personal character the remarkable unanimity and promptness with which these newspapers, without replying to our interrogatories and without meeting or denying our statements, hastened to endorse his statements is, to say the least, significant.

From the general tenor of the *Chronicle's* article we infer that it considers Mr. Hayward responsible for the prospectus and its statements, we had supposed the directors and their mining experts were the responsible parties.

If the *Chronicle* is disposed to look into this matter it will find overwhelming proof of the justice of the REVIEW's article, and should it not be satisfied we shall be found very willing to give it additional and stronger evidence.

EN PASSANT.

To those of our readers conversant with the affairs of that colossal white elephant the General Phosphate Corporation Ltd., the announcement of the insolvency of Knud Sando, its promoter and late managing director, will not come as a surprise. It will be remembered that the Corporation was formed in London to acquire some 2,660 acres of undeveloped phosphate lands in the county of Ottawa, for £98,000 stg. The vendors received £20,000 stg in cash, £17,500 by bills of exchange, and £57,500 on mortgages redeemable in five years. The nominal capital was £1,000,000, but £100,000 stg. was subsequently borrowed upon debentures secured by the properties and uncalled capital. After some two years of unsuccessful work operations were suspended, and the affairs of the concern are now being investigated by a committee of share holders. As his share of the spoils, Sando actually received about £15,000 stg. promotion money, but he claims that out of that he paid £9,000 in respect of calls on his shares in the Corporation. He also collered some £11,000 stg. commission on the sale of the Stewart properties of the Corporation, and received a salary and expenses in managing its affairs. Not withstanding he ascribes his insolvency to the Corporation and to loss of business (whether as wool-broker, gold miner, or commission agent is not stated) owing to his absence in Canada.

Among Sandos's wild-cat schemes it is hardly necessary to remind our readers of his projected line of railway up the Lievres river, for which he obtained a charter from the Dominion Government. He also endeavored to secure a grant of lands in the North-West territory, for a colonization company, and gained some newspaper notoriety as the philanthropic promoter of a co operative scheme to benefit the Homestead strikers. Doubtless we will hear more of him and his little ways when the shareholders present the report of their investigations to the Corporation.

The Leeds Copper Company, which is the new name of the Excelsior Copper Company, (operating the old Harvey Hill mine at West Broughton, Que.) is already in difficulties, although the reconstruction only took place in January, 1891. The report tersely states that "the whole of the works have been shut down and beyond the wages of the caretaker no expense is being incurred." We should think even the cost of a caretaker might be dispensed with; for between January 16, 1891, and November 30, 1892, the company earned only £542 gross on a paid up capital of £284,405, and the expenses incurred in earning

this immense income were over £17,000. Under these circumstances, "it appears to your directors that the only course left open is to liquidate the company, with a view to reconstruction." That liquidation is necessary there is no doubt; but what object will be gained by a second reconstruction, beyond further loss to the shareholders and further fees to the directors, it is hard to see.

The slavering eulogies of the Halifax *Critic*, whose endorsement of the notorious Dobson and others of like ilk is well remembered must be very comforting to Mr. A. A. Hayward. He has our sympathy.

A contribution to the Halifax *Herald* thinks the REVIEW made an "onslaught on one of Waverley's gold mining industries" in its article on the Lake View Syndicate. We have made diligent inquiry and find this "industry" has been closed since April 1892. We were not (and are not) aware that locked buildings and absence of employees constituted an "industry." The same contributor imagines that the "criticism" is that of a "jealous rival." Did any one ever before hear of a rival to a moribund failure!

The Halifax *Chronicle* is quite right in saying that the functions of the REVIEW as an official organ of any Society cease with the publication of the official reports of that Society. No society, association, clique nor individual, excepting only the Editor, has any control *whatsoever* over the opinions or statements of this journal, which will continue in the future, as in the past, to be fearless in its exposure of what it believes to be wrong or detrimental to the mining interests of the country No single article published in the REVIEW on a doubtful mining scheme has ever before in so short a time found so complete a justification of its warning as is evidenced by these acrimonious articles in the Halifax papers, which seek to make the matter one of personalities rather than one of *facts*.

With that characteristic caddishness and utter disregard of truth which has earned for it the contempt of the mining men of Nova Scotia, the Halifax *Critic* publishes a statement to the effect that a well known Nova Scotia mining man has a heavy financial interest interest in the REVIEW and that its editor must publish what this gentlemen sends to him. Now we need not tell our readers—for the personality of the REVIEW is thoroughly well known throughout Canada—that such a statement is a deliberate and malicious lie. Moreover the *Critic* knows it.

Dr. A. R. C. Selwyn, Director of the Canadian Geological Survey, again urges the opening of the museum to the public on Sundays. He says:—"There will doubtless be strong objections urged against such action, based chiefly, if not entirely on the very erroneous, but unfortunately very prevalent idea, that a museum is a place of amusement, whereas it is essentially a place of instruction as is the church and Sunday school; and the principal difference between the two, concisely stated, is, that in the museum the *work*, and in the church and school the *word*, of the *Creator* is expounded. This admitted, there seems no obvious or intelligible reasons why the one establishment should be closed and the other opened on the Sabbath. Since the foregoing was written, I have sought opinions on this subject, and I have been much gratified to find such a large number of persons, including clergymen of various denominations, who regard the opening of the Museum on Sunday afternoons favorably, and think that to do so could not prove otherwise than advantageous to the community, and especially to that very large class of person whose daily occupations leave them no time in which they can avail themselves of the valuable information and instruction which the Museum is designed to afford."

All of which we heartily agree with. But in the meantime, if Dr. Selwyn is sincere in his desire to be a benefactor to the working classes, why not open the Museum on *public holidays*, and extend the hours of admission on week days so that the working men can study the work of the *Creator after four o'clock*. It seems to us much can be accomplished by the Doctor before he intringes on the day of rest.

The Hardy Patent Pick Company Limited, of Sheffield, are introducing a new patent disintegrator called the "Multiple," for producing fine and impalpable powders. This disintegrator reduces material by percussion, and is so constructed that the substances are subjected, as they progress through the machine, to the percussive action of several separate sets of beaters of increasing lengths and velocities, working in separate chambers. The whole circumference of each chamber is provided with serrated linings of excessively hard chilled iron, which are used as grinding surfaces, and this arrangement, it is claimed, gives about eight times the grinding surface of any other percussive disintegrator of equal size. The chambers increase in diameter as they approach the outlet, and the fan action of the large beaters in drawing the air from the chambers of the smaller ones, produces a through current of air from the inlet to the outlet. The material enters the smallest beating chamber, and from thence passes through the others, being subject to repeated percussive action, increasing in intensity in each successive chamber, and the current of air is continually carrying away the finished material. In the production of fine powders, this machine is not dependent upon grids or screens, as is the case with other percussive machines; but provision is made for a screen if it is deemed desirable to use one. This may be placed at the outlet, but it is not subjected to any beating action, and is only used when necessary to prevent any small pieces of unreduced material from escaping. The special features of this machine are its large grinding surface, its adaptability for fine grinding, producing a beautifully soft and even sample, and treating materials that cannot be dealt with in any other machine.

The total dividends paid by the Witwatersrand mining companies in 1892 amounted to £833,212, or about 16 per cent. of the gold output reported for the district; the greatest amount paid by any one company, £190,312 by the Robinson, being at the rate of 7 per cent. Other companies paying a less amount made a better return to their stockholders. Thus the Ferreira paid £56,250, or at the rate of 125 per cent.; the Crown Reef, £63,000, or at the rate of 55 per cent; the Jubilee, £17,502, or at the rate of 60 per cent. The Birthday Mining Company, in the Klein Letaba district, paid £22,150, or at the rate of 15 per cent. on its capital stock. The South African mines at present are making larger returns to English owners than these are receiving from their investments in any other country.

At the Rock Springs coal mine, Rock Springs, Wyoming, an electric locomotive has been introduced to haul a number of trucks a distance of 6000 feet. The current is supplied by a dynamo located a mile distant from the mouth of the mine, the generating pressure being 550 volts. The loss in transmission from the power house to the mine is about 10 per cent., so that the current received at the mine has an electromotive force of about 495 volts. The locomotive, which is of 60 horse power, is of 30 in. gauge, and it collects the current from an overhead wire, the rails forming the return. It hauls 30 trucks, which when filled weigh 40 tons.

How strangely one can sometime come across the ancient and the modern in machine-tools still working side by side in some of the engineering-shops! "The other day" says the *Iron monger*, "I went through an engineering-works in Lancashire, and saw the larger hammer, "*Thor*," put down by Nasmyth to forge guns, about forty years ago, and, although altered in the valve-motions, still running, and doing good work in forging cranks and shafts up to 10 tons weight. In the same works I observed several other of Nasmyth's tools, one a wheel-cutting machine made about forty years ago, and another the first slot-drill patented by Nasmyth forty-three years ago—both still doing excellent work, in company with similar tools made by the leading tool-makers of to-day—whilst in other portions of the work were some of Nasmyth's original patent shaping-machines, working alongside with others by Whitwork and Muir. Again, as illustrating how some so-called modern arrangements are very frequently anything but new, I noticed in one of the shops cast-iron coiled piping fixed around the columns for warming the place with steam, this principle of coiled piping, which has been applied as something new in recent years, having been fixed in these works for nearly half a century."

In the western parts of Mongolia, there are such rapid alterations of temperature that ordinary bricks, and even the usual building stones, disintegrate very rapidly. The inhabit-

ants of that country have a process for making extremely hard bricks, having the appearance of trachyte. In an article by M. E. Blanc, in *Dingler's Polytechnisches Journal*, the process is described, but the writer does not inform us as to the exact constitution of the clay. The brick kiln is in the shape of a vertical cylinder, surmounted by a dome. There is a rather large hole in the top of the dome, and during the first stage of the process the hole is left open. Three draught chimneys, built inside the furnace, open outwards at the height of the dome, and are kept closed with clay at the beginning of the operation. The kiln is heated for three days during the first part of the process, and then the hole at the centre of the dome is gradually reduced in size by means of blocks of moistened clay. The fire is allowed to die down, and the small hole remaining is covered with wet felt. The felt is covered with sand, which is continually kept moist. The three lateral chimneys are then opened, and the fire is lighted again The draught is thus reversed, and the second stage of the process thus commenced lasts four days. During this time the water from the felt is heated and fills the kiln with an atmosphere of superheated steam. At the beginning of the second part of the process the bricks have a light red colour, but this changes to uniform dark gray. At the end of four days the bricks are finished.

There appears to be some development of the mica mining industry in Australia. The Australian *Mining Standard* in a recent issue has something to say editorially of a promising district, known as the McDonnell Ranges Mica field. Some idea of the difficulties under which the producers of mica labor in that country may be gathered from the fact that all packages have to be carried some 500 miles on camels to Oodnadatta station, the present terminal point of the great overland railway being constructed by the South Australia Government. Thence it is carried to Port Augusta and shipped to the most profitable markets. The *Standard* quotes values as follows:—Sheets of the size of 6 in. by 5 in. are worth about 5s. per lb., and their value increases with the size of the article, sheets 8 in. by 9 in. being valued at 10s. per lb., and those 12 in. by 12 in. being readily saleable at £1 per lb. The great want of the field is a man who is accustomed to practical working of such deposits.

Here's a pointer for some of our local Governments. The Australian Government has made a grant this year of $100,000 to aid parties in prospecting the resources of that county. Previously the vote was $200,000, (£40,000.) During the debate on this reduction one of the speakers proposed that the salaries paid members of parliament should be reduced and the amount saved added to the prospecting vote. Needless to say this excellent suggestion involved too severe a strain upon the patriotism of the members to permit any strong hope of its being carried.

