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The Canadian Mining Review

Established 1882

Vol. XV.—No 5 MONTREAL—OTTAWA—HALIFAX. MAY, 1896.

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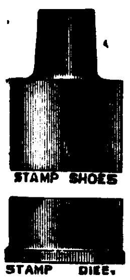

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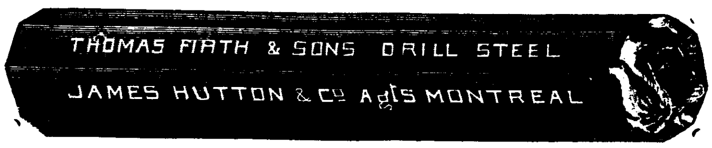

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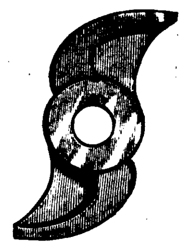

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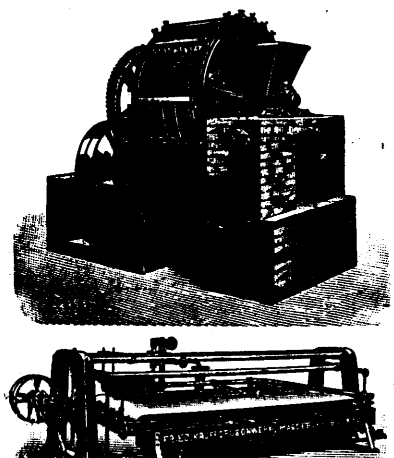

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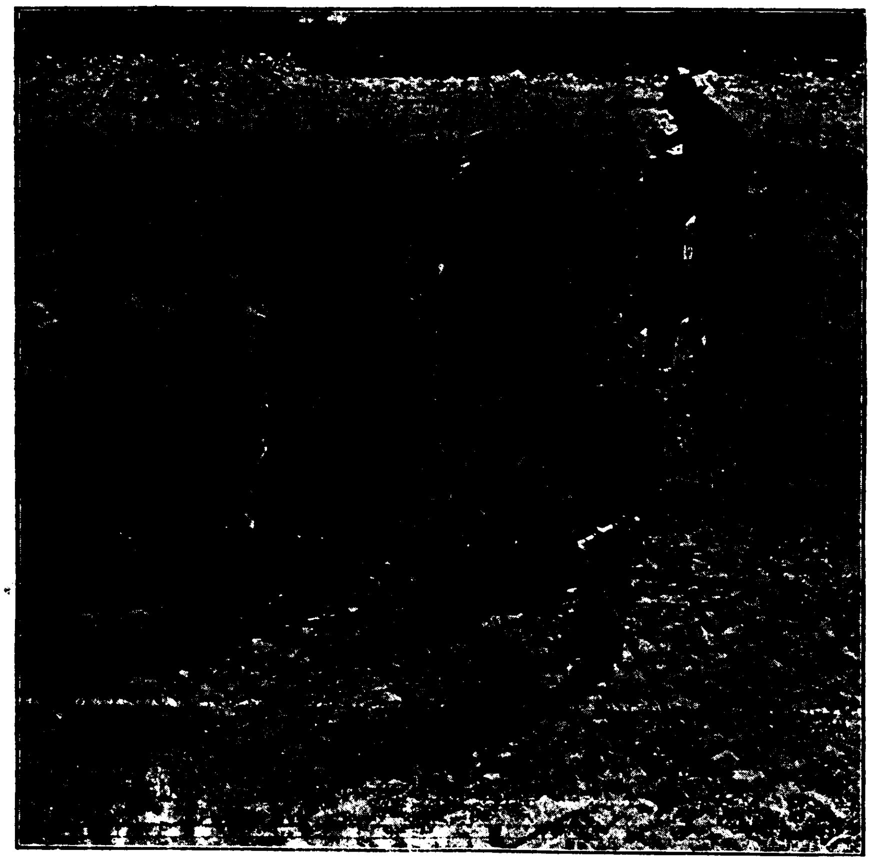

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Original discoverer of ore or mineral on claim entitled to stake out a second claim.

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

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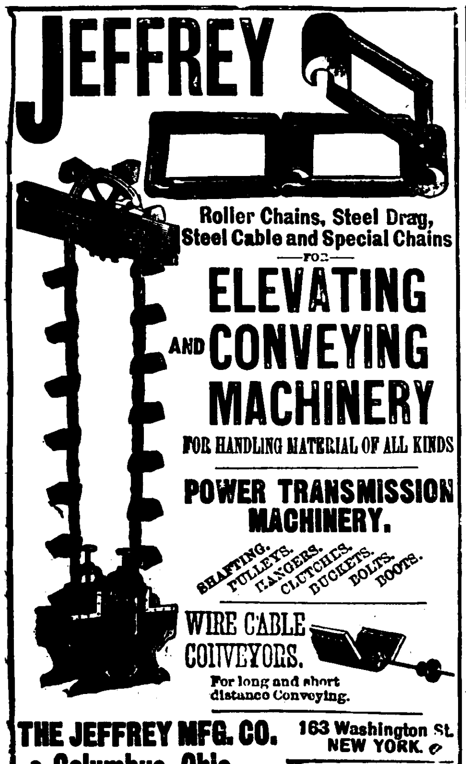
ARCHIBALD BLUE,
Director Bureau of Mines

TORONTO, May 25th, 1894.


T.J.C. INJECTOR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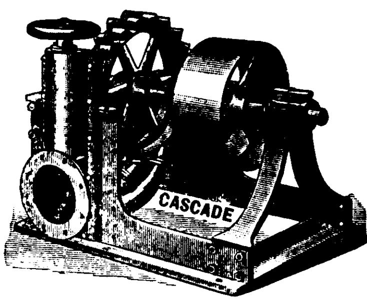
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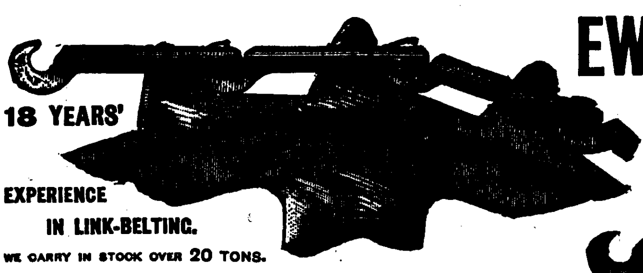


The Canadian Mining Review
Established 1882

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

B. T. A. BELL, Editor. Published Monthly. OFFICES: Slater Building, Ottawa.

VOL. XV., No. 5 MAY, 1896. VOL. XV., No. 5

EN PASSANT.

With this issue subscribers receive the sixth annual issue of the "Canadian Mining Iron and Steel Manual." The new volume is handsomely gotten up and, as in former issues, will be found to be a handy and serviceable reference to our mineral industries and to the organization and operations of our mines and mining companies. Much of the book has been rewritten and the information brought down to date, while its value is enhanced by the publication of close upon one hundred photo-engravings of our collieries, metal mines, smelting works and blast furnaces. The edition having, like its predecessors, being almost entirely sold in advance of publication, only a few copies will be placed on sale.

Mr. Harrison Watson, Curator of the Imperial Institute, writes us with a view to improving the mineral exhibits from Canada, and particularly those sent from the Province of Quebec. He says:—"Thanks to the kindness of Dr. G. M. Dawson, the exhibits of asbestos and mica are representative, but approximately all the other specimens which we have are relics of the Colonial Exhibition of 1886, and it is more than probable that very substantial additions would require to be made to the collection to bring it up to date.

"Ontario and Nova Scotia have good collections transmitted by the Provincial Governments, and British Columbia is also fairly well represented. New Brunswick has practically nothing and Manitoba and the Territories, where of course less development in this line has taken place, are also unrepresented.

"To return however to Quebec, the ministers last summer, Messrs. Taillon, Beaubien and Nantel, expressed their willingness to improve the existing collection generally, and the Government would doubtlessly be willing to pay the transportation charges of any additional specimens which the Quebec association wished to send over."

This is a matter deserving the immediate attention of the Commissioner of Crown Lands. These exhibits are of the greatest value to the development of the country, and there is no reason why the varied mineral resources of the Province of Quebec should not be prominently displayed in the Institute. We commend the matter not only to the Quebec Government, but to our mining men, who will doubtless be found willing to co-operate with it in an improvement of the present collection.

Our paragraph respecting the interpretation of the law respecting the free importation of mining machinery has called for the following remarks from one of our blast furnace operators:— "I agree very fully with you in your remarks with respect to giving the manufacturers the most liberal protection possible. It is, however, quite unfair to misinterpret and circumscribe the tariff item referring to the importation of mining machinery in such a way as to exclude machinery not manufactured in Canada and thus make the item practically inoperative. Certain manufacturers are always ready to say 'they are willing to manufacture if they only had an order,' when as a matter of fact they have never made the machine, and in attempting to do so would only be an experiment likely to result in failure. As an instance we might cite our big blast furnace blowing engines. A Canadian company who had never built, and who at their very best could only have had the most superficial acquaintance with the requirements of such machinery, wrote us offering to supply our engines. In view of the fact that the success or failure of our enterprise depended on these engines working satisfactorily, we, of course, could not entertain the placing of the order except with manufacturers whose experience and reputation was such as to guarantee absolute satisfaction, and we had to go to a foreign establishment for them, with the result that we had to pay a duty of 30 per cent., which, in this particular case, meant a very considerable sum. It is not likely that the most sanguine of us can expect to see even 10 sets of blast furnace blowing engines installed in Canada during the next decade, therefore I take it that any manufacturer would be extremely foolish to attempt the construction of such engines. In view of this there is no object in giving protection in this particular case, whereas by admitting them free it would give a certain amount of encouragement to the blast furnace business, which it is very badly in need of."

While the officials of the Department of Customs are endeavoring to place the most liberal interpretation possible upon the law, the chief difficulty heretofore has been with the collectors at ports of entry, who have had no uniform statement furnished them as to what classes or kinds of mining machinery are manufactured in Canada, other than the vague and misleading inventory compiled by the Jenckes Machine Co. of Sherbrooke. So much friction and difficulty was created by the use of this list by the Government that the Mining Societies of Nova Scotia and Quebec were compelled to take action and a more complete and definite statement was prepared by a joint committee of Canadian manufacturers in conjunction with the mine managers. Were each collector furnished with this statement we would hear less of difficulties in bringing in machinery entitled to the benefit of the law.

An instance has been brought to our notice of two Forster ore-breakers imported recently for use in a Nova Scotia gold mine having been held for duty. There is something wrong here, for the machine is distinctly of a type not manufactured in Canada; and further, to our certain knowledge, it has been already brought in "free" at the port of Halifax for use at the Oldham and West Waverley gold mines. This mistake we believe will be rectified.

Only the other day a Tremaine stamp mill was held for duty at the port of Winnipeg, but on proper representations to the controller the machine was admitted duty free according to law.

Fire-proof paper, for printing and writing purposes, is now manufactured in Berlin by a new patented process. Ninety-five parts of asbestos fibre of the best quality are washed in a solution of permanganate of calcium and then treated with sulphuric acid as a bleaching agent Five parts of wood pulp, as used in paper factories, are added, and the whole is placed in the agitating box with an addition of lime water and borax. After being thoroughly mixed the material is pumped into the regulating box, and allowed to flow out of a gate on an endless wire cloth, where it enters the usual paper making machinery. It is easy to apply water marks to this paper, which ordinarily has a smooth surface, but which can be satin finished, this being more preferable for writing purposes Paper thus produced is said to resist even the direct influence of flame and remains uninjured even in a white heat.

The Le Roi Mining and Smelting Co, Trail, B.C., have just closed a contract with the Canadian Rand Drill Co, of Montreal, for the largest and most extensive air compressor plant ever built in the Dominion of Canada. The specifications call for one cross compound condensing Corliss air compressor of about 450 indicated horse-power. The machine is to be fitted with the latest type of mechanical air valves, which effect a considerable percentage of economy. When in position the machinery will be used for hoisting and pumping and to operate about 40 drills at the elevation of the Le Roi mines, which is about 3,500 feet above sea level. The machine is to be built in the new works of the contractors at Sherbrooke. When it arrives at the property it will be put on the Black Bear, which is west of the present shaft house on the Le Roi. The plant will weigh 137,000 lbs.

The proceedings of the Smithsonian Institution contain a recent contribution of much interest on "Asbestos and Asbestiferous Minerals." by Mr. George P. Merrill. The points brought out in this paper and the suggestions are :— (1) That a very considerable proportion of the mineral in commercial use, and labelled as asbestos in mineral cabinets, is in reality anthophyllite, and (2) that the fibrous structure in this case, and that of the true asbestos as well, is due, in many instances at least, to a process of shearing—is, in fact, an exaggerated form of the process of uralitization. The fibres are drawn out along the plane of the vertical axis only, the parting or line of separation between individual fibres taking place mainly along cleavage lines, each one being, therefore, an elongated prism bounded by cleavage faces, but with form somewhat compressed or otherwise distorted by pressure. The broad faces on the fibres will therefore correspond to the faces of the unit prism. The fact that the fibres do not in all cases run even approximately parallel to the wall of the inclosing rock is not necessarily opposed to the view Owing to a lack of homogeneity in a rock mass subjected to a compressive force, there may be developed at an early stage a series of short, step-like folds bordering closely upon, or perhaps passing into faults, in which the materials forming the yielding portion of the mass may be ground to powder, crimped, puckered, or even rendered fissile, or fibrous, according to their individual qualities. In such cases the fibres may stand, relative to the inclosing, more resisting rock masses, in all positions short of at right angles.

If the foregoing is correct, it may seem, on first thought, that we should find asbesti-form augites, enstatites, and other members of the the pyroxene group. This does not necessarily follow, since these minerals, as is well known, are peculiarly subject to alteration under conditions of strain, giving rise to actinolitic, tremolitic and talcose products. These may or may not be asbestiform, according to local conditions. It is Mr. Merrill's belief that the asbestos form is never a result of original crystallization, but is always secondary, the original mineral doubtless being an orthorhombic or monoclinic pyroxene, or perhaps an amphibole The references made to the works of Blum, Heddle, Sandberger and others, in the earliest parts of this paper, seem to point to this conclusion. It is possible in such cases that the mineral derived from the rhombic magnesian pyroxenes may take the form of anthophyllite, and those from monoclinic lime-magnesian pyroxenes that of tremolite. Such a rule can scarcely be considered as universal, since in many cases the mineral undergoes more or less chemical as well as molecular alterations under these conditions. The absence of appreciable quantities of alumina in the asbestos proper is perhaps the strongest argument against its derivation from augite or other aluminous pyroxenes, though it is doubtless to such an origin that we can trace the uralites from Nahant and Malden.

There is ample field here for further observation, and should this paper be effective in causing collectors to note more carefully than heretofore, not merely where the mineral occurs, but how it occurs and with what associations, it will serve at least one good purpose.

At a recent meeting of the Manchester Geological Society Mr. Henry Hall, one of Her Majesty's inspectors of mines, exhibited a couple of self igniting safety lamps such as are now being largely used in German mines. One of these was a Wolf lamp, a German patent, and the other an ordinary Clanny lamp, both fitted with self-igniting apparatus, one of the lamps burning benzine and the other colza oil, the igniting apparatus being equally effective in re-lighting either of the lamps. The igniting arrangement consists of a narrow tape carrying on its surface at intervals, small patches of fulminating material, this tape being fitted inside the lamp in connection with a small shaft passing through the bottom of the lamp similar to the pricker wire of an ordinary safety lamp. The tape passes from the bottom of the lamp up to the wick through a tooth clip, and, by drawing the small shaft up, projects from underneath the lamp quickly downwards, the fulminate on the tape is brought in contact with the teeth of the clip and at once ignites, setting the portion of the tape projecting towards the lamp wick in flame, and then, by leaning the lamp a little on one side, this flame is brought in contact with the wick, and relights the lamp. One length of tape is sufficient to relight the lamp from 50 to 60 times, and there is consequently no need to interfere with the apparatus for a considerable period. Mr. Hall, having experimented with the lamps to show the working of the igniting apparatus, remarked that there were objections in some quarters to placing an apparatus of that kind in the hands of a collier, as it was held by many mining engineers that when a lamp was put out through any accident it ought to be examined by some responsible person before being relighted. Against this objection, however, there were several advantages, the chief of which was that lamps were subject to being accidentally knocked out by the lads employed in carrying them to and from the face and the lamp stations, and there was the danger of men continuing their work in the dark owing to their having no means of relighting them. The view taken in Germany, where these lamps with self-igniting apparatus were in general use, was that in case of a large explosion the use of such lamps enabled the workmen who were not injured, but whose lamps would in all probability be put out, to again procure a light, which would and had often been the means of saving a considerable number of lives. He (Mr. Hall) thought this view of the matter was very important, as there could be no doubt that in case of an explosion a miner could scarcely be left in a more terrible position than being deprived of any means of procuring a light to help him in his escape If it was thought unwise to put this apparatus for relighting lamps in the hands of a collier on the ground that an insecure lamp might thus be relighted, the apparatus might be so designed that it could only be operated by a fireman. Personally, he did not express any decided opinion as to the advantage or otherwise of the apparatus, but thought it well worth the consideration of the mining members of the society, both as a matter of economy and of precaution. Certainly it would take away the temptation to improperly open a lamp when gone out, and there would be a saving of the expense incurred in employing boys to carry lamps from point to point for relighting. He also understood the workmen themselves were often put to considerable expense during their day's work as things were at present through not being able to procure a light after a lamp had accidentally gone out.