The application of electricity for the purposes of power and lighting was, but a few years ago, looked upon as almost beyond the possibilities; but to-day there is scarcely a village that has not got its electric lighting plant, and the use of electric motors, for conveying power, where steam would be either impracticable or costly, is steadily increasing. The great advance in working metals with the aid of electricity began when it was shown that the process of welding could be gone through without subjecting the articles to the heart of the furnace, and now many operations are conducted with the electric current alone. One of the latest steps in connection with metal working by electricity is that of the Electrical Forge Company of Boston, U.S.A. They have brought out a machine for making round forgings by a rolling process, and the work accomplished by the apparatus is said to be simply marvellous. The machine can be worked at any speed, according to the class of work required, and it is readily adjusted in all its parts. It will successfully roll the highest grade of crucible steel or the open-hearth and Bessemer, as well as iron, copper, and brass, and it is claimed that all the work will be turned out solid. Among many other things of which the machine is capable of producing are steel handles of all sizes, and it is said that one hundred can be made in the same time that it takes to make one by the old lathe process. It turns out anti-friction steel balls from ⅛ in. to 2 in. diameter at a rapid rate, and the shape of each is perfect. They are cut from a steel bar which is inserted between the revolving dies, and each revolution of the machine forges a ball, the bar being kept heated by electricity. Hexagon bolts with head and thread are made in one operation, as are conical shells, shuttle tips, hinge tips, right and left hand threads, rolled steel cane, umbrella tips and bicycle spindles; in fact, any round-shaped article that will suit the size of the machine, of which ten sizes are made, ranging from 0 for the smallest work, to 10 for the largest forgings. Heretofore such work was done at considerable expense, as the finishing on the lathe required very careful manipulation, but with the new system it is claimed that the articles can be produced with a degree of accuracy as to size and shape that could not be obtained by hand labour. In general appearance the machine is simple and compact, and is geared up so as to obtain very great power.

The following method of determining lead in galena has been devised by Herr Rudolph Benedikt. The pulverised mineral is covered with water in a porcelain capsule, and then decomposed h a few cubic centimetres of commercial hydriodic acid of 1.7 specific gravity.

If the moistening with water is omitted there ensues a violent effervescence. The capsule is covered with a watch glass and heated on the water-bath, by which the lead sulphide is completely converted into lead iodide. When the change is complete, the whole is evaporated to dryness The residue when cold is covered with dilute nitric acid, the capsule is covered and heated on the water-bath. The nitric acid decomposes the lead iodide, with liberation of iodine. As soon as the oxidation is at an end the capsule is uncovered, the contents evaporated to dryness, the residue is moistened with dilute nitric acid, filtered, and washed out, when the entire lead is in solution as lead nitrate, and may be determined with sulphuric acid in the usual manner. Lead sulphate can be converted into lead nitrate in a similar manner.

Messrs. Qualter, Hall & Co., Railway Foundry, Barnsley, England, have just completed for the Powell Duffryn Steam Coal Company a couple of screens with an endless travelling band of somewhat novel construction. The travelling belts, which work continuously, are 56 feet long and 5 feet 6 inches wide, made of steel plates carried on cast-iron standards, with angle iron slides and top and bottom rollers on each side of the band. The fixed screens consist of thirty-two bars each, 12 feet long, and 6 feet wide, and 3½ inches deep. The shaking screens are 6 feet long, and about the same width, and will distribute the coal on to the belts, from which the impurities will be removed by persons on each side of the former. The bands are made of steel plates 14 inches wide, and are all secured by three chains, with a link patented by the managers, and are geared down to 16·1, enabling them to travel at the rate of 40 feet per minute. The coal is taken from the screens from the ends of the belts by self-acting raising and lowering shoots on to the waggons placed at right angles to the belts. The belts, and, indeed, the whole of the appliances, are driven by a pair of cylinder engines which makes 100 revolutions per minute. The whole of the machinery is mounted on cast-iron columns and rolled iron girders. The quantity of coal which will pass over each screen and belt will be 600 tons each, or 1,200 tons in the course of a day of ten hours. The whole of the structure, including the bands, screen, &c., is about 100 feet long, and will weigh upwards of 100 tons.

Nickel steel for an experimental 8-inch breech loading rifle have arrived at the naval gun foundry Washington, and the manufacture of the gun will begin at once. Great interest will attend the construction and subsequent experiments with this gun. Nickel steel has never been used in the manufacture of guns, and it is thought that the non-corrodible quality of the alloy, coupled with other physical characteristics such as increased elasticity and extraordinary elongation, render it specially adapted for guns subjected to high pressures with nitro-powders. The forgings for this particular gun have 3.15 per cent. of nickel. The guns will be 304½ inches long and will weigh 31,300 pounds.

The minimum physical characteristics o the gun will be, for the tube, tensile strength, 85,000 pounds; elastic limit, 42,000 pounds; elongation, 20 per cent. For the jackets the same characteristics will be, tensile strength, 90,000 pounds; elastic limit, 45,000 pounds; enlgation

13 per cent. The gun will be of special design. It will be composed of only 3 parts—a tube, jacket and hoop—and will be assembled by means proposed by William Sellers, Philadelphia.

It is claimed for this class of guns that they can be dismounted after considerable service, the corroded or damaged tube readily removed and a new tube substituted, the old jacket and hoop being used on the new tube. Should the experiment be found a practical success, not only will the original cost of the gun be considerably reduced, but it will be possible after extensive use to make virtually a new gun by merely supplying another tube, the wear and tear on the jacket and hoop being of no particular account in firing. Mr. Sellers contends that the jacket and hoop can readily be removed by a process of artificial contraction and expansion, similar to that recently applied to the 13 inch gun.

A most interesting showing of the causes, the cost and the results of strikes in Great Britain is given in a report issued not long since by the Labor Correspondent to the Board of Trade. This report covers the year 1891, and starts out with the announcement that the strikes during this year were not so numerous as those of the year preceding. During 1891 there were 893 strikes, affecting so far as known 4507 establishments, and there were 13 lock-outs affecting 48 establishments. Disputes as to wages were the chief causes of strikes, 54.2 per cent of the total arising therefrom; 30.23 per cent were due to demands for adyance of wages. In the 3 previous years the proportion of strikes due to wages disputes was, in 1888, 61, and in 1889, 67 per cent on a rising market, the percentage of advance of wages strikes in 1890 was 42.4. The strikes against reduction of wages were 11.6, as against 8 per cent in 1890. In 1891 the strikers won 45 per cent of the wage strikes and 23.4 per cent were particularly successful. The number of persons engaged in the unsuccessful wages strikes was, however, much larger than in the case of the successful or partially successful strikes. One particularly interesting feature of the report is that referring to strikes against non-union workers. In 1891 there were 47 strikes of this kind in Great Britain, and 51 per cent were total failures. A general review of all the results shows that in 676 of the chief cases 266,885 work people were concerned. 369 out of 893 strikes were known to be successful, which is a proportion of 41.32 per cent, in which 68,247 persons were engaged 181, or 20.27 per cent, with 98,117 persons affected, were but partially successful. 263, of 29.45 per cent, with 92,763 persons involved, were entirely unsuccessful.

As to the loss incurred by these strikes, the report presents an estimate, and states that a total of £1,500,000 in wages which might have been earned during the time taken up in these strikes. Reports from 237 firms state that the actual outlay caused by stopping and reopening their works amounted to £92,238. The trade unions spent £145,785 in sustaining 261 strikes. Statistics given by the trade unions apparently show that the strikes entered upon were not a total loss, for in 234 strikes of the year the weekly wages previous to these strikes were £89,667, and after the strikes they amounted to £94,325, an apparent gain in wages per week of £4,658. By following out the calculation and taking into account the loss of wages during the strikes it will be seen that a long period of advanced wages must follow before the workers can catch up with the cost of their strikes.

The report mentioned contains some additional statistics showing the trend of opinion among the employers and workmen of Great Britain as to the best means of avoiding strikes. In answer to a question of this character 222 employers made replies and 77 were in favor of arbitration boards specially appointed as occasion might demand. Out of 231 trade unions, 68 were in favor of the same mode of settlement, 21 employers and 19 trade unions were in favor of State boards of conciliation and arbitration. Conciliation, rather than arbitration was favored by 45 employers and 92 trade unions.

The gas trustees of Findlay, Ohio, after carefully going over the accounts for the fiscal year ending April 1, 1893, the receipts for March being now nearly all in, find that during the year the net profits of the gas office had been $56,500. This amount does not include the receipts from the factories for the gas consumed during the month of March, which will aggregate $5,500. This is not received until next month, so does not come in as receipts during the present fiscal year. If this were included, the total proits would be $62,000. During the past year the city has spent $20,000 on new pipe lines and mains which will not have to be laid next year, and this would indicate that the net profits of the plant next year will equal $82,000.

As a play upon mining terms and phrases, the the following contribution on the "wants of the miner," from a United States contemporary, is very good:—"He wants a 'false set' of teeth for the 'mouth of the tunnel,' 'stopping' for the old ones, and a girl of experience to paint and powder the 'face of the drift.' He wants a four-in-hand tie for the 'collar of the shaft,' and a boot for the 'foot of the incline.' He needs a jockey who can ride a 'porphyry horse,' and use the 'spur of the ledge' on a 'bucking donkey' (pump), and 'drive a crosscut.' He wants an 'expert' burg'r to 'tap the ledge," a detective to 'follow the vein,' and a watchman to guard the 'silver plate." He wants a hat that will fit a 'head of water," and a man who can wear the 'cap of a tunnel-set.' He wants a solder who has been 'drilled' to handle a 'gun' and to 'shoot' and work a 'battery'; also a painter who can distinguish a 'color.' He wants a 'square set' of men to work for him, some feed for his 'giraff,' a bird for the 'cage,' a hunter to hunt a 'gopher,' and a 'grizzley' and a sprinter to 'run a drift' against time. He wants a tidy man who will put an 'apron' on and 'clean up' the mill, sweep up the 'dust' and 'wash dirt.' He also would like to have the Government furnish him with 'stamps' free of charge. He wants the 'roof of the drift' shingled with twenty-dollar pieces. And when he 'dies' he wants to go to the 'upper level' and play on a silver 'horn,' and have his 'slap jacks' baked in a 'gold pan.'"

A most valuable addition to mining literature is the very comprehensive review of the mineral industry, its statistics, technology and trade in the United States and other countries, presented in a handsome volume of some 600 pp. by our esteemed contemporary the *Engineering and Mining Journal* of New York. This volume covers so wide a field that we can do no more at present than recommend it most heartily to every reader of the REVIEW who may desire a handy, serviceable, and reliable review of the mineral industries of this continent. We bespeak a wide sale in Canada for this latest evidence of the snap and enterprise of our New York contemporary.

Mr. H. M. Wylde, secretary of the Mining Society, has issued his prospectus convening the June meeting of the Society, at Glasgow, on 29th and 30th insts. As intimated in a previous issue the proceedings promise to be of unusual interest. On arrival of the morning train (29th) from Halifax at Eureka Junction (Ferrona) members will be taken to the Iron Works, thence on to Bridgeville, where they will visit the mines of the New Glasgow Iron, Coal & Railway Co. who have undertaken to conduct the excursion, and to lunch the party. An opportunity will also be given to inspect the new works of the Pictou Charcoal Works, recently erected at this point. The first session will be held in the evening, in Bell's Hall, New Glasgow, commencing at seven o'clock. Among the papers announced are the following: "Prospecting and Mining Magnetic Iron Ores with the aid of Tiberg's Magnetic Inclination Scale," by E. Sjostedt, and a note on the "Occurrence of Manganese and Zinc Ores in Nova Scotia," from the pen of Dr. Gilpin, the Provincial Deputy Commissioner and Inspector of Mines. A Conversazione and Reception will be held in the same building at eight o'clock, when an address, on behalf of the local reception committee, will be made by the Hon. A. C. Bell; to be followed by a short historical paper on "The Discovery of Coal and Iron Ore in Pictou County," from the Rev. Dr. Patterson (the historian of Pictou County). The proceedinge will be enlivened by music, and refreshments will be served. On the following day (the 30th) an opportunity will be given to participate in a visit to the steel works and collieries of this district, as well as a geological excursion to the Pass of McLellan's Brook. Needless to say that this attractive programme should conduce to make this the most successful outing yet held by the members of this energetic and enterprising

society. While the REVIEW unfortunately can not be present on this occasion, its July issue, as usual, will contain a full report of the proceedings.

In these days of bank smashes and other unsettling events in the financial world, the feeling of distrust in monetary institutions which seems to be inherent among the more ignorant classes of the people is likely to gain strength and lead to a considerable increase in private hoards, The Boers are notorious for making their waggons their banks, and some curious questionings have been provoked in the United States by the discrepancy between the amount of gold known to have been produced and imported, and the amount officially returned as being in the country. According to the best available data, the authorities calculate that there should be fourteen hundred millions of dollars in gold in the country, but the returns only account for about half that amount, and the question is, where is the balance? It is thought that it is very largely to be accounted for by the hoarding-up tendencies of American farmers and others who either live at a distance too remote to enable them to avail of banks with advantage, or who have been unable to conquer their distrust of such institutions.