In valuing an iron mine one must apply very largely the rules and principles which are used in getting at the value of any other kind of property. The standard by which the valuation must always be gauged is the earning capacity of the mine It would be a mistake, however, to accept as evidence the cost sheets of its office. Mr. Nelson P. Hulst, in an able article on this subject in the "Engineering Magazine" for April, says that sometimes the balance sheet may show, or may be made to show, a gratifying prôfit in the mining work, by continually charging up to the inventory account, at full cost, the machinery and the various permanent improvements required for the business. The veriest tyro in the business ought to know that their value is only that of tools which are steadily wearing out, like the shovels or hammers, or are becoming obsolete, and must soon be abandoned for something more economical which will place the mine at equal advantage with competitors; and that, in the event of the exhaustion of the mine, they can have only a tithe of the value accorded them in the book accounts. On the other hand, a mine may not be worthless because it has shown a debt producing capacity, for sometimes a good mine may have a bad manager. Judgment of a mine must therefore be independent of its existing management, as well as of its books of account.

After showing a number of other factors that have to be considered in the valuation of a mine, Mr. Hulst concludes that the determination of value involves questions of business, of mining, of engineering, and of chemistry. Only intelligent and conscientious effort can estimate the value of the different factors with any degree of accuracy. The questions to be solved require a thoroughly reliable, capable man, who is up-to-date in mining practice. He should be thoroughly conversant with the market value of iron ores, and familiar with their chemical qualities. He should have a clear conception of the ways in which economies, big and little, are obtained in mining—a conception which has been disciplined by successful superintendence of an iron mine, as well as by the studies of its cost sheets. He should have worked upon the problems of the opening of iron mines, and the adaptation and installation of mine equipments. Only with such qualifications can a man be expected to furnish a reliable estimate of the value of an iron mine, or of the cost of opening it, and putting it into effective working order.

At a recent meeting of the South Wales Institute of Engineers, an interesting discussion arose as to the merits of a new hydraulic pumping plant described by Mr. James Barrow, of Maesteg. Some of the members were struck with the statement that only a three feet stroke could be got out of the pump when there was a four feet stroke in the engine; but it was argued that the percentage of loss was small when the great distance of transmission was taken into account, and that a 75 per cent. effective output compared favourably with the compressed air or other methods. The president, Mr. A. J. Stevens, of Newport, did not know of any valve that would last long under a pressure of 800 or 900 lbs. for a number of hours per day, and he explained that such valves, at the works of Messrs Armstrong, had to be renewed once every three weeks. This would be most inconvenient in a colliery. As to the loss of 25 per cent. in the Moore pump, he believed that elasticity of the air in the water had much to do with the loss. If that were so, it could hardly be reckoned as loss, for some of the elasticity would be given back at the return stroke. Most engineers who have had anything to do with mine pumps will consider that a 75 per cent. efficiency is a high one, and will concur in the opinion of the president that such loss was accountable to a large extent to the elasticity of the air within the water.

The phosphate market shows no sign of improvement. The great bugbear of the phosphate producers in every land has been Algeria. It was bruited that the output of this section was going to be enormous, and many brokers prevailed upon producers to sell at a fall by taking advantage of such a pretext. The output from this source for the year, however, was only 121,475 tons, which, when compared with the large and growing consumption of fertilizing material in Europe, is but a small matter. The output of phosphates in other parts of Europe and America shows a decrease. Commenting upon this *L'Engrais* says:—"Since moreover the consumption of phosphate increases rather than diminishes, we must look elsewhere for the cause of the slack in purchasings. The reason is found, in the fact that, for two years, the superphosphate manufacturers have exhausted their old stock which they hold in reserve and have, in the presence of the steadily increasing fall, been accustomed to supply themselves only to meet the demand of their actual needs. But the low prices have proved too much of a good thing and the producers, reduced to the alternative of being ruined or of defending themselves, have wisely chosen the latter. The ball has been started rolling by the superphosphate producers of France and Belgium, who after engaging in a bitter war against each other, are now united in a general trust. We much desire to see a trust take place soon between the phosphate producers of Europe and America. The thing is not impossible and it is the best wish we can make for them on the opening of a new year."

Exploring with the Govt. Diamond Drill.

By Thos. W. Gibson, Bureau of Mines, Toronto.

One of the most important aids to mining yet invented is the diamond drill, which has been widely adopted since its invention by Leschot, and is now in almost universal use. Its value consists in the opportunity which it gives the miner at a minimum of expense of actually seeing and handling a section of the material whose character it is all-important for him to ascertain, yet which is concealed from his gaze by a covering usually of rock, scores, perhaps hundreds of feet in thickness. This the diamond drill enables him to do without sinking shafts or excavating drifts and tunnels, which, after all, might turn out to be so much time and money wasted. It is equally of service in testing new ground and in exploring for bodies of ore in working mines. By its means the prospector may satisfy himself at a comparatively small cost whether the property he is investigating contains ore sufficient in quality and quantity to warrant regular mining operations. If he finds that it does, he knows beyond peradventure where to sink his shafts and how to lay out the work to be done; if it does not, he is saved further trouble and loss. The mining manager is enabled on the one hand to locate masses of ore in advance of actual drifting, and on the other to prove what parts of his territory are dead ground from which no returns can be hoped, and so to conduct his operations in either case intelligently and economically. In almost every large mine diamond drills for exploratory work are part of the regular plant and are constantly in operation. There can be no guess work as to the strata penetrated by the drill; the cores brought to the surface speak for themselves, and, what is no small advantage, supply samples large enough for detailed examination and analysis. The only point open to question is whether the cores themselves are thoroughly representative of the strata or deposits from which they are taken. As to this, in the matter of gold ore, for instance, there is sometimes room for doubt. The drill may pierce a rich pocket in a gold vein and so bring up a core showing a value quite out of proportion to the average contents of the vein, or it may run through a barren stretch and exhibit a core altogether worthless; producing a record in one case unduly flattering, and in the other unjustly condemnatory of the property. Such results, however, are only to be feared where variable and irregular deposits—as gold veins are occasionally found to be—are being examined by the drill. This drawback is absent where large bodies of ore or mineral, such as deposits of iron, copper, nickel, or beds of lithographic stone or marble, or similar masses are being examined.

There are various makes of diamond drills, but the principles on which they are constructed are substantially the same in all. The boring tool is an annular steel bit set with diamonds, which is attached to the end of a series of hollow rods, and being rotated under pressure wears away the rock upon which it bears, the core rising up in the hollow of the rods, or rather of the core barrel forming the terminus of the series. As the hole is put down additional lengths of pipe are screwed on, and when it is desired to bring the core to the surface the rods are raised and the core taken out. In this way a continuous section of the ground from the time the drill enters solid rock can be obtained, the boring capacity of the machines varying from a few hundred up to two thousand feet. Some of the smaller drills are made to work by hand, but the majority are operated by steam power, or in underground workings by compressed air. For surface work the engine is usually attached to the drill, both being mounted on a waggon for convenience of transport. The boiler for the same reason is also set on wheels. A supply of water is essential to the working of the diamond drill, and a steam pump forms part of the outfit, the duty of which is to send a constant stream through the rods down to the bottom of the hole where the bit is at work, and so bring the cuttings to the surface by means of the ascending current, which comes up between the rods and the casing or walls of the hole. It may occasionally happen that in porous or broken rock some fissure or jointing affords the water a subteranean passage, and it is "lost," or ceases coming to the surface. This is far from a desirable state of affairs, and it is necessary for the driller to recover the water. He usually seeks to do so by sending down to the bottom of the hole a supply of cement sufficient when hardened to stop the leak. In some cases bran or similar material is resorted to. Besides bringing the cuttings to the surface, and so keeping the drill runner constantly informed of the nature of the ground being passed through, the "wash" water, as it is called, indicates by its flowing freely or scantily the favorable or unfavorable progress of the work at the bottom of the hole.

An important part of a diamond drill outfit, and one which enters largely, both into its first cost and the expense of operating it, is the diamonds, or carbons, as they are sometimes called. They are veritable diamonds, procured mainly from Brazil, and are of precisely the same chemical composition as the white and more highly priced gems used for jewelry and ornamental purposes, differing only in color. They are black, or nearly so in shade, occasionally of a reddish tinge, and are found in various sizes. A stone recently got in the old diamond district of Brazil weighs 3,100 carats, and is by far the largest diamond ever known. It is now in the hands of the jewelry firm of Messrs. Kahn & Co, of Paris, and the Government of Brazil is negotiating to purchase it for the national museum of that country. Uncertainty as to how so unusually large a stone would turn out has made the dealers somewhat chary of handling it, and the price demanded is considered too great. The probable value is about $40,000, or 52s. 6d. per carat. When stones are found of larger size than can be conveniently used in the diamond drill, they are broken into pieces of about two carats weight, which is the size ordinarily employed. They are of a hardness quite equal to that of the white or colorless variety, and as the abrading action is largely done by the edges and angles of the stones, there is room for considerable skill on the part of the operator in setting the diamonds so that they may do the greatest amount of work with the minimum of loss. The price of black diamonds fluctuates a good deal according to the conditions of supply and demand, and also to the ability of the combinations which control the black diamond mines to rule the market. In the summer of 1894, when the department purchased the diamond drill plant, the market price was $17 per carat, and at that time and a little later a supply of diamonds was laid in amounting to 82.605 carats, at a cost of $1,356.16, or an average price of $16.40 per carat. Since then the market in the autumn of 1895 advanced to $19 per carat, and again in the following November to $21 per carat. An exceedingly brisk demand set in from the South African gold fields, and in January, 1895, the price rose to $25 per carat, in March to $30, and in April to $36, by far the highest price ever known. Almost the whole production of black diamonds at the present time can find ready sale in South Africa.

The practice in operating a drill is to keep a sufficient supply of diamonds on hand for at least two bits, so that one may be set while the other is in use. Usually eight stones are set in the bit. Some are placed directly on the face of the bit, some are made to project a fractional part of an inch on the outside of it, and some to project similarly on the inside, the object being to cut an annular ring out of the rock a little greater in width than the bit itself, thus allowing the latter and the rods to which it is attached free play. If for any reason it is desired to enlarge the diameter of the hole after it is put down a "reaming" bit is employed, in which the diamonds are set wholly on the outside. The wear on the diamonds varies greatly according to the hardness and compactness of the rock which is being drilled. In comparatively soft rocks, such as limestone, slate or shale, the loss is insignificant, while in such material as quartz, diorite or granite, the wear is very much greater. In the same way, the rate of boring varies widely. Where the rock is solid and not too hard, a hole may be put down 30 or 40 feet in a day of ten hours, but where greater resistance is met and drilling operations are interfered with by seams and fissures, perhaps the utmost diligence on the part of the drill runner will not suffice to gain more than 3 or 4 feet in the same time.

Numerous difficulties are likely to present themselves to the operator of a diamond drill plant, and as his work is so largely hidden from view, only native ingenuity and skill born of experience can enable him to overcome them. The following extract from an excellent article in a recent number of *The Engineering Magazine* of New York deals with this practical aspect of diamond drill work :

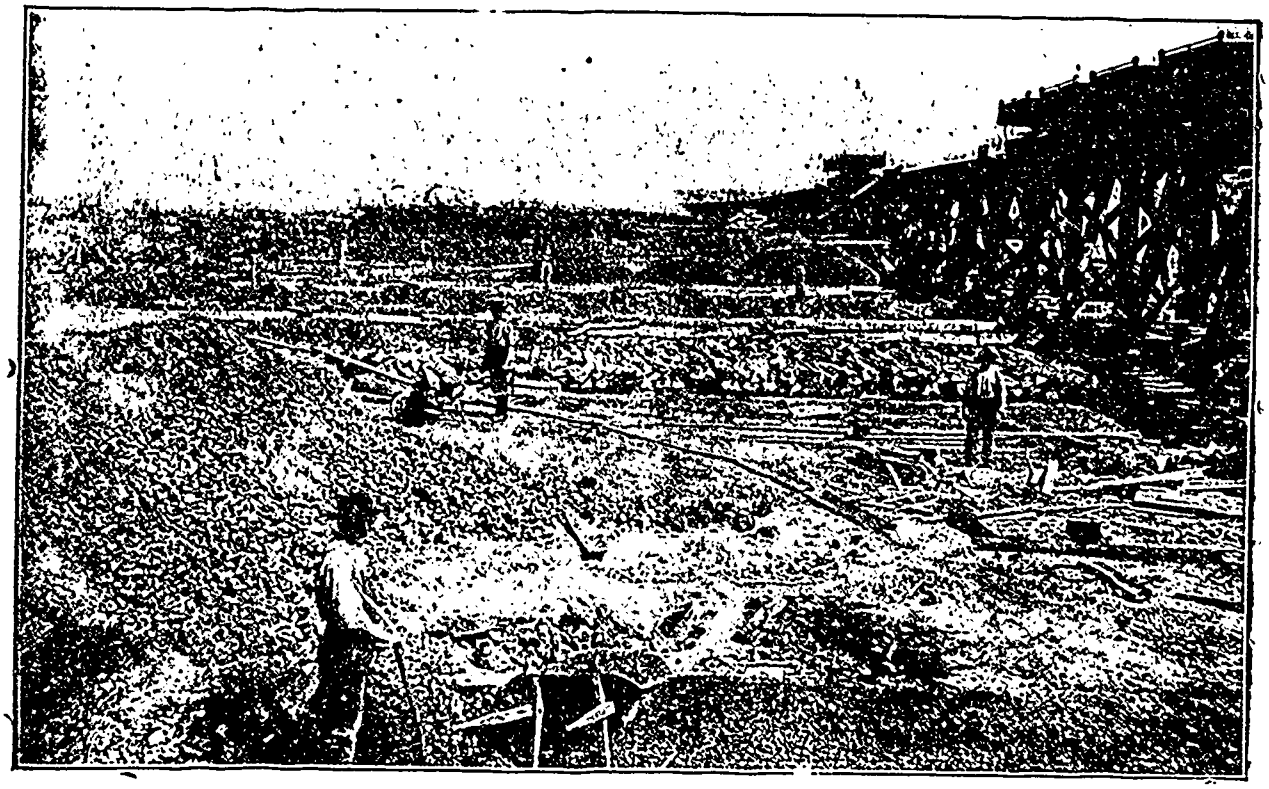
"The mishaps that may occur in drilling are many. The most common is the parting of the rods while in a hole. This may come from a fracture of the rods, the stripping of a thread, or the unscrewing of a coupling. The last is more liable to occur when pulling the rods than at any other time, and may result in smashing a set of stones. If rods are simply uncoupled, they can usually be caught by gently lowering and entering the top piece, and turning it to the right. In cases of fractures various sizes of inside and outside recovery taps are provided. The writer once spent two days in recovering a bit in a flat hole where the core shell had twisted off at the core lifter ring and left the ring in the lower half of the shell. The recovery tap entered the ring, which was so hard that the tap would not catch it, and yet it would twirl round with the tap, preventing the tap from advancing and catching the inside of the shell. After cutting several portions from the end of the tap, it finally caught the top of the broken shell with one thread and pulled it out.

"When casing or rods are fast in a hole near the bottom, that portion above the construction can be removed with a left-hand tap. In using left-handed taps the right-handed rods must be pinned at their joints to prevent unscrewing. Fishing for broken rods is much complicated in cases where the ground is soft or caving, and large chambers have been washed out in which the end of the rod may rest and the tap pass by it. It sometimes happens that a diamond is wrenched loose from its setting and remains at the bottom of the hole, either unbroken or in several fragments, when the rods are withdrawn. In cases of this kind the bottom of the hole should be cleaned out by a mass of soap or wax attached to the end of the rods and lowered in the hole. The fragments of rock and carbon will adhere to the sticky material when it is withdrawn. If caving ground catches the rods above the bit, they may be released by drilling down a casing outside of the rods and cutting away the bound rod with a steel rose bit.

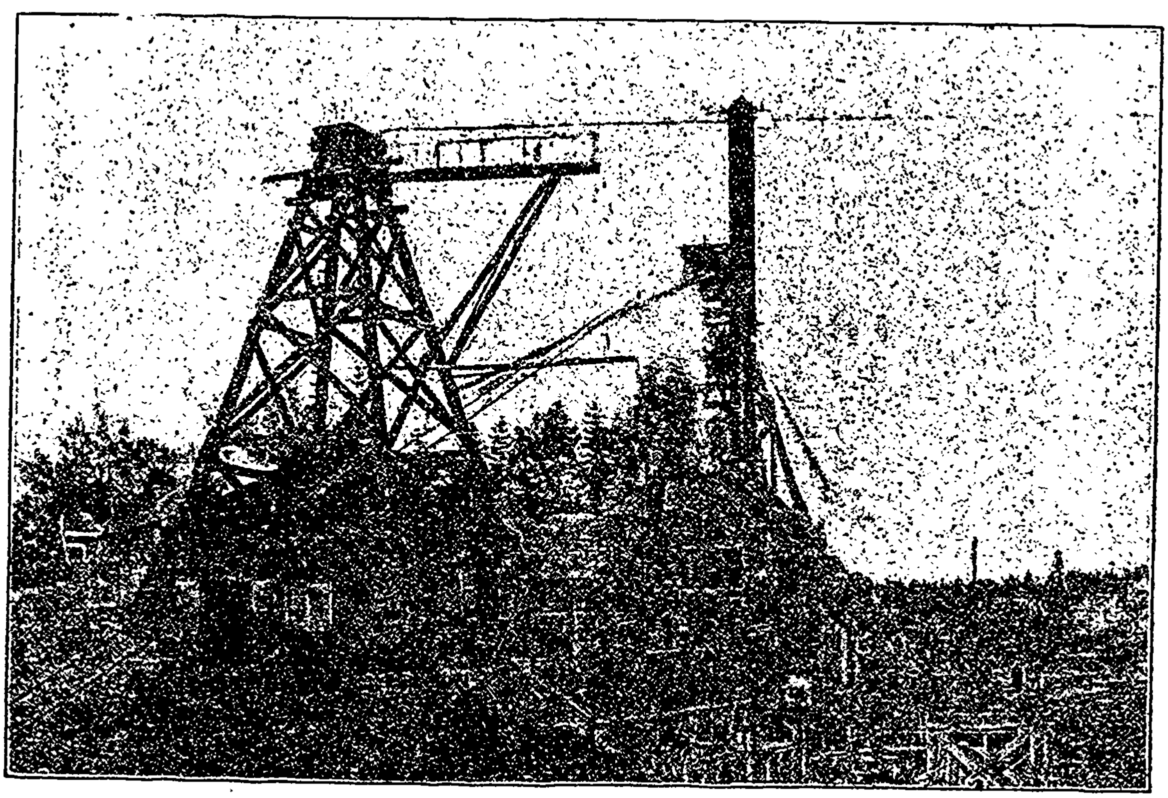
"Overcoming difficulties at the bottom of a deep hole will tax the ingenuity of a good runner and show his capacity. No man should undertake a deep hole—one over 750 feet—who has not had a good experience with shallow holes." *

* "Prospecting with the Diamond Drill," by J. Parke Channing, in *The Engineering Magazine* for March, 1896, pp. 1085-6.