Further particulars of the new unfreezable explosive, 'Maximite,' are to hand. It appears that for four years the inventor, Mr Hudson Maxim, has been experimenting with smokeless rifle powders, making a specialty of nitro-compounds, and he has been successful in this direction. In the course of his experiments he found that the compound could be made so cheaply that it could compete with dynamite, and that he could, therefore, make with the guncotton a smokeless explosive for blasting. The material is now made by the Columbia Powder Manufacturing Company, of New York, and is said to cost no more for the same amount of work than dynamite. It is claimed that 10 ozs. of Maximite is equal in effect to 1 lb. of 40 per cent. dynamite. The products of combustion of Maximite are mainly carbonic acid gas and water. A specialty of this explosive is that it is unfreezable. It is also claimed that one cartridge cannot be exploded by the explosion of another standing beside, but not touching the first, that the material is difficult to set fire to, and that it cannot be exploded by striking with a hammer, whilst a temperature of about 400 degrees Fahr. is required to explode it by direct heat. It can be used for quarrying by packing the cartridge lightly so as to prevent the shattering effect required in mining and other ordinary blasting. The cartridges weigh about 14 oz., and are used in competition with the ordinary 1-lb. dynamite cartridges. It is claimed that Maximite is equal in power to pure nitro-gelatine, weight for weight. The comparative power of different explosives is as follows, the unit being black blasting powder: Black blasting powder, 1; dynamite, ordinary 40 per cent, 9; dynamite, No. 1, 75 per cent. nitro-glycerine, 13; guncotton, 14; nitro-glycerine, 16; blasting gelatine (nitro-glycerine), 17; Maximite, 17.

From the Broken Hill Mine (Australia) silver and lead of the value of over $40,000,000 have been taken within seven years; and it continues to yield about 220,000 ounces silver and between 600 and 800 tons lead per week.

In the report of the British Commission on Mining Royalties, not the least important portion is that which deals with what is called nationalization of minerals, which means that all minerals should be national property directly under the control and management of the state. This feeling found expression in the evidence of some of the representative miners, especially from Scotland, examined by the Commission. They advocated that the state should acquire the whole of them inerals of the country, whether worked at the present time or not, and should hold them for the benefit of the community. Several of the witnesses supported this opinion by the expression of a conviction that if the minerals were made national property, the well-being of the miners would be more carefully attended to than under present circumstances, while a portion of the proceeds might be applied to their benefit in the shape of provision for disabled miners and their families, and superannuation allowances. It was further urged that mines could be worked more economically than at present, which we fail to see; all past experience showing that private undertakings are far more economically managed than they could be by any department of Government.

A wide divergence of opinion, says the *Iron and Coal Trades Review*, showed itself amongst the witnesses on the question of the terms and conditions on which minerals should be acquired by the state. The most extreme view represented was that the state should take the minerals from their present owners without giving any compensation whatever. The reasons given for a proposition, which advocates wholesale legalized robbery, were that the minerals originally belonged to the Crown, and now belong "to the people as a whole." Private property in minerals was considered an injustice which ought to be remedied, while the benefit which private owners and their predecessors had already enjoyed at the expense of the public ought to be set against any claim which they might advance for compensation. Arguments such as these are hardly of a nature to commend themselves to a civilized community. It passes ordinary comprehension why minerals, which are acquired property, should not receive the same protection that other kinds of property enjoy. But the great majority of witnesses recognized the right of the present proprietors to compensation. To bring the scheme of the acquisition of the minerals by the state into full operation, however, it would probably be necessary for the state not only to own the minerals, but to work them. As this would raise another claim for compensation, that of the coal owners or lessees, whose capital has been invested in the enterprise of working and winning the minerals, something like £100,000,000 would have to be found to compensate them. What the sum would amount to to pay out the present royalty owners may be left to imagination; but it would be appalling. The suggestion of the nationalization of minerals was not approved of by a good number of the miners' representatives, while lessees, the persons most nearly interested next to the royalty owners, much preferred the present condition of the law of mineral property to remain as it is. Under these conditions, the commission was perfectly right in declining to discuss the subject further, leaving its solution, if it can be solved satisfactorily, to the time when the larger question of the nationalization of the land comes up. But that time is far distant as yet.

In the January number of the *North American Review*, the Hon. D. D. Field, a distinguished lawyer, has something to say of interest regarding the relations between employers and workmen. Speaking of the possible remedies for industrial strife, Mr. Field contends that compulsory arbitration is impossible because the state cannot fix the price of labor any more than that of corn or any other article. How then he asks "can the state as such aid in the reconciliation of capital and labor," and suggest that when capital applies for privileges the state may make the concession of them dependent upon an undertaking that labor shall also have a definite share in the accruing profits. As an illustration he gives the following example:—

"Let us imagine such an establishment as I suggest. Suppose a factory to be chartered, with a capital of 1,000,000 dols., divided into 200,000 shares of 5 dols. each, three-fifths of them to be payable in cash or property as at present, and two-fifths in prospective labour; the former to be invested in land, buildings, machinery, and whatever else may be necessary for such an undertaking, and the latter reserved for such workmen as may be taken into the concern; the skilled workmen to be allowed wages, say, for illustration, at the highest rates of the market, 4 dols. a day or more, and the unskilled 2 dols. a day, and each one to be registered for 400 shares. If the earnings were 6 per cent. on the capital, each skilled workman would be credited in twelve months—that is to say, for 300 days' work—with 1,200 dols. for wages and 120 dols. for profit. Deducting 500 dols. for his supplies, including food, clothing, and lodging, there would be left to his credit at the end of the year 820 dols., which would pay for 160 shares of the stock. He would then have had his living and become the owner of 164 shares of the company. In the next year he would acquire 164 additional shares, and in less than three years would have more than paid for all the 400. The rate of wages, the supplies furnished, the admission and dismissal of share workers, and the discipline of the establishment should be vested in all the shareholders, actual or expectant, while the financial department,

and the purchases and sales, hould be in the hands of the cash or property shareholders. Capital and labour would thus be brought into closer communion, and made to lean on each other. To this end the requirement of a cash or property capital would be in part dispensed with, and instead of it an obligation to labour accepted. The share-workman must have the means of living while he is earning the price of his shares. He mus be enabled to live as cheaply as possible, by having his supplies furnished at the lowest price. He must have fair wages, and withal reasonable maintenance, and the prospect of bettering his condition by becoming a participant in the profits of the combined labour and capital. But all concerned should have the power of superintending the conduct of the workmen, choosing between applicants, and dismissing the idle or incompetent, recompensing them, of course, for what they have already earned and saved."

To such of our readers who may be interested *in this subject, we commend a recent* contribution by Mr. C. R. Iorns, to the Manchester Association of Engineers, in which much interesting data is given.

In the matter of the relative cost of fuel for glass factories between coal in a coal country and gas at 5 cents per thousand feet, Secretary A. L. Strasburger, of the Model Glass Company, at Findlay, O., states that his company was using 300,000 feet per day in its 14-pot factory, which made the fuel cost $15 per day. This was about 50 per cent. cheaper than oil, and about 10 per cent. cheaper than coal in the Ohio Valley. If they could secure a steady supply of gas, they would be entirely satisfied with the present rates as they had made a careful test and found that through a meter they were using less fuel than they had anticipated, and could *make money under the present arrangement.*

There is hardly a country on the face of the globe that does not produce its samples of asbestos, and in newspapers, from time to time, we see items concerning this and that fibre which has been found, all of which is stated to be very fine, but which upon investigation proves to be worthless to the manufacturer. Good asbestos requires four prime qualities, infusibility,, tensile strength, fineness and elasticity, and if one of these be lacking it is useless in a commercial sense. Australian asbestos, for instance, is very brittle, and cannot be spun or woven. African asbestos lacks the principal requisite, the fire resisting quality. Russian asbestos, which for a long time was considered worthy of attention, had to be abandoned , and so on, until there are only two varieties which are practical, Italian and the Canadian. These are different in their texture, but each has its uses. The Italian variety has a long coarse fibre, is a greyish brown, and is soapy, while the Canadian consists of fine somewhat elastic fibres in color, varying from almost pure white to greyish and greenish tints, and in length averaging from two to four inches with a soft silky aspect looking very much in fine specimens to floss silk.

At the present time there are over one-hundred varieties of goods made from asbestos; twelve years ago there were no more than four, and twenty-five years ago it was a curiosity of the laboratory. It is now found in almost every workshop where steam is employed and its use is constantly extending.

MINING NOTES.

[From our own Correspondents.]

Nova Scotia.

Caribou District.

It is reported that the old Lake lode workings are to be unwatered and the high ground on both sides of the deep shaft tested. Rumor has it that a working bond from the owners has been obtained, and that work will begin in July.

The Truro company are confining their operations chiefly to dead work. The main shaft is sinking towards the roll, and some work is doing in the old shaft.

Fifteen Mile Stream.

Reports from miners coming from this district is that a new and high grade vein has been cut and is now being opened. This report lacks confirmation from headquarters, but we hope it is true.

Oldham.

On the night shift on the 13th inst., a large open seam was cut by a shot in the shaft of the Rhode Island Co. on the Dunbrack lode. The water came in very fast, and on Thursday the 15th, the shaft was abandoned until machinery can be erected. The men were put to work on a drive running west, and the management hope to keep the water at that level until pumps get running.

The Columbia Mining Co. have re-arranged their stamping machinery under the direction of L. J. O'Shaughnessy, formerly with the Oldham Gold Co., and better results are confidently expected. Mr. Stephen has replaced Mr. Whidden as the foreman of the company.

The Standard Gold Co., (Taylor & Hardman), are sinking a shaft upon a new lode called the "McDonell." The shaft is now down over 40 feet and shows a seven or eight inch quartz vein carrying copper, galena and gold.

Stormont.

The North Star Co. have found a new lode on the western end of their property, which promises to become a high grade producer. The vein, when cut, was about two inches thick, and the first bucketful of quartz raised was pronounced 40 oz. rock. Later advices say that the lode resembles the old North Star lode in its palmy days, some spots being very rich, others poorer, but the whole making a high grade rock.

The Richardson Co. now have twenty stamps pounding, and expect a large bar for June. The quartz continues to yield from 7 to 10 dwts. per ton, and bids fair to be the largest producer of the province for 1893.

Renfrew.

Rumor has it that D. A. Macdonald, (known familiarly as "Chummy,") has uncovered some pay quartz on the old New Haven property. Mr. Macdonald is prospecting the property for a Pictou organization, and is confident of success.

Mt. Uniacke.

A new ten stamp mill is to be built on the property owned by Curren, Prince and others, formerly the British and Colonial Co.'s ground. It will be built near the mill torn down by John Nicholls, and is designed to thor *oughly test the ground abandoned by Capt. Nicholls.* M. Thos. Prince is in charge.

Mooseland.

During the past year much good work has been done at Mooseland on the property of the Mooseland Gold Mining Co., Ltd., under the direction of H. G. Stemshorn. In the eleven months ending May 31st, about 580 ozs. have been won, principally from quartz obtained in opening up the mine. The main shaft has been sunk 112 feet and levels driven to the east and west for 100 feet each way. The pay chute runs easterly and is cut by the east level. But little stoping has been done, leaving a considerable body of reserves available. The mine has paid all expenses of development and has something to the good. The company is to be congratulated on the success with which Mr. Stemshorn has managed the property.

Ontario.

The Mutual Gas Company, of Port Colborne, Ont., which supplies the Erie Glass Company with gas for manufacturing purposes, and supplies many local consumers, found last winter that it was unable to meet the demand, owing to the large drain made by the glass works. It therefore decided to put down a new well to get an adequate supply. The attempt was looked forward to with much eagerness by the Provincial and the Erie County companies, who supply Buffalo with gas. The result has been a great disappointment. The well has proved a failure. The drill was pulled at a depth of 854 feet, having pierced the second gas sand into the red shale.

Mr. J. R. Gordon, C.E., superintendent of the Creighton Gold Mining Co., (Ltd.), operating in the Sudbury district, was in Ottawa the other day, attending a meeting of the directors of his company. He reported that good progress was being made with the work of opening up the company's mines; the machinery installed gave good satisfaction, and the construction of the mill was well advanced. About 20 men were employed.

North-West Territory.