(To be continued.)



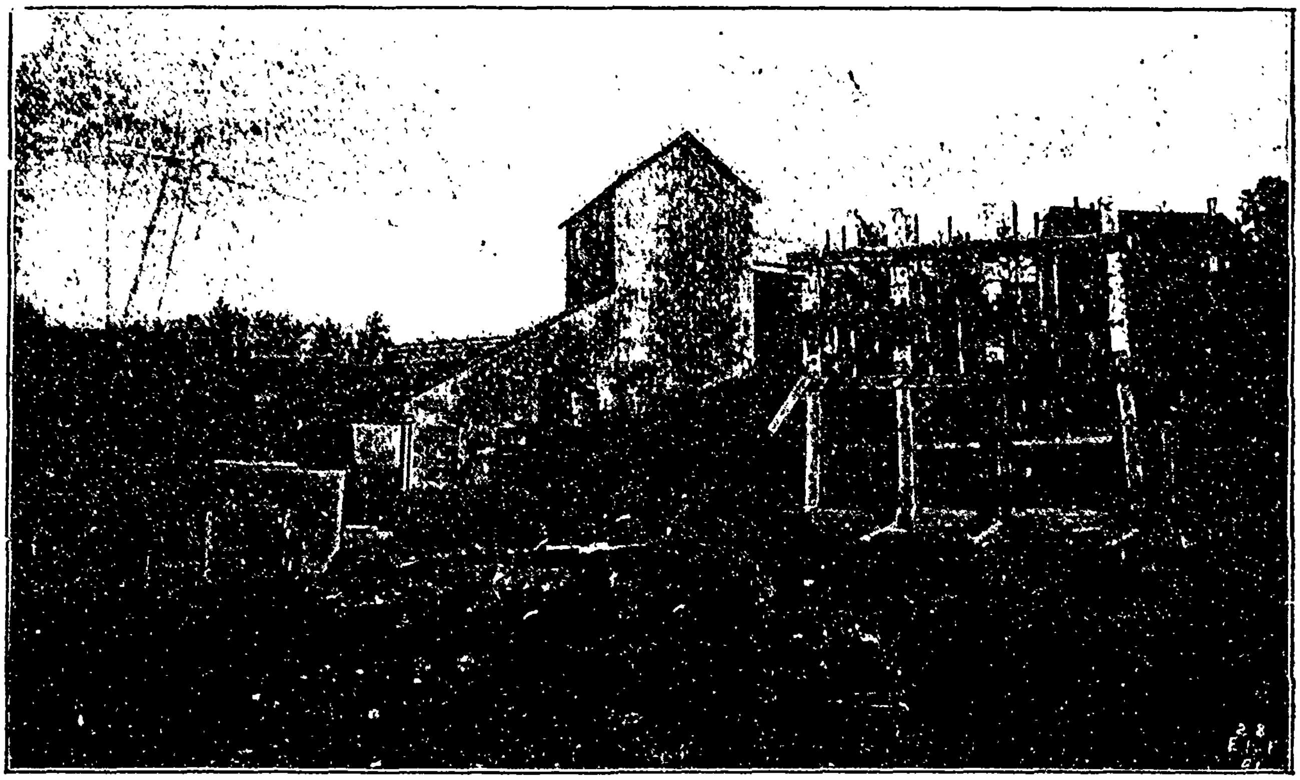
Canadian Copper Co.—Roasting Nickel Ore at Copper Cliff, Sudbury, Ont.



Wentworth Gypsum Co.—Cable Towers and Hoisting Plant at Quarries.

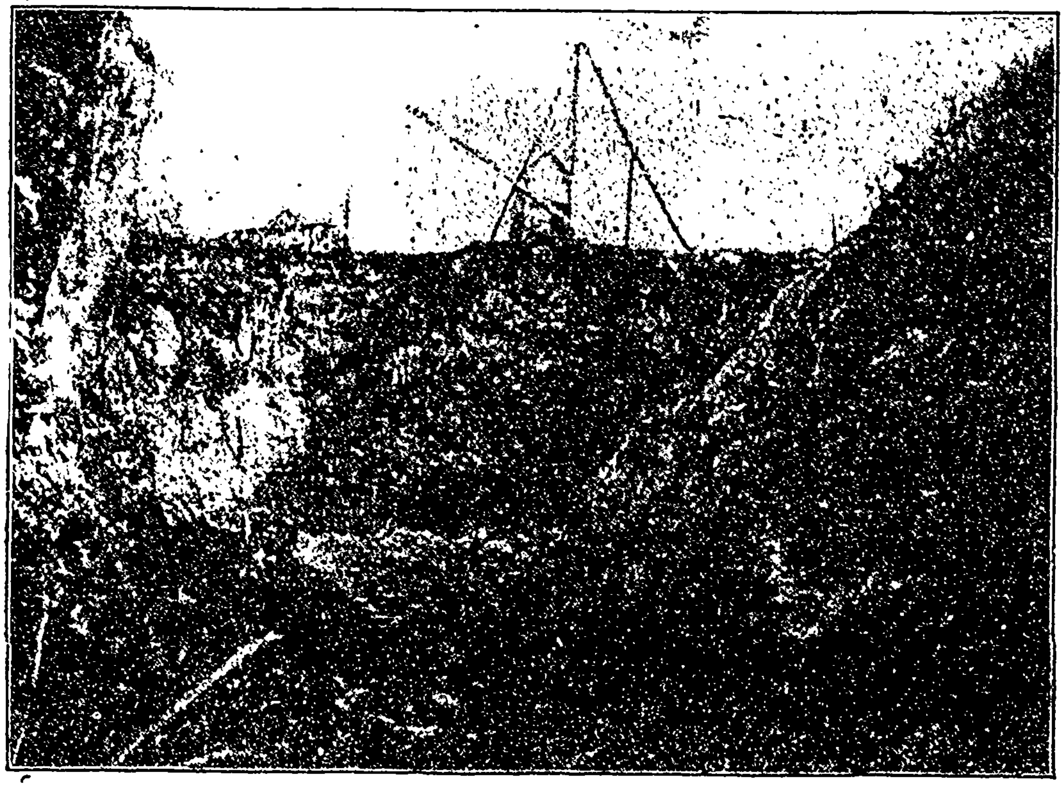
Bell's Asbestos Co. Ltd.—Exterior of Mill Building, Thetford Mines, Que.

Pictou Charcoal Iron Co.—General View of Furnace and Works at Bridgeville, N.S.

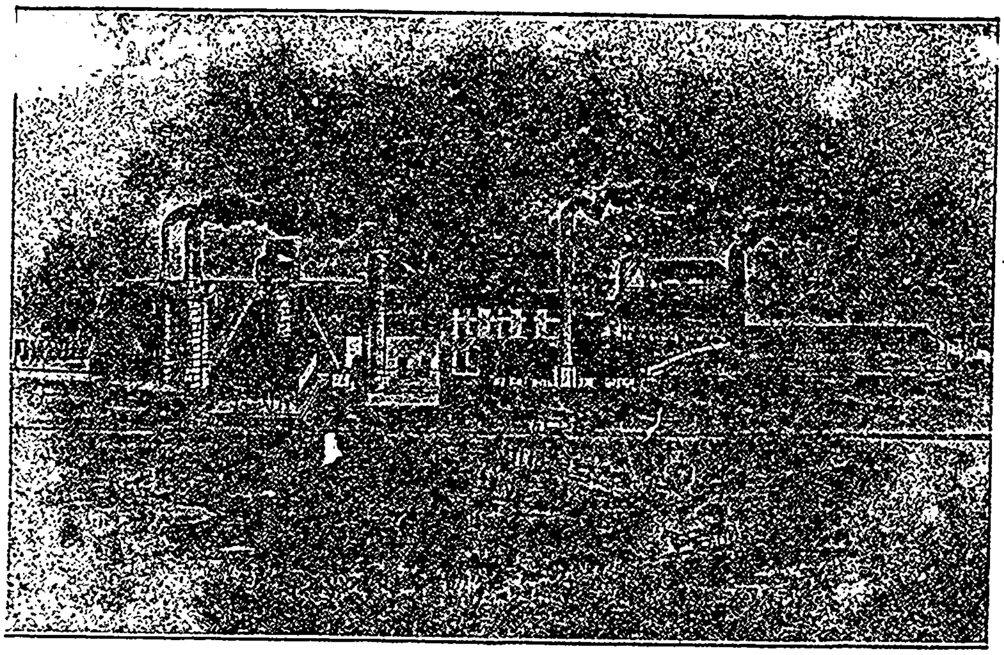


Oldham Gold Co.—Exterior of Mill Building with Battery of an old Mill in front, at Oldham, Nova Scotia.

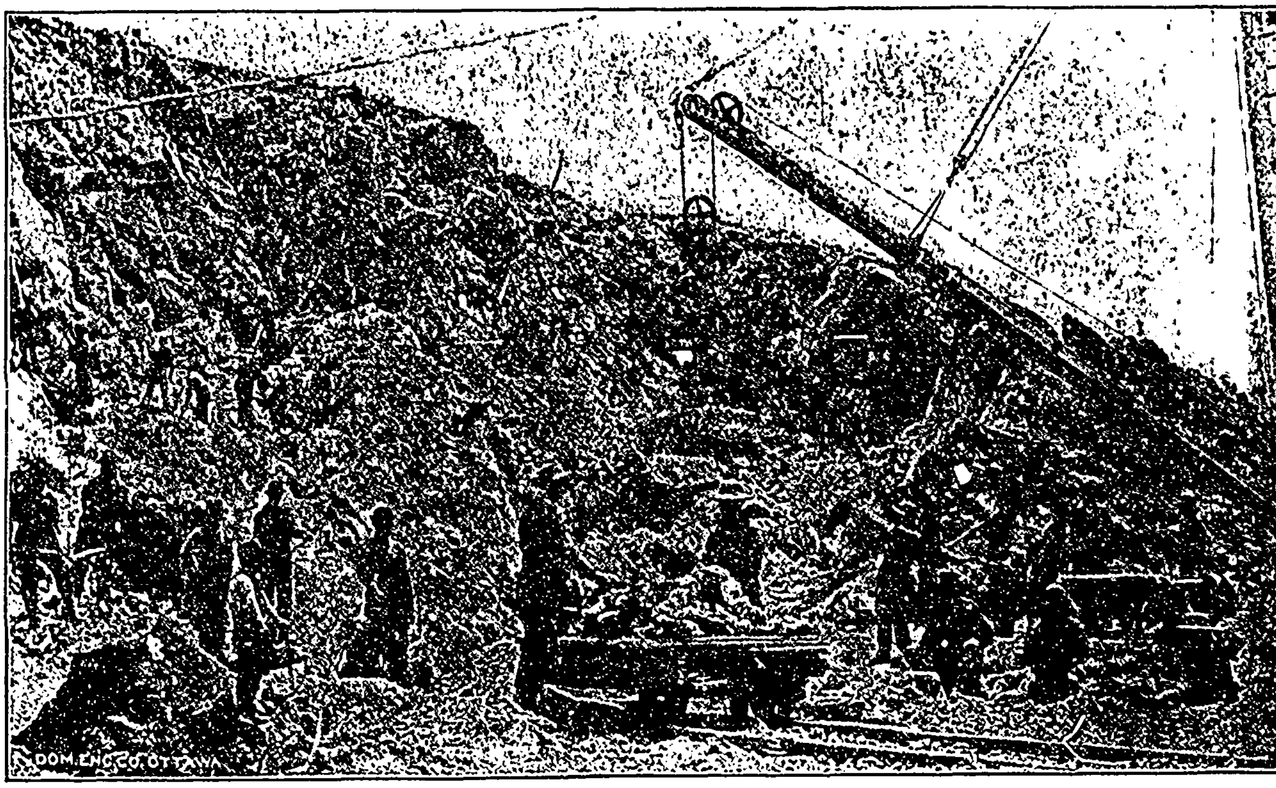
Golden Group Mining Co.—Exterior of Mill Building at Montague, Waverley District, Nova Scotia.



Blackburn Mine—Main Pit, Templeton, Que.

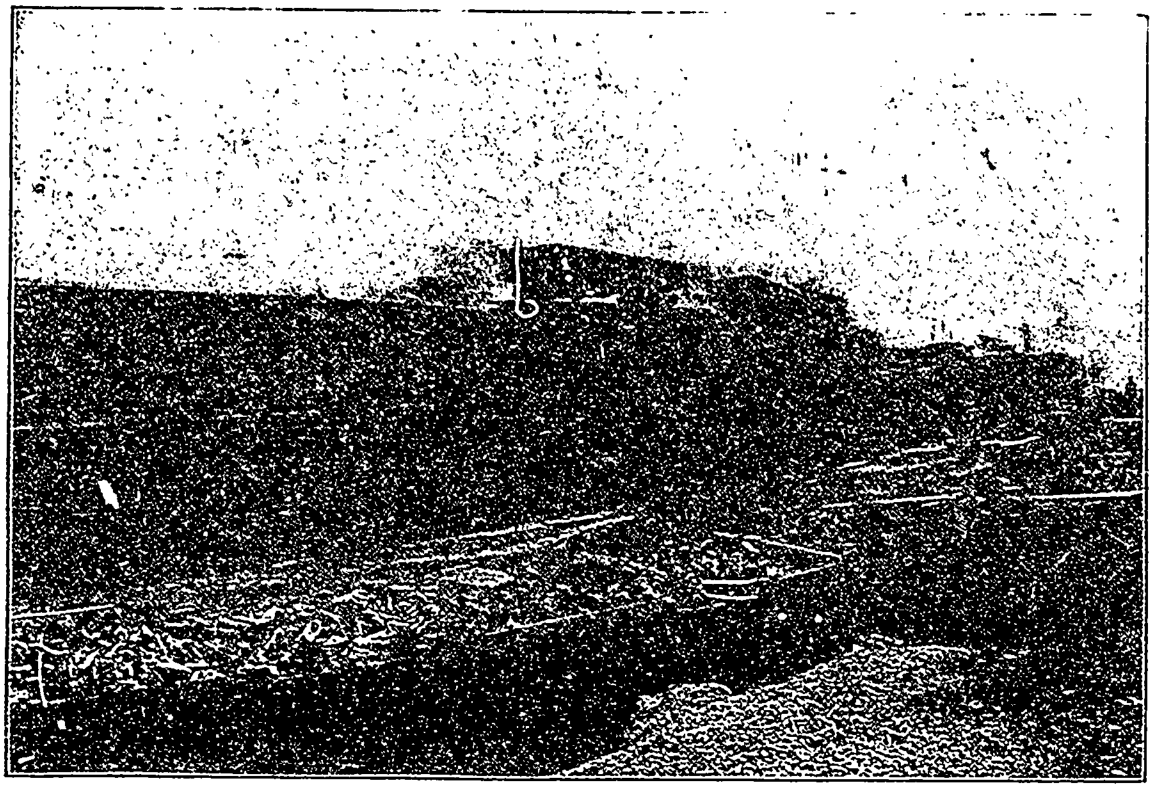


Nova Scotia Steel Co. Ltd.—Furnace and Works at Ferrona, N.S.

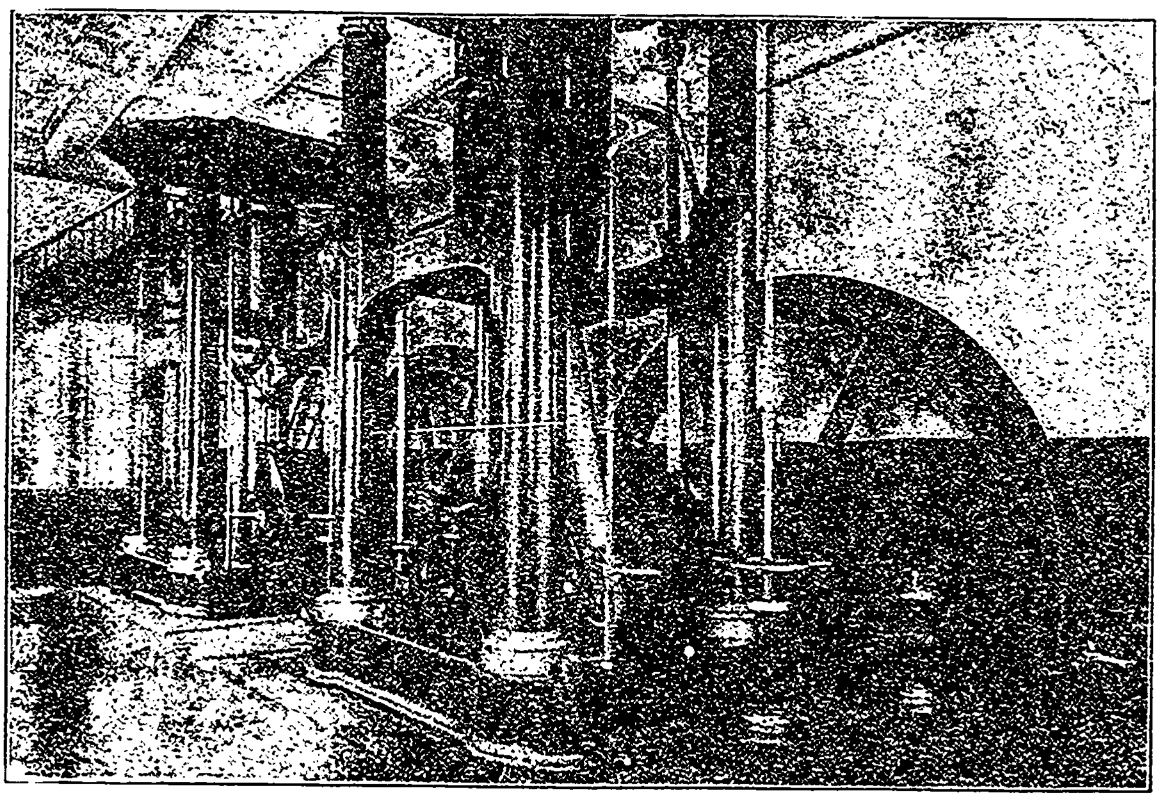


American Asbestos Co. Ltd.—View of Main Pit, Black Lake, Que.