"We learn," says the Calgary *Herald*, "from a reliable source that a considerable move in mining in the Alberta slope of the Rockies is likely to take place shortly. Competent mining men assert that Alberta is quite as rich in minerals as British Columbia. The only reason why our resources in this direction have not been developed seems to be that they have never been brought before the notice of capitalists. Efforts are now being made to call the attention of those interested in mining matters to the field which Alberta offers to enterprise and capital in the development of her mineral wealth, which will in all probability stir up our long neglected mining interests considerably in the near future."

British Columbia.

The New Vancouver Coal Co. made its "record" day's output on the 30th May, when the yield was 2,300 tons. It is expected that even these figures will be beaten, when the Protection Island shaft is in full working order and No. 5 shaft is again opened.

The New Vancouver Coal Company is still carrying forward its very desirable scheme of providing of five acre homesteads for its workers, on easy instalment terms of purchase. Roads are now being built and a large area of land laid out for this purpose at Starks' Crossing, about 8 miles South of Nanaimo, near the No. 5 mine shaft, and on the line of the Island Railway.

The Kanaka Bar Gold Dredging Co., of which notice of incorporation appears in our companies column, intend by means of a patent centrifugal pump, to seek the gold lying under the waters of the Fraser River, for a distance of some three miles at Kanaka Bar, in the neighborhood of Lytton, B.C. The pump to be used will, it is said, suck up 200 tons of river bottom daily, catching up with other matter the particles of gold underlying the stream. The company thus hopes to make excellent money returns upon the capital invested, which the undertaking involves. Dr. Dawson, (Geological and Natural History Survey of Canada,) gives the data upon which the company bases its hopes of success, in the following passage: "Gold has been gradually concentrated in the river bottom by the action of the stream, while in many places paying deposits have been left upon the surfaces of 'benches' at various levels. Thus when the work of 1858 and 1859 began, the miners obtained with comparative ease and in a short time a large quantity of gold. How much gold has been obtained from the Fraser it is impossible to ascertain, but it may be stated that practically the entire output of the Province for 1857 and 1858 with the greater portion of 1859 was derived from this river, and by far the larger portion from that part of the Fraser extending from Hope to Quesnelle. The aggregate yield for these early years alone can not be placed at less than $1.700,000. The mode of working these gold deposits was comparatively a simple one. Then so-called 'bars' were nothing more than portions of the riverbed, which being left bare at low water could be reached by the miner. They varied in richness not only in different parts of the length of the river, but also in correspondence with the local relation of the current and set of the stream. They were worked generally to a very low limited depth, being often merely shunned over in consequence of the trouble from water, most of the work was accomplished with the primitive rocker, In the bed of the river itself at each season of flood a

partial rearrangement of material occurs, and additional supplies of gold are brought in by the wearing away of the banks."

More particularly referring to that portion of the river that the Kanaka Bar Gold Dredging Company intends to dredge, Dr. Dawson, after referring to the fineness of the gold up to Yale: "From a point on the river, about 16 miles above Yale to Cisco Flat, a short way below Lytton, a distance of 25 miles, rich deposits of 'heavy' gold were worked." In this 25 miles, are included the 3 miles leased by the Company, and, as in the case of Hill's Bar, referred to by Dr. Dawson, as having produced $2,000,000 worth of gold in less than 1-2 square mile. the Company's 3 miles commence at the food of a very rapid portion of the Fraser, where the river first frees itself from the canyon, and expands to a greater width with a slacker current over the Kanaka Bar, inducing the belief that for centuries gold has been washing through this gigantic ground sluice, the quantities on the Bar, now the Companys' leasehold. Those interested the Company are sanguine of complete success, which it is to be hoped they may achieve by their somewhat novel, yet apparently thoroughly practical method of river gold mining."

The question of sampling works for Kaslo is practically settled and the Boston and Montana Mining and Smelting Company has deposited through its agent, C. H. Bartlett, $1,500 with the Kaslo Townsite Company as a guarantee for the completion of the works within four months. The capacity of the plant will be 100 tons daily and all the machinery will be of the latest and most improved pattern. The plans call for a three story building to be built in a substantial manner. The ore will be delivered to a Blake crusher on the third floor and go from there to a Gates crusher on the second floor, after which it is quartered and then ground down and parted until the quantity is reduced to proper quantity for assaying.

According to the *Outlook* the Columbia mine on Mineral Hill in the Okanogan country is one of the most promising looking properties in that section and it appears as if the owners intended to do some systematic and extensive development on the property. Since the return of E. P. Wheeler from Bridgeport, Conn., where the major portion of the stock is held, he has been busy. A wagon road is being graded from the old shaft house to the new workings, about 200 feet further up the hill, where Mr. Wheeler took out and shipped four tons of ore to Omaha which milled 146 ounces in silver, 22 per cent. lead, 15 per cent. copper and $8 in gold to the ton, which would at this time mean a total value per ton of $180. So far, three veins have been found on the property, and being within a space of fifty feet it will be surprising if they do not run together at no great depth and thus form one great ore body. Two of these veins are eighteen inches and one a foot wide, all ore of high grade. As indicative of the confidence which the owners have of the quality of their property they are buying up as many of the adjoining claims as they can, having secured a two-thirds interest in the Buck Horn, all of the Franklin Boy, and a quarter interest in the Eureka claim, which last named property is owned by Nelson Clark of Spokane Two Bridgeport (Conn.) capitalists, Messrs. Horace Pigg and Dr. May, have purchased 50,000 shares of the company's capital stock from J. L. Spath and with Mr. Rodgers, one of the other large stockholders, these gentlemen will visit the property this season to determine upon the nature and extent of development to be done. The stock is now all held by wealthy men who will thoroughly test the ground and when convinced of the extent and value of the ore bodies will push the work vigorously day and night, erect a concentrator and put up substantial buildings for the accommodation of the large force of men to be put to work. With men of the capital and enterprise of those composing the Bridgeport Mining and Milling Company the Okanogan is sure to be an active district this season and we trust that many rich ore bodies will be exposed in addition to those already uncovered.

(From the Nelson *Tribune.*)

Ainsworth keeps forging ahead, and to-day it is one of the most active camps in the district in developmeut work. A very significant fact about the camp is that railway men are becoming active in pushing its claims to the front and making investments in it. Railway men, above all others, know a good thing when they see it. J. V. Carroll, of the Baltimore & Ohio railway, was here about ten days ago, and went over it very carefully, examining many prospects, and as a result he has bonded two claims for a mining company of which he is the president, and made arrangements with Messrs. Strobeck & Hardy to build a wagon road from the end of the present Cedar Creek road to his claims (about 3000 feet) for $1000. W. R. Busenback, general traffic manager of the Chicago & Great Western railway has purchased an interest in the Spokane and Trinket, and is expected daily in the camp to meet John A. Wolgamo, the chief owner of these two claims. They will proceed at once to sink the present shaft in the Spokane fifty feet, and when that is completed they will put in a boiler and engine and the necessary machinery for further sinking. They will also do some tunnelling.

Manager Johnson of the Schaffer company is knocking out six feet a day in the big tunnel, and is running night and day- So strong has his faith become in the value of the camp that he has bonded several claims and has gone to Seattle to induce his friends to buy and develop them.

The Highland has the call at present on everything in the camp, and to the average denizen of Ainsworth it is his pride to speak of it. Less than a month ago it was spoken of as a fair average prospect, but Messrs. Stevenson & Mikel have in that time worked a complete transformation. They have run two tunnels; one on the lower and larger ledge, the other on the upper and slightly smaller ledge. Besides this tunnel work they have sunk three shafts on three different veins running from these ledges and cutting the formation. They have 150 tons of ore on the dump ready for shipment as soon as the wagon road to the Cedar Creek bridge is completed. In the lower tunnel, they struck a large body of high-grade ore at thirty feet from the mouth. The ledge in the tunnel is eight feet wide; the vein is about five feet with a solid ore body of nearly three feet in width, and will assay 150 ounces silver to the ton. This has been done with an expenditure of less than $1500, aud a prospect has been thus raised to the dignity of a mine. This experiment has shown what can easily be done with many other prospects in the camp when gumption and grit characterize the men in the enterprise.

CANADIAN COMPANIES.

The Kanaka Bar Gold Dredging Company, Ltd., with a capital of $50,000 in shares of $10.00 is seeking charter of incorporation under the laws of British Columbia, with the object of purchasing and acquiring the rights, concessions and privileges owned by Thos. J. Beatty, C. S. Bailey, W. H. Gallagher, and H. G. Neelands, known as the Kanaka Bar Driving and Dredging Company, by virtue of an indenture dated 31st Jan., 1890, and made between Frederick Hussey, as Gold Commissioner, and the said parties as licensees; also to carry on the business of miners, submarine or otherwise, and to win, get, mine and work ores, minerals, metallic substances and precious metals of all kinds. Directors; Robert A. Anderson, W. H. Goodwin and Charles S. Bailey, all of Vancouver, B.C. The Head Office of the company will be at Vancouver, B.C.

The Prince Albert Flat Hydraulic Mining Company, Ltd., is also seeking charter under the laws of British Columbia. Authorized capital, $200,000, in shares of $1. Head Office, Vancouver, B.C. Directors, George D. Scott, W. J. McGunigan and Albert H. McNeill of Vancouver, B.C. Formed to take over and acquire mining leases of lands or claims in the Province of British Columbia, and to acquire all the rights and interest of all parties interested in such lands; to carry on the business of hydraulic processes of mining, &c.

Quesnelle Forks Canal aud Hydraulic Mining Company, Ltd., is the name of another new British Columbia Company formed to take over and operate certain water rights, and for bringing a ditch or canal to the bench lands in the neighborhood of the North and South Forks of the Quesnelle River, Cariboo District, in the Province of British Columbia; also to acquire mining leases of the company is authorized to carry on, or any business or transaction capable of being conducted so as directly or indirectly to benefit this Company, and to take or otherwise acquire and hold shares or stock in or securities of, and to subsidize or otherwise assist any such company, and to sell, hold, re-issue, with or without guarantee, or otherwise deal with such shares or securities, &c. Capital, $300,000, in shares of $100. Directors, J. Loewan, W. P. Sayward, C. N. Gowan, Wm. Wilson and Frank S. Barnard. Head Office, Victoria, B.C.

Bridge River Gold Mining Company, Ltd., has been formed in British Columbia, with a capital of $25,000, in shares of $100, to carry on the business of smelters, refiners. founders, assayers, dealers in bullion, metals and products of smelting of every nature and description; to carry on the business of buyers and sellers of and dealers in all kinds of ores, minerals, gold dust, mineral substances and compounds, coal, timber, logs, lumber produce and merchandise of every description, negotiable paper, securities for money, and to do all kinds of commercial business, except banking and insurance; to carry on the business of miners of every description, and to procure by purchase or otherwise, mine and work, mining locations, mines, ores, minerals, gold dust and all other metallic substances and compounds of all kinds, &c. Directors, George E. Bower, John Leatherdale, W. G. Allen, J. A. Russell and Finlay R. M. Russell, all of Vancouver. Head Office, Vancouver, B.C.

The Bothwell and London Crude Oil Company, Ltd., has applied for charter in Ontario for the purpose of purchasing, acquiring by lease or otherwise lands in the County of Kent and boring, digging and constructing petroleum and oil wells and pumping thereof, and the storing, tanking, refining and dealing in petroleum oil and oil wells, etc. Capital, $20,000, in shares of $10. Directors, W. T. Strong, J. D. Wilson, H. R. Abbott, P. W. D. Broderick and G. A. McGillivray. Head Office, Bothwell, Ont.

Kootenai Hydraulic Placer Mining Company.—This company has 15 or 20 miles of claims, extending some distance back from the banks of the Pend Oreille River. The ditch has been completed, and the water will be turned on the gravel very shortly. The flume is 18 miles long, and is said to have cost $75,000.

North American Mining Company.—The annual meeting was held in Montreal, May 15th, and resulted in the election of G. N. Ducharme, F. Bayard, A. Montreuil, A. Renaud, A. Yale, A. Bayard and O. Henault as directors. At a subsequent meeting of the directors G. N. Ducharme was elected president and A. Bayard vice-president.

The Boston and Nova Scotia Coal Company.—At a meeting of this new organization held this month in Halifax the following officers were elected:—President, Hon. John Chandler, Boston; Vice-President, John McKeen, Mabou, C.B.; Treasurer, W. J. Fraser, Mabou, C.B.; Secretary, A. C. Ross, North Sydney, C.B.; Directors, David S. Baker, John C. Cobb and R. P. Fraser. The several properties at Broad Cove, Cape Breton which have been under offer to the company were taken over and their development was decided upon.