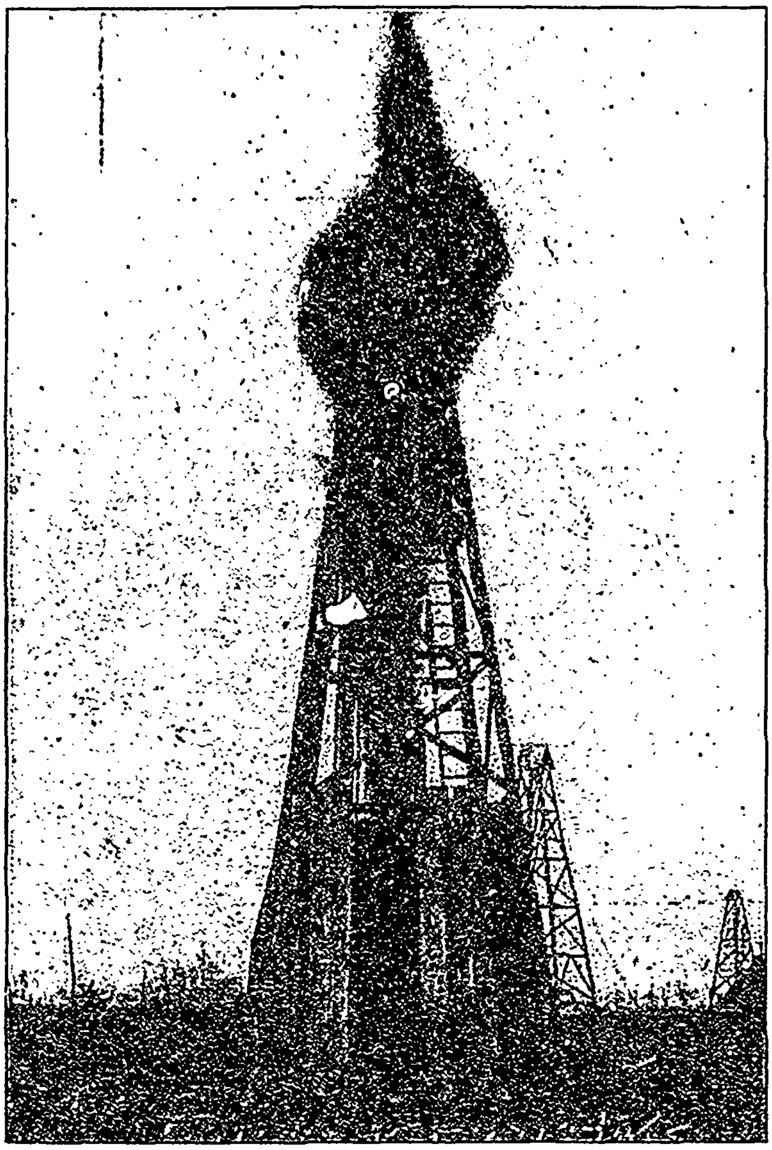
Canadian Copper Co.—Pile of Nickel Matte at Copper Cliff Mine, Sudbury, Ont.



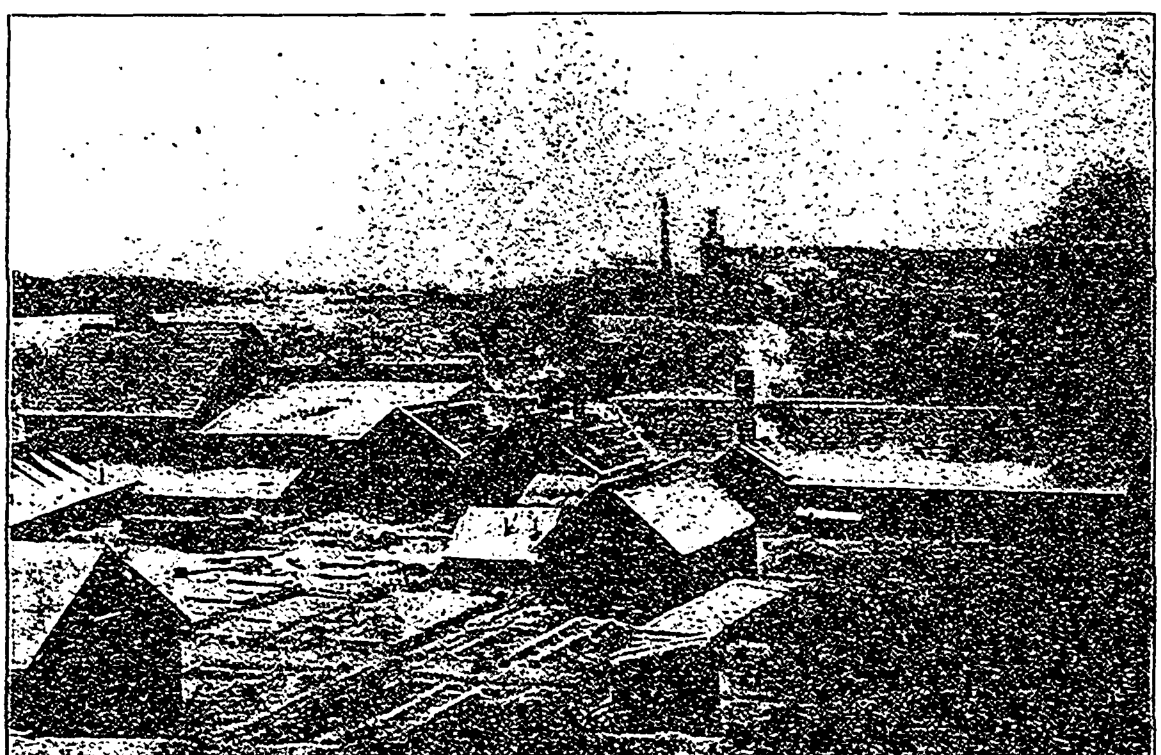
Londonderry Iron Co. Ltd.—Coke Ovens.



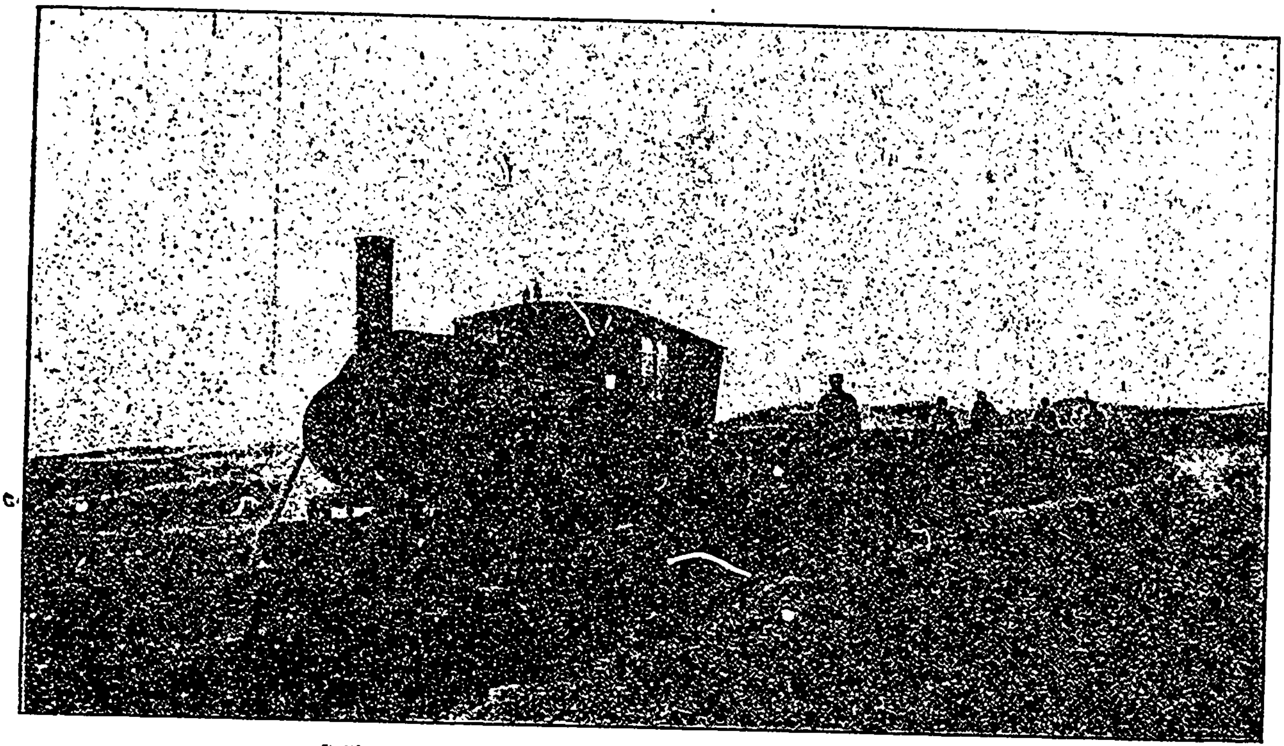
Londonderry Iron Co. Ltd.—Blowing Engines.