New Vancouver Coal Mining and Land Company, Ltd.—In their report for the half-year ended December last the directors of the New Vancouver Coal Mining and Land Company, Limited, state that the net output for the half-year was 195,318 tons, and the sales were 197,537 tons. "There was a slight improvement in prices as compared with the former half-year, but the market has, on the whole, continued dull. At the present time our agents report the outlook as a little more encouraging. A reference to the accounts will show that a net profit of £3,097 5s. 10d. was made during the half-year, but, as considerable amounts have in the course of the half-year been expended on capital account, the actual financial position has not improved; this fact, the prospective requirements of the company in respect of bunkers, and the payment for electric haulage in the East Field mine, preclude the payment of a dividend for the half-year." It is proposed in future to hold only annual meetings, although half-yearly accounts will be sent to the shareholders.

History of Tin.*

TRANSLATED FROM THE WORK OF E. REVER BY BRENTON SYMONS, M. INST., C.E.

In ancient Hindu tin was called *Naga*, in Persia *Aonya*, in Hebrew *Anak*, and in Ethiopian *Naak*. The similarity of these diverse appellations proves that this metal proceeded from the same centre of production, presumedly, the inexhaustible stream works of the East Indies. There can be little hesitation in believing that here originated the name by which it was afterwards known throughout Asia and the east of Africa. Besides these very old names, from a thousand years before Christ to the early centuries which followed his advent, the term *Kassiteros* was habitually used in the countries which bordered the Mediterranean Sea; Homer knew it by this name, as did also the Romans. Where tin first received this designation is yet unknown, but it is far from improbable that the Phœnicians, who during this period controlled the world's commerce, extended its use afar; they were merchants or pirates, according to circumstances, and exchanged the treasures of Europe for those of Asia. From time to time they made voyages to Spain and England in search of the metal, and it thus appears likely that it was the Phœnicians themselves who introduced the term Kassiteros to the Indies. However this may be, it is certain that in the last centuries preceding Christ, this name was found in the Hindu writings corrupted to *Kastira*, whilst anteriorly it was always the native term *Naga* that was employed.

The tin from the Indies was, without question, the most important for commerce in olden times, and the quantity of this metal absorbed by the civilized states of Asia in the preparation of bronze must have been very considerable. China supplied herself partly from the same source, but also from the mines which she possessed in the provinces bordering on the Indies. The Chinese bronze industry flourished between 1800 and 1500 B.C. and between 1100 and 900 B.C.; that of the Indies was not more ancient. Money, vases, bells, mirrors, and other objects of art were manufactured in such large quantities, and the employment of tin for plating kitchen utensils was so general, that one may reasonably conclude that the production of that metal was colossal. Probably at this time Europe consumed only English and Spanish tin, and as the uses for it were very limited, the industry was in an almost barbarous state.

It is to be regretted that no statistics with respect to the production of tin in the Indies at those remote periods are available, and with respect to Europe the following paragraphs contain about all the information which has reached modern times. As has been already remarked, the Phœnicians, who possessed the commerce of Europe, obtained tin from Spain and England. Their principal entrepot was the town of Cadiz in Spain, which, founded about 1000 B.C., had rapidly acquired a great importance.

* Transactions Mining Institute of Cornwall.

They must also have supplied Egypt with tin, because this old civilization possessed neither mining industry nor commerce. The metals which Egypt absorbed were, from the most remote times, furnished by Asiatic merchants, and it was only during the earlier centuries after the Christian era that the Egyptians began to navigate through the Red Sea—direct relations with the Indies. The early Christian centuries were contemporaneous with the prosperity of the Ethiopian Empire, and trade relations were therefore commenced and continued through the intermediation of this people. The Arabs interested themselves in the tin trade subsequently. The Abyssinians used the Hindu word *Arak*, whilst the Arabs used the Mediterranean term *Kestar*. After the conquest of Spain by the Romans, the Phœnicians lost the tin trade.

Concurrently with Spain, one of the principal producers of tin was England: Cæsar speaks of the "white-lead" that was imported from England and Diodorus recounts that the Britons found the ore in the stones. The smelted metal was transported in bars by way of Nectis (the Isle of Wight) across Gaul, on the backs of horses, to Rome. Marseilles became the Roman emporium and rapidly grew to the same importance that Cadiz enjoyed the Phœnicians. The metal was almost exclusively consumed in plating copper for the manufacture of vases, casks, etc., and occasionally for minting. The alloys of tin and copper were used to cast statues, to make weapons, mirrors and coins. There seems every reason to believe that anciently alloys were not obtained by the mixture of the metals them lves, but by the simultaneous metallurgical treatment of the two minerals. They probably smelted copper pyrites with stamped tin ore, just as they produced zinc bronze by smelting calamine with tin ore.

As a proof that the tin of Spain was, during the dawn of the Christian era, dominated by that of Cornwall, it may be recorded, that instead of the Latin term *plumbum album*, the gaelic word *Istean*, or *Stean* in Cornish, became prevalent. The names zinn, tin, etain, are of similar derivation.

Marseilles became a flourishing commercial town and even added a new branch of industry—that of casting bells. The ancient Hindu custom of using bells soon extended to Byzantium, and in the tenth century had already reached Italy, where it was applied to the services of the Christian religion. Later on, the use of bells increased more and more, until villages, as well as convents, took a pride in possessing the largest. (The first large church bell was founded in the Campagne hence the Latin word *campana*.)

The great increase of this industry favors the supposition that the production of, and commerce in tin, received a remarkable impulse during the middle ages. Gradually Marseilles was dispossessed of the tin trade by other commercial emporiums. Cologne had already business relations with England at the time of William the Conqueror, and during the twelfth and thirteenth centuries Bruges acquired the control of the eastern European markets, and consequently of the trade in tin.

At the beginning of the middle ages it would appear that Devonshire may have furnished the greatest amount of tin, from the rich stream-works existing there. About 1200 A.D. the production of the Cornish workings was still inferior to that of its sister county, but in the centuries immediately succeeding, the production of the mines of Cornwall surpassed that of the stream-works of Devonshire; the former county has preserved its supremacy to the present day, whilst the stream-works of the latter have become successively exhausted and now give to commerce but insignificant quantities.

Towards 1300 A.D. the miners and smelters of Cornwall ceded to the lord of the soil as royalty, about 40 % of the raw produce, in 1480 they yielded up 20 % to the lord and 20 % to the occupier of the land, in 1750 6⅔ to the lord and 11 % to the occupier whilst in 1830 the royalty diminished to 4½⅔ to the lord and 6 % to the surface proprietor.

During the latter part of the middle ages, the tin pigs were exported to Bruges, to which place the Italian and German dealers came to purchase them. The ordinary route by which the tin was exported, was by land towards Italy, but from the beginning of the fourteenth century, half the bulk was transported by sea in Italian bottoms, which then supplied the coasts of the Mediterranean and particularly the East (*Constantinople, Alexandria, etc.*)

It was about this time that tin, produced from the mines of Granpen in Bohemia, began to appear in the Continental markets, and it may be conceded that English tin was, to a very considerable extent, replaced throughout Germany by its youthful rival. The mines of Granpen have been known since the twelfth century, and during the thirteenth, Schonfield, another mining district in Bohemia, also produced much tin, and it is probable that Cologne—which at that epoch was possessed of the Boheman trade—threw a large aggregate of tin from these mines on the market. The mines of Granpen and Schonfield produced abundantly during the whole of the fourteenth century, and the tin not exported in bars to Germany was consumed in the country itself. At the Teinhof works in Prague they employed experienced smelters from Venice and Lombardy. The principal objects manufactured were table services, and untensils for religious ceremonies. Towards the conclusion of the middle ages, the production of tin must have considerably augmented, on account of the general practice of making bronze cannons, and because the use of tin for table services was common amongst the people of Italy and Germany.

During the first half of the sixteenth century so much capital was engaged in the opening of numerous mines in Bohemia, that the production of tin was soon much increased. The Attenberg mines were working during the latter half of the sixteenth century, and during the first ten years its washings returned 500 to 750 tons of tin annually. The ancient mines of Granpen, Schonfield, Schlackenwald, Ehrenfriedersdorf, and Geyer, have been re-worked several times, and new washings installed at Eibenstock, Platten, Gottesgab, Abertam, Hengstererben, &c. Very soon afterwards, mines were also opened in various places in these districts. About 1546 A.D. twelve dressing floors were put up at Platten for the treatment of the tin ores, and at the same period the districts of Attenberg and Ehrenfriedersdorf in Saxony were conspicuous as tin producers.

The mineralized rock, or tinstone, was everywhere extracted in Bohemia and Saxony by the aid of wedges and by fire. Towards the termination of the fifteenth century the ores were still crushed in mortars and hand-mills, and the resulting pulp washed on frames. Stamps did not appear until the earliest years of the sixteenth century; the concentration was made on sleeping tables and in slime pits; the slimes were roasted and the impure tin was subjected to liquation.

In the sixteenth century the Italians invented new ways for the application of tin, viz:—tin leaf was employed to coat mirrors, and to glaze majolica and cooking utensils, and to enamel iron. Then, very soon, tin became indispensable to the dye-houses, on account of the discovery of the valuable properties of its salts as a mordant. Libavius first made tin chloride, but it was Dribble who first discovered, by accident, its value for fixing dyes, and the use of this important mordant speedily extended to Germany, England and France.

The early years of the seventeenth century are of great importance in the history of tin. In Bohemia and Saxony, the mining districts of Schlackenwald, Platen, and Altenberg, produced tin abundantly until the outbreak of the thirty years war, which caused the suspension of all the mines for at least fifty years. At the same epoch the miners in Cornwall worked only four hours a day, and broke all the ore by use of the wedge. In Bohemia and Saxony the science of mining was more advanced, and some German workmen who were invited to England, much improved the method of draining the mines, breaking the ores, and smelting them. Becher instructed the Cornish smelters how to reduce the tin ore in reverberatory furnaces with charcoal, and the improvements made had a sensible influence on the English production. During the thirty years war the English tin industry gained what that of Germany lost. The Indies and China continued to produce and to absorb immense quantities of tin. The Dutch, who in the seventeenth century repulsed the Spaniards and Portuguese from the East Indies, seized on a portion of the tin trade. Despite the great increase in the production of English tin, it must be admitted, that even early in the seventeenth century, the aggregate production of the civilized countries of Asia exceeded ten times that of Europe. During the eighteenth century the returns of tin from Bohemia and Saxony were much increased, and the trade continued in a flourishing condition, but modern times have seen the closing of nearly all the tin mines in the centre of Europe.

Towards the middle of the present century the system of contract (tutwork and tribute) was generally adopted.

The Newcomen steam engine replaced the horse engines and water wheels for the drainage of the mines, but between 1770 and 1780, these engines gave place to those of Watt. At the end of the eighteenth century, Cornwall sold more than 3000 tons of tin annually. In 1828 stamps were first used in that county. Near 1800 A.D. Siam and Malacca produced about 1500 tons yearly, and Junk, in Ceylon added 200 to 500 annually. From 1820 to 1860, Malacca sold about 2000 tons, but from 1860 to 1870 the production was much increased

The first man-engine was laid down in Cornwall in 1842, and in the same year round huddles came into use. In 1840 the tin ore was relieved of its impurities, and the produce raised, by treating it with hydrochloric acid.

Beginning from the end of the last century, the proportion of copper ore in the Cornish mines, increased with the depth, but from 1850, on the contrary, the percentage of tin ore has again increased. The production of tin since then has been about 8000 tons yearly. Between 1850 and 1860 trommels were introduced in the Schlackenwald district, for the classifying of the "roughs," and the slimes were roasted with salt. In England they followed the same method in certain mines. In 1858 tungstenic ores were first treated by Dr. Oxland (at Drakewalls mine) with soda, and the wolfram transformed into tungstate of soda, was sold as a by-product. This salt is employed in dyeing, and for the impregnation of substances to be made fireproof.

Banca produced, during the last century, more than 3000 tons of tin, but during the early decades of the present, this decreased by one-half. In 1850 it attained its maximum output—5000 tons yearly. After 1860 the production fell to 1000 tons, but this amount increased to about 4000 tons after 1870. Between 1850 and 1880, Peru, Chili, Bolivia and Java, have each exported from 50 to 200 tons of tin annually to England. In the United States, tin ore has been found in many localities, but up to now rarely in workable quantity. Since 1853 tin has been produced in Victoria and New South Wales, and in Tasmania since 1872. Important improvements in the preparation of the ores have been lately introduced in Australia. Long droughts compel the mines to establish numerous reservoirs, and to employ with the utmost economy the storage water. The European workmen have been pushed aside by the heathen Chinee to such an extent, that the government, to place a limit on the Chinese immigration, has established a heavy poll-tax The production in Australia, between 1874 and 1877, was from 10,000 to 15,000 tons annually.

The uses of tin have considerably multiplied and grown during the past 200 years. From 1700 A.D. tin has been widely applied in Bohemia and Saxony to the plating of iron Agricola was aware of the method of coating iron with tin, though, in his time, little use was made of the knowledge. Plating was introduced into England in 1670, and afterwards into France. But both before and after the invention of plating, numerous articles of commerce were manufactured exclusively from tin, and this branch of the trade was developed in an extraordinary manner during the eighteenth century in Germany, France and England. Salmon describes, in his splendid volume on tin smelting, the methods of working and the objects manufactured, and in his woodcuts, we find table services, knives and fork, jugs, candelabra, lamps, chemical and surgical instruments, boilers, etc., in the most varied forms. There existed in England in the last, and even in the present, century, a crowd of miserable little tin work shops, many of a very inferior class, which were occupied in the making of tin ware, and in the plating of copper and iron goods. It is only during the last three or four decades that the spirit of enterprise influenced capitalists to embark in this kind of industry. Between 1840 and 1850 A.D. Griffith perfected the manufacture of tinned utensils in one piece, and this branch of the trade was especially developed in France, between 1850 and 1860 A.D. Instead of compression by a blow, which caused much waste, a slow continuous pressure was applied Since then, pressed articles in plated iron have overcome all competition, as they unite the strength and cheapness of iron with the valuable properties of tin. The United States sustained the competition successfully by contriving in 1866, a method of manufacturing impermeable boxes from a single piece without soldering. England has, for a long time, produced large quantities of tin plates, and two-thirds of its colossal production have been exported, most of which between 1850 and 1860 found a market in the United States.

An interesting detail in the history of tin is the recovery of that metal from the waste. In the workshops using tin plates and notably in those making cans and buttons, six per cent. of loss occurs. Many attempts, more or less successful, have been made to recover this loss. Schmuck in 1848 patented various methods. In 1854, Higgins obtained a patent for the following way: solution in hydrochloric acid (with a little saltpetre) and precipitation by means of lime. Phillip's process for purifying the tin of Peru was employed later to extract tin from tin plate cuttings, viz:—the impure metal was granulated, and dissolved in hydrochloric acid, then, provided the tin was in excess, the wolfram, antimony, and arsenic, up to five or ten per cent. would not be attacked; the tin was deposited on zinc plates, and the zinc thus placed in solution was precipitated in the form of white zinc, by the addition of milk of lime. Jacobson used soda lye, and Parks concentrated sulphuric acid, to put the tin in solution, and the salt obtained was in each case employed in dyeing. Kunzel boiled the tin plate clippings in water acidulated by nitric acid; the tin was then thrown down by zinc, dissolved in hydrochloric acid, and the resulting salt was sold as a mordant; he treated in this manner, during 1869, over 400 tons of waste obtained from the manufacturers of canned preserves at Nantes and Paris. This method is somewhat varied by substituting for liquid hydrochloric acid the same acid in a gaseous state.

Tin is used for the preparation of phosphor bronze In the fusion of that alloy, the absorption of oxygen is very prejudical to its quality, the formation of oxidulated tin rendering the alloy brittle. Formerly they endeavored to hinder oxidation by stirring the mass with wood, or by adding a little zinc, but for the last dozen years this object has been much more efficaciously attained by the addition of a little phosphorus: this augments in a remarkable degree, the compactness, resistance and elasticity of the product, besides giving it a beautiful golden color. Cannons, statues, ornaments, bearings, etc., are cast in phosphor bronze with the greatest success, and the sale is day by day increasing.

If we combine the information relative to the production of tin, we obtain the following resume (1881):

Australia	10,000—15,000
England	10,000
Straits, Malacca, etc	10,000
Banaca and Billiton	7,000—9,000
Tasmania	3,000—5,000
China	5,000

or for the whole world, say, from 40,000 to 50,000 tons annually.

The largest consumers of tin are China, the East, United States, England and France. The most important use in Asia is for plating copper, whilst in Europe and America, tin is almost solely employed in the tin-plate trade; the manufacture of bronze and white metal, absorbing in comparison, only feeble quantities.

Testing Station for Explosives at the Produits Collieries, Flenu, Belgium.*

The object of this testing station—due to the manager and underground manager of the Produits Colliery, and to the managing director of the Clermont Powder Mills

*From *Explosifs de Surete*, by A. Macquet, director of the Hainault School of Mines.

and the Matagne Dynamite Factory, Liége—is to prove that under identical conditions, the various explosives now used in mining, are far from affording the same guarantees of security; to compare them one with another, in order to find out which is the safest and which are unsafe; to determine whether these guarantees persist under the most dangerous conditions; and, lastly, to recommend, to those engaged in mining, an explosive absolutely safe in the most unfavourable cases, where prudence may be conspicuous by its absence; as well as to afford the opportunity, to all interested in the subject, of judging for themselves as to the correctness of the results obtained.

The Produits Testing Station was laid down on the plan of that at Neunkirchen, with the modifications dictated by experience, or the desire to reproduce as faithfully as possible the dangers actually encountered in underground workings; and as a study of the part played by coal dust did not enter into the question, but only a comparison of the explosives themselves, it was possible to simplify the arrangements.

The French Firedamp Commission practically lays down as a principle that, to make absolutely sure of the degree of safety which may be depended upon in a given explosive, it must be tested by explosion in the open air, and under the most favourable conditions for incomplete explosion, because "it may always happen accidentally, through the imprudence or inattention of a miner, or other cause, that the explosion of substances employed in the underground workings may be determined before they are safely charged into the bottom of a shot-hole," and that "the danger presented by explosion in the open air is therefore not purely imaginary." The accident which would provoke explosion in the open air "is doubtless very difficult to imagine, but it is not quite impossible, and should be provided against."

These protestations against foreseen objections are not convincing. Given an explosive which requires the violent effect of a detonator to explode, it is difficult to imagine how it can be accidently exposed to so energetic a shock in underground workings. The French regulations require that explosives be always kept in a safe place, protected from accident. They are to be shut up in boxes, in such a manner that a fall of the roof would be powerless to explode them, the detonators being kept separate from the explosives. The following is the text of the Belgian regulations on the subject:—

Art. 53—"Powder, dynamite and detonators must be isolated from one another and kept in separate bags or boxes."

Art. 56—"Up to the time of using them the cartridges and fuses intended for blasting are to be deposited in a safe place, to be chosen by the chief miner."

As to imagine the deliberate use of explosives not charged into a shot-hole, but simply placed on an obstacle to be shattered, where has such a risk ever been run at defiance of the most ordinary dictates of common sense; where could such waste take place, in any case and under any pretext? If there were reason to fear the explosion of a substance through fall of the roof, measures of safety would be sought rather in requiring a minimum of resistance to shock than a minimum of explosion temperature. In fact, on account of the complexity and the slight stability of the phenomena which may take place during explosion in the open air, one can never be sure that a method of incomplete explosion, unforeseen and not tried in experiments calculated to establish the safety of an explosive, may not occur at any time.

One of the constituents of the explosive may (as acknowledged by the French Commission) on account of imperfect mixture, explode seperately on the surface of the cartridge, and this element might be that of the two capable of giving out dangerous flames. It should not, however, be assigned a too high value, as that might induce another danger. The men, knowing that they had to deal with a resisting (stable) explosive, might be imprudent in the stemming, while the inventors, knowing that their explosive requires a strong tamping in order to act effectually, might go so far as to advise that stemming be performed with the hammer, in defiance of all thought of prudence; and the shot might be fired during the stemming. It is for these reasons that no arrangements have been made at the Produits Testing Station for causing explosions in the open air.

What are the most dangerous conditions of explosion that may be met with in practical mining? To realize something similar in our boiler," says the French Commission, at page 71 of its *Report*, "in the case of a shot which is not blown out, but under conditions certainly more dangerous than any which may happen in practice, we suspended, so as to be surrounded by firedamp, the explosives enclosed in a metal tube (lead or tin) closed at bottom and open at top. In this tube the explosive rested on 5 cm. to 6 cm. (2 in. to 2¾ in.) of clay or sand, and was covered by a tamping of clay, sand, or even, in some cases, coaldust 10 cm. to 12 cm. (4 in. to 4¾ in.) thick. The explosion burst, and projected in the state of dust, that portion of the tube where the explosion occurred, the upper and lower portions generally remaining intact at the bottom of the boiler. The nature of the metal, and especially its thickness, might be varied; but no observations have been made in this connection, nor was there any interest in making them, except in the case of explosives which ignite firedamp in the open air.

As the tube burst, the hot gases certainly came more immediately into contact with the surrounding explosive atmosphere than in the case of a shot which does its work; and they are so much the hotter as the energy taken up by the bursting of the tube is less. The tubes used by the French Commission required an expenditure of dynamic force equal, on an average, to one-third the total energy of the explosive; and the force of shocks in rock is much greater. But the danger of these artificial cases is far from equalling that of a blown-out shot, all the hot gases of which are impelled forward in one direction, and at a high temperature, the work accomplished being insignificant as compared with the total effort of the charge. It is evident that the conditions are in the highest degree dangerous if the shot be blown out while it is being tamped, and still more so if this occur while the charge is being inserted. Several accidents of this kind have happened. A shock given to the detonator while the cartridges are being placed in the hole, or while the charge is being withdrawn in the case of a misfire, may occasion ignition while the explosive is not covered by any tamping; and these are evidently the most unfavourable circumstances.

In the Produits Testing Station, attention was only turned to reproduce, easily and without danger, an unlimited number of blown-out shots; and it was with this view that the testing station was established in a large open space, surrounded by walls, behind the surface buildings of pit No. 25, at Flénu. The shot-hole was reproduced by a Krupp cannon of crucible mild steel, measuring 55 mm. (2⅛ in.) calibre and 58 cm. (23 in.) deep, the metal being 172 mm. (6⅞ in.) thick, which corresponds with an external diameter of 50 cm. (20 in.); the outside length of the breech is 70 cm. (20 in.), leaving 20 cm. (8 in.) for the thickness of steel at the breech end.

The mine drift or heading is represented by an old boiler 1·5 m. (5 ft.) in diameter, and 10·9 m. (36 ft.) long. One end is open and the other closed, over a length of 30 cm. (12 in.), by a solid mass of masonry in which the cannon is laid parallel with the boiler, but 20 cm. (8 in.) below its centre line. The cannon is pointed slightly upwards, so that the issuing flames may strike the roof of the "heading" (boiler) at the end of the gas chamber, which stops at 4·55 m. (15 ft.) from the face of the back wall, flush with the muzzle. In this way the flames traverse the mixture of gas and air (which may happen to be not thoroughly mingled) in their most inflammable zones. In order to give greater stability to the "heading" the boiler is sunk 60 cm. (2 ft.) below the ground level; and earth is piled up over the mass of masonry, against which the boiler abuts. Besides, to deaden the effects of recoil, the boiler has been strengthened by connecting it, through an angle-iron, with a heavy ring or collar bedded in the masonry. The outer wall bears on the boiler, projecting by 40 cm. (16 in.) beyond the inner back wall. The apparent length of the "heading" is therefore 10·2 m. (33½ ft.) outside, and 10·6 m. (35 ft.) inside, a trench being made in front of the boiler for taking off the gases and smoke of the explosions. At first, this trench was only 2½ m. long; but gradually its length was increased to 12 m. (39 ft.) for favouring the expansion of the gases. In this manner the effects, in the case of an explosion, were confined as much as possible, while the vacillation of the accompanying flames were facilitated.

The total capacity of the "heading" is 18·73 cubic metres (625 cubic feet); and an impermeable screen stretched transversely 4·55 m. (15 ft.) from the end, serves to isolate from the shot a gas chamber of 8 cubic metres (282½ cubic feet) capacity. The working of the apparatus is very simple, the operation being accomplished in less than a minute. At the right distance a double-channel iron hoop is riveted inside the circumference of the "heading," forming a groove of about 2 cm. (¾ in.) A sheet of paper soaked in paraffin, the edges of which are bent into the groove, is fixed to it by an elastic bandage, the latter being short enough for its tension to ensure tightness of the joint. The seam between the channel iron and the boiler was also rendered tight by caulking with hemp and red lead, or with metallic lead.

For the explosive gas, lighting gas was used, the apparatus being placed in communication with the gas main supplying the surface buildings of the colliery. A meter in the pipe permits of rapidly introducing the desired proportion of gas; and the gas pipe terminates on a line with the cannon and 50 cm. (1 ft. 8 in.) in front of it. To effect a mixture of the gas and air, an agitator is suspended from the roof of the heading, being worked from the outside of a copper wire, the edges of the hole through which the wire passes being rounded off. This stirring is sufficient for the object in view, although it may happen sometimes that the mixture is not quite homogeneous. To exactly fulfil the conditions which occur in practice, it would have been better to have experimented with natural fire damp; but when this cannot be obtained the author sees no reason why *formene* should be employed, as fire-damp is not pure *formene*. Sometimes the hydrogen which it contains makes it more inflammable than *formene*, while, rendered impure by carbonic anhydride and nitrogen, it loses much of its sensitiveness; besides, it is proved that, with lightning gas of medium composition, mixtures are obtained, the explosibility of which is not less than that of most samples of fire-damp. Moreover, it has been proved that air containing 10½ per cent. of this gas is practically as dangerous as the most explosive.

To introduce dust into the phenomena, two methods were employed. Sometimes form 8 to 10 litres were strewed upon a board within reach of the flame from a shot. The board was laid upon two bricks placed on end, one of its ends resting on the cannon 12 centimetres (5 in.) below the centre line of the hole. With this arrangement the flames only licked the dust near the hole, drove them forward and brought them into a state of suspension in the surrounding atmosphere. Whatever was done and whatever might be the composition and degree of fineness, more or less dust was always floating in the air; and the finer portions remained permanently suspended in the "heading." At other times—for instance, if it was desired to constitute an inflammable atmosphere by the aid of dust alone and without gas—a rag was hung to the agitator so as to drag over the dust on the board. It should also be noted that the draughts due to the working of the agitator were sufficient to raise enough dust. Lastly, to create clouds of dust outside the scope of the agitator a broom was brought into requisition.

Ample measures were taken for observing what passed inside the "heading" and for avoiding any dangerous effects of a gas explosion. In a casemated chamber which contains the gas-meter and the electric firing apparatus, the charges are prepared. Of course there could be no question of any other than the electrical method of firing, which is the only safe one. The Belgian Firedamp Commission, appointed in 1888, gave preference to induced currents, the sparks which they may produce being easily avoidable, and their drawbacks being less than those of batteries. A static induction machine of Bornhardt or Ebner, with Bornhardt detonators, charged with 0·54 gramme of fulminade, were used for firing; and Nobel detonators, containing a gramme of fulminade No. 5, were exploded by a Scola and Ruggieri contact-maker. The Bornhardt or Nobel detonators were sufficiently to ensure complete detonation, even with grisoutite; and it should be remarked that it is not so important that the detonators contain a large charge as that there be a great density of charging, both as regards the intensity of the shock and the degree of safety.

In researches which have hitherto been made as to the properties of explosive mixtures, with or without coaldust, and of the comparison of various explosives as regards safety, too little attention has been directed to the temperature of the place where the explosion occurs. It is not that there was any doubt as to the influence which this temperature might exert on the explosibility of these mixtures; but no thorough investigations have been made in connection with this subject, so that they still remain to be carried out. Galloway, in a study of the influence exerted by climacteric conditions on firedamp explosions has only considered the question of temperature, so far as variations of the thermometer (in the atmosphere at the surface of the colliery) may be repeated in the underground workings, while causing considerable variations of volume, and outbursts of gas similar to those brought about by barometric fluctuations; but, as regards the influence of the temperature of air-currents in the mine itself, there is scarcely any question. It would appear that the special commissions which have made investigations into mine accidents, and especially as to the danger of explosives, have generally had no other thought than of experimenting under conditions comparable with those of underground workings.

The author remarks that Hall and Clark, in their investigations as to the explosibility of coaldust, arrived at their conclusions only in the case of dry mines at a high temperature. With respect to Sir Frederick Abel's experiments, the author quotes from the report of the English Firedamp Commission as to heating the air, in order to obtain such results as are produced by coaldust in most underground workings where the normal temperature is relatively high. As dry mines are precisely hot mines, and *vice versa*, at any rate generally, he thinks it possible that, in studying the influence of dust on explosions, the effects of dryness of the dust may have been sometimes confounded with those of their temperature.

Herr Wullmer and Herr Lohmann, in their report on the experiments made at the physicial laboratory of the Aix-la-Chapelle University, state that they made no experiments with respect to the relation between the temperature of ignition and the temperature and pressure of the explosive gas. Its easy ignition in contact with large incandescent surfaces leads to the supposition that the temperature of ignition falls, and that of the gas rises, but those authors do not consider that, practically, there is any appreciable connection between these variations. The statistics of the German Commission and its experiments with explosives are not more instructive. Nor has the French Commission on explosive substances determined what might be the influence of temperature of the atmosphere, where a mine shot is fired, upon its inflammability. But it was, in the opinion of the author, during the experiments at Schlebusch, at the manufactory of the Dynamite Actiengesellschaft, that this influence was clearly manifested.

It was at the time when experiments were made for arriving at the best composition for grisoutite. Various mixtures had been compared, with charges varying from 80 to 200 grammes, without tamping, or with coaldust tamping, and in mixtures impregnated with coaldust and containing 0 to 16 per cent. of gas. The temperature had not exceeded 30 degs. Cent. (86 degs. Fahr.), and no ignition had taken place; but at the thirteenth experiment, with a temperature of 35 degs. Cent. (95 degs Fahr.) an explosion occurred. After a great deal of discussion, it was determined to attribute the cause to the temperature. Two more experiments were made at 30 degs., under the same conditions; but no explosion ensued. When, however, the temperature was again raised to 35 degs., explosion again occurred. There was no more room for doubt; to avoid a fresh ignition the gases of detonation must be cooled down. In principle it was possible to arrive at this result by charging a portion of volatilisable salt on the top of the explosive; and two experiments in this direction confirmed this supposition. The result might be still better attained by increasing the proportion of hydrated salt, incorporated in the explosive, for the same quantity of explosive substances. Thus,

three charges of 200 grammes (6⅔ oz.), tambed with coaldust and blown out into a dusty atmosphere containing 12 per cent of gas, gave rise to neither ignition nor explosion, although the temperature was raised to 35 degs.

It was thus proved that the proportion of dydrated salt *for preventing ignition must increase with the temperature* of the explosive atmosphere, the harmlessness of which it was desired to ensure. What can this be but that the "apparent temperature of ignition," as defined by M. Mallard and M. Le Chatelier increases with the temperature; it would, therefore, be a function of the pressure of explosion and of the surrounding temperature. It follows that the degrees of safety possessed by the various explosives can in reality only be relied upon, subject to the condition that they be made with an equal surrounding temperature; because—as may be deduced from the Schlebusch experiments—the limit of temperature where safety ceases to exist, may be such as is met with in the undergrounld workings of a colliery. With a variation of *1 or 2* degs. in temperature, *any explosive normally harmless*, may become dangerous, or, at any rate, lose its quality of safety. Deep and hot mines are therefore more dangerous than others; and in this case again the first remedy for the evil is powerful and abundant ventilation.

As the Schlebush result must leave doubt on the subject, the author quotes, from the report of the French Commission on Explosives, facts to prove that the explosive itself is highly sensitive to the influence of temperature. The above Commission also deals with the question in a special chapter as to the possible influence exerted on the inflammability of firedamp by the quantity of steam contained in the air, in the course of which the following observation occurs: —"It is possible that if the *quantity of watery vapour contained in the atmosphere* be increased, the inflammability of firedamp may not be so much reduced as it would otherwise be." The report then quotes Mr. Dixon's deductions, that carbonic oxide does not combine with oxygen, under the influence of the electric spark, when the gases are perfectly dry, observing that a similar fact as regards gasy mixtures would be of great importance in collieries where the air is generally saturated with moisture. One more quotation from the report terminates in the following words:—"Laboratory experiments have not permitted of noticing any appreciable difference in the inflammability of mixtures containing more or less humidity."

Considering the importance attached by the author to the influence of *temperature*, he has *recorded fractions* of degrees, the thermometer used in the Produits experiments being graduated to tenths of a degree (Centigrade). Suspended about the middle of the gas chamber, it recorded the mean temperature of that chamber; and a clay plug closed the aperture by which the thermometer was introduced, so as to avoid any escape of gas. The reason why the thermometer only marked a mean of the temperature was on account of the heating apparatus, which consisted of a steam coil of five spirals of equal diameter, held by flanges against the wall, behind the boiler. The temperature was therefore necessarily higher near the cannon's mouth; and the products of the explosion, representing a blown-out shot, thus passed through the most dangerous point of the atmosphere first of all.

In the top of that part of the boiler which constituted the gas chamber, three man-holes had been cut; and the covers which closed them rested simply on india-rubber rings; but chains, the links of which are made of ¼ in. round iron, attach them to much stronger rings riveted to the boiler plates. The covers were well luted with clay every time that gas was introduced into the apparatus; and in this way the covers formed safety valves, while they also acted, to a certain extent, as dynamo-meters, the intensity of the explosion being shown by the manner in which these covers were lifted up, and thrown forward or torn off. One explosion, with forcite, threw one of the covers a distance of 40 m. over the wall of the enclosure; another, with Favier explosive, threw a cover to almost the same spot; and another, 45 m. distance over a double span of coal-shed roofs, similar effects being obtained with the same explosives in other experiments.

Spontaneous Combustion in Coal Mines.*

In submitting the following paper on "Spontaneous Combustion in Coal Mines," the author does so rather in the hope of eliciting valuable information in the discussing, than with any expectation of conveying knowledge to those members whose experience has been gained in mines liable to this species of catastrophe. The few remarks submitted are the result of knowledge gleaned in his experience and travels in districts most liable to spontaneous combustion, such as Leicestershire, Warwickshire, Staffordshire, and in other districts where it is less frequent, such as Yorkshire, Derbyshire, and Nottinghamshire. He is, however, also indebted to the various papers add writings of others, published in the proceedings of the various scientific bodies, and to his private correspondence with mining engineers and chemists, whose assistance he gratefully acknowledges.

Most of the dangers and difficulties encountered in a mine, can be overcome in certain well-known ways; water can be raised by pumping-engines: gas can be carried away by ventilation, and the danger obviated by safety lamps; faults can be passed through by sufficient expenditure of money; but spontaneous combustion can hardly be prevented, and when once begun it is sometimes impossible to stop it, except by some process that involves the entire closing of the colliery.

Spontaneous combustion of coal or as it is sometimes, *and perhaps more correctly called spontaneous ignition*, means the firing of coal without the direct application of a lighted match or other flame.

In some cases the cause of spontaneous ignition is obvious. Take for instance a ventilating furnace built in a seam of coal. The heat from the fire makes the brick-shale work hot, and raises the temperature of the coal or coal adjoining to the point necessary for ignition, which is between 700 and 800 degs. Fahr. The remedy for this kind of spontaneous ignition, if it can be so called, is very simple, and that is to separate the coal or coal shale from the furnace by a passage conveying a current of cool air. It is not enough to provide an air space, because air is as easily heated as any other substance; it is necessary, to *provide a constant current so that there may be always* cool air between the arch containing the furnace and the arch supporting the coal or other strata.

But spontaneous ignition often takes place under conditions where there is no fire or any apparent source of heat equal to 700 or 800 degs. Fahr. Any large heap of ordinary bituminous coal is liable to spontaneous combustion—say, one, 10 feet thick and 30 or 40 feet square. The larger the heap and the smaller the coal, the greater the liability of fire. Thus, a heap of coal built up of large blocks of hard coal 15 feet high will probably not take fire, but a heap of slack of equal height from the same seam would probably take fire.

If a little artificial heat is applied to a very small heap of slack, of say, 2 or 3 tons, it is liable to fire. Suppose, for instance, there is a brick flue carrying the hot gases from a fire to a chimney and 3 or 4 tons of slack are tipped against this flue, it is very likely to take fire. The reason of this again is very obvious. The outside of the boiler-flue feels cool, because it is exposed to the wind, but the inside of the boiler-flue is very hot, perhaps 800 degs. Fahr., or more in temperature. When the slack covers the external wall the heat is no longer carried away, and the outside of the brickwork in a few days will become nearly as hot as the interior, whose heat is quite sufficient to set fire to coal.

There are, however, other cases less easily understood. For instance, if a heap of coal be laid over a steam pipe it will soon take fire, though the temperature of the steam and the pipe never exceeds 330 degs. Fahr., which is less than half the temperature required for the ignition of coal. But this is not so curious as the ignition of coal where there is no artificial heat of any kind.

Coal is not the only substance that will inflame without the application of a match. If newly burnt charcoal is ground up, it will take fire. Rags or waste soaked with vegetable oil and put in a heap will take fire. Very finely divided iron or lead will also burn. Phosphorus takes fire with the warmth of the hand. The compression of air, by means of a piston in a syringe, will give heat sufficient to ignite ether or tinder soaked in a solution of nitre.

In coal mines there is a general liability to spontaneous combustion in the majority of the coal fields of Great Britain in some districts it is exceedingly rare, and in others it is exceedingly common. Experience shows that it is very rare in thin seams and very common in thick seams; and that in seams of equal thickness it is more likely to occur where a large proportion of the seam is left in the mine, either as slack or as roof coal. In fact, spontaneous combustion, as a general rule, occurs in those mines where a great deal of small and broken coal is left in the goaf, and is hardly, if at all, known in those mines where all the coal is sent out, and where there is no coal in the mine except the solid uncut seam or large and uncrushed pillars.

The districts where gobfires are most common in Great Britain are South Staffordshire, West Leicestershire, and Warwickshire.

In South Staffordshire, the Ten-yard coal is worked pillar and stall. It is got in panels, locally termed "sides," say about 80 to 100 yards square, in which area there would be sixteen or twenty pills s about 10 yards square. The whole of the coal between the pillars and the ribs separating the sides or panels is got, with the exception of the roof coal, say a yard in thickness, which is left because of the danger of trying to get it. A good deal of slack and of coal mixed with dirt is also left in as being valueless. In course of time the roof falls and a good deal of coal no doubt breaks off the sides of the pillars. Thus considerable heaps of coal, dirt, and slack are formed, and in a short time these heaps frequently get very hot, and unless precautions are taken they would burst into flames.

The usual method of preventing this is to put stoppings in all the roads leading into the "side" so as to prevent any fresh air having access; thus any combustion that begins speedily exhausts the oxygen, and further combustion is so prevented. The slow combustion, however, so far as it takes place, has the effect of making the mine in that part exceedingly hot. In some places air draws through cracks in the ribs, so that a more rapid combustion can take place and great heat is produced. The main roads leading past these hot districts, are sometimes arched with brickwork, to assist in the exclusion of the air and to maintain a good road. Sometimes the brickwork gets so hot that it cannot be touched. As a general rule, however, the exclusion of the air stops the combustion. After the whole of the mine has been worked the sides are often re-opened to get the pillars and ribs.

In Leicestershire the coal is worked in two ways; sometimes by long-wall and packed gates, and sometimes by heading out and working back. Where the packed gates are used, the packs are made impervious to air by means of wax walls. These wax walls are made of clay, which has been worked to the proper consistency *for making bricks, and is sent down in large lumps* about 9 inches square and 18 inches long, and is built up into walls on each side of the gate road, while small dirt is packed on each side of the wax walls. These walls being soft have no strength to support the roof, and the packs are made to a great extent of wood. The wood used is the small branches of trees cut into lengths of about a yard and built into square piles: It is commonly called "brattice wood." These timber packs are placed about 4 feet apart, and the space between them is filled up with stone made for the ripping of the gate roads. In this way the goaf between the gate roads is kept from the air current; the only place where the air comes in contact with the goaf is close to the working face. In order to *prevent the air from* getting back into the goaf near the working face, the ventilation is kept as slack as is consistent with safety. The face is moved forward pretty fast, say, 2 or 3 yards a week, and consequently the goaf near the face has not time to heat. If, however, there should be a stoppage, owing to slackness of trade or a strike, the goaf would take fire at the face; and to prevent that, the wax wall has to be carried along the face from gate road to gate road.

Mr. Alfred Ely, in a valuable paper read before the Chesterfield and Derbyshire Institute, in pril, 1877, describes another method of excluding the air from the goaf at the face. He packs a bank of dirt all the way along the face on a slope from the roof to the floor. The face of this slope he then covers with a layer of sand 6 inches thick, which has the same effect as a clay wall in keeping out air.

Where the system of heading out and working back is employed; no wax walls are required, except during a stoppage, and then a wax wall is run along the face between the coal and the goaf, so as to exclude the air from the goaf.

In some collieries, the manager arranges as far as possible to finish off a district before the summer when trade is slack, and then he opens out a new district ready for the ensuing winter; the point to be aimed at being that the air current must never pass over or through heaps of slack or broken coal as in a goaf.

In Warwickshire the liability to spontaneous combustion is met by working the face as quickly as possible. For this purpose a number of coal-getters are concentrated in a small area. Where ever practicable, the mine is worked by heading out in the solid, and then bringing the coal back.

In many Warwickshire mines, the bulk of the coal lies to the dip of the shaft; in this case the headings are driven down to the dip boundary, and then the coal is brought back, the goaf being allowed to fill with water.

Both in Warwickshire and Leicestershire, a considerable portion of the coal in the seam worked is not got, being of slightly inferior quality to the coal that is got. Also a good deal of slack is left in the mine, so that there are great heaps of slack and broken coal.

But the question now arises, How can this coal take fire considering that the natural temperature of the earth in these mines is, say, from 60 degs. to 65 degs. Fhr.?

The explanation formerly given was that the iron pyrites, that is, disulphide of iron (fe S), which is often found in the coal and in the shales, is decomposed by the oxygen of the air, and that this decomposition is accompanied with heat. It has been found by experiment that in some cases great heaps of shale, containing a large percentage of iron pyrites, have taken fire through the decomposition of the pyrites. But the amount of pyrites in the coal mines is too slight to have any appreciable effect in heating the coal, and this theory is now given up by those who have most studied the question.

Prof. Vivian B. Lewes, has made some valuable contributions to the knowledge of this subject in papers read to the British Association, in 1891, and subsequently to the Society of Arts. He states that it has been demonstrated by Richters, that newly cut coal will absorb oxygen; some coal absorbing 1¼ times its own bulk, and other coal 3 time its own bulk.

How the oxygen gets in and is compressed into the very small space it must occupy is another question, but there is no doubt that it does go in, and that active chemical decomposition of the coal takes place, forming carbonic acid gas and water, and that this decomposition is accompanied with considerable heat.

The hotter the mine the more rapid the decomposition, so that the process of heating when once begun goes on at an accelerating ratio, or in geometrial progression provided there is a sufficiency of oxygen to keep up the the combustion.

In mines where the air is successfully kept from the goaf however, the heat rises up to a certain point sufficient to make the mine very warm, but does not exceed that point, and then cools down again, because there is not enough air for further slow combustion.

The return air of a mine, the natural temperature of which is about 62 or 63 degrees Fahr., will probably be 70 degrees, and in some places warmer still.

In order that the heat may get up to the point of combustion, it is necessary that the coal or slack should have no opportunity of cooling. In the case of a very large heap of slack the heat which is generated in the centre cannot escape, and in the case of a small heap of slack, which is buried in the goaf of a mine, the heat there also is kept in by the cover of shale and roof. But while the

* Paper by A. Lupton, Transactions Federated Institution of Mining Engineers.

cover keeps in the heat it also excludes the oxygen, which is necessary for combustion; therefore, the heating will arise from the oxygen which is taken into the coal before it is finally covered up by other coal or by falls of roof, and the heating proceeds from the centre of the heap outwards. But if, when the heat from the centre has reached the outside of the heap, there is a supply of fresh oxygen at the outside, the heap will rapidly take fire.

Where the workings in a long wall face are being moved rapidly forward, the outside of the heap never gets hot enough to fire, because the heap is being continually lengthened and the old part of the heap is kept from the air by the wax walls on each side and the new stuff in front.

It is sometimes recommended, as a way of preventing spontaneous combustion, that the goaf should be cooled by strong ventilation.

There is no doubt that this cooling by ventilation will prevent a gob fire, if it is thoroughly efficient. That it may be efficient it is necessary that there should be no large heaps of broken coal, because the wind cannot be forced through these heaps, and, as a general rule, it is found impossible to prevent combustion by cooling, so it has to be prevented by the exclusion of the air. The air roads would have to be within a few, say 15, feet of each other to ensure effective cooling.

When every precaution has been taken it will happen, however, that the mine will catch fire in places, and unless these fires are immediately extinguished, the flames may rapidly extend to the whole mine. It is therefore necessary that the mine should be continually traversed and examined for any signs of combustion, which is usually detected by the condensation of moisture or the pungent odor from the heating mass.

In many cases, as soon as heating is discovered it is put out by simply digging out the hot part and sending it out of the pit, and in some cases, filling up the place with sand. It sometimes happens, however, that the mass of hot material is too large to be dug out, and a sort of hand fire engine has been used to pump water on to the fire, after which the combustible material is dug out and the place filled with sand.

In some mines water is laid on all over the mine under pressure, and is ready for extinguishing a fire from whatever cause it may arise.

In a great many cases the only way of extinguishing a fire is to build off the district in which it occurs. In this case, the stoppings are generally made by building a brick wall with mortar, this wall is sometimes faced with a clay wall, which is kept damp and constantly smeared to close all the openings and so prevent air from drying it. Several stoppings are built a few yards apart, so as to reduce the chance of leakage past the walls. The burning coal in the enclosed area soon exhausts the oxygen, and then the fire goes out.

If, however, there should be any tendency due to the ventilating pressure of the mine for air to pass through this district, it is exceedingly likely that some air may find its way in and keep the fire smouldering, ready to relight as soon as the stoppings are pulled down. Sometimes such a fire may smoulder for thirty years, and there are cases of underground fires that have lasted a longer period.

The only certain way of extinguishing a large fire is to submerge the mine or district of the mine under water; this is never resorted to until every other plan has failed.

Cases have happened where gob fires have not been even subdued by the stoppings built, but owing to air drawing through cracks in the coal pillars, the fire has gone through the pillars.

In one mine known to the writer he has been told that the pillars of solid coal fired spontaneously not far from the upcast shaft, and before the fire was discovered it had reached proportions which made it hopeless to extinguish it. It was therefore necessary to close the pit, and the shafts were stopped by hanging scaffolds about 20 yards down by means of chains, and on to these scaffolds was put earth and clay, filling up the shaft completely to the top. The air being thus entirely excluded, the fire extinguished itself by burning up the oxygen, and subsequently the mine was re-opened.

Sometimes, the exclusion of the air from a district in a mine which has taken fire involves the building of a great length of brick wall, owing to the joints in the roof and coal permitting the air to pass; but by building all round the district a brick wall, which is dug into a trench in the floor and into a nick in the roof, the air is excluded to a sufficient extent to permit of the working of the colliery.

Where a main road has to be taken through a district which is hot it is often best to arch it with brick-work, the arch being surrounded with sand. In order to prevent the air drawing through cracks in the floor, the archway is inverted, the invert also being laid on sand. The object of the sand is to cover up all small holes in the brickwork, or any cracks that may subsequently occur therein, and so prevent air drawing through. It must, therefore, be very carefully rammed into position. The inside of the wall may be lime-washed from time to time, to fill up the cracks in the wall.

If a fire in a mine once gets fairly hold of the coal in a place where there is a sufficient supply of air, the heat produces a great deal of gas from the coal which may form an explosive mixture with the air, and thus a serious explosion may result.

A Good Canadian Oil Well.—A few weeks ago a large syndicate of London capitalists purchased 45 acres and bonded several other parts of the Bothwell oil territory for the purpose of testing same for the oleageneous. No. 1 well was finished a few days ago and drilled to the depth of 400 feet and only a few hundred yards from the old Nash and Townsend well drilled many years ago. The result was very gratifying, and one of our oil experts from Petrolia estimates the production at from 15 to 20 barrels per day. The great trouble is that the company is testing its well with an old 2-inch pump and the well has quite a supply of water. When the well is ironed off there is not much doubt but that the production will be increased.