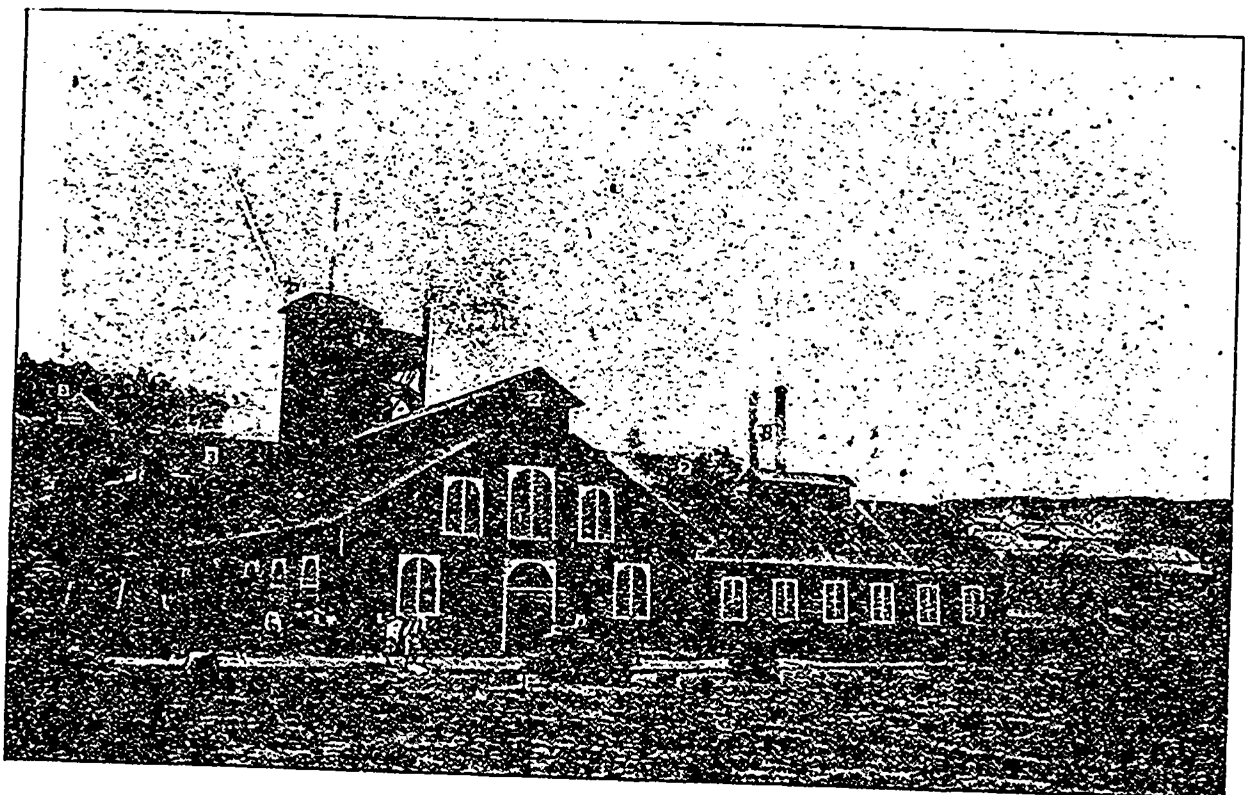
"Shooting" a Well, Petrolia, Ont.



Londonderry Iron Co. Ltd.—Pipe Foundry and Pipe Yard.



Bell's Asbestos Co.—Unique Style of Locomotive at Thetford Mines.



Pictou Charcoal Iron Co. Ltd.—Furnace at Bridgeville, N.S.

Notes on Gold Milling.

By E. B. Preston, M.E., California State Mining Bureau.

(Continued.)

This contraction of the plates is made to this day in most of the mills, when connecting with the sluice-plates. The liquid pulp, starting with a width equal to that of the mortar-discharge, is made to pass over sluice-plates from 1 to 2½ ft. in width; hence the comparatively small percentage of amalgam obtained from them. The only condition under which narrower plates are permissible, is where, previous to receiving the pulp, a certain amount of the solid matter has been diverted. Where all the pulp goes from the plates to concentrators, the latter become an important factor in regulating the amount of water turned into the battery. The feed-water required for concentrators of the vanner types is from one to two gallons per minute.

In dressing the apron-plates prior to starting the stamps, they are first washed down with the hose, to remove all particles of coarse sand which might otherwise scratch the plate during the subsequent dressing, then rubbed with a brush, using, if necessary, some fine tailings-sand to remove all spots or stains. During this part of the operation, the brush is moistened with different chemicals, according to the preference of the millman; some use weak cyanide of potassium; others use strong brine, with a small addition of sulphuric acid; also, sal ammoniac, or soda, or lye, besides other combinations. In many cases these prescriptions are carefully guarded by their possessors as trade secrets, and are considered the basis of all the success the owner has achieved in his business. Anything that will give the plate a clean surface, free from oxidation stains, and retain for the quicksilver its bright condition, is useful in this respect. The main point to achieve success is to always keep the amalgam on the plate bright, and of the right consistency, and this art can only be perfectly acquired by actual practice around the battery and plates. After the plate has been thoroughly cleaned, quicksilver is thinly sprinkled over the entire surface, through a cloth, and spread evenly by means of a brush or piece of blanket, and finally the surface gone over with a soft broom or brush, from side to side; this leaves the amalgam remaining on the plate with fine ridges parallel to the screen.

Among the plate devices used in California mills, which may take the place of the apron-plates, or may follow them, is a late invention known as the *Gold King Amalgamator*. It consists of an iron cylinder, or drum, 6 ft. long and 12½ in. in diameter, divided lengthwise into two equal parts, hinged together, and capable of being locked. Fitting tight inside of the cylinder are two corresponding semi-cylindrical silver plates, each with two longitudinal ribs set radially, at one-third distance apart and about 3 in. deep. The upper end of the cylinder is furnished, around the circumference, with tooth-gearing, into which fits a spur wheel with a four to one transmission, driven by a 12 in. pulley. In the centre of this end is a 3 in. feed opening, through which the pulp is dropped into the revolving cylinder. A trunnion at the lower end rests in a slide bearing, that permits of fixing the grade to be given the cylinder by means of set screws. The machine makes forty revolutions per minute, the pulp requiring about 3½ minutes to pass through the machine before being discharged. It is run by less than ¼ h.p., and is easily set up. The pulp, when dropped in the closed cylinder, is caught by one of the ribs and raised to the highest point, when it drops, to be again taken up by the next rib, advancing at the same time a short distance ahead. The discharge is through the centre at the lower end of the cylinder. From 15 to 20 tons can be passed through in a day; or, for a larger-sized machine, from 25 to 40 tons.

Where concentrators are used in the mill, the sluice-plates that follow the aprons are usually not over 8 ft. in length and from 16 to 20 in. wide, with less grade than the apron. This latter point is reversed in some mills, and the sluice-plates are comparatively steep.

Between the aprons and the sluice-boxes a drop box is placed, into which the pulp from the aprons discharges; there is one to each apron, or one for two adjoining ones. These boxes are 1 ft. wide and about 10 in. deep, with flat or partly sloping bottoms; these latter, generally where one box is used for two aprons, the bottoms sloping from each end across the width of the apron, toward a central part where the bottom is level, and from whence it passes by overflow to the sluice-plates. These sluice-plates are in short lengths, and are either laid overlapping or screwed down to form a continuous sheet, and are prepared and treated in the same manner as the aprons. Of late years a useful addition is being made to the plates in the form of a shaking-plate, of the same width as the aprons, and immediately below them. It is either suspended or on a movable frame, and is given an end or side-shaking motion and light grade; for an end shake, the motion is imparted by a cam with ⅜ in. stroke, and 200 strokes per minute. The correct strokes for these plates must be determined at each mill by experiment. Their efficiency was demonstrated in one mill, where the pulp passed over two consecutive apron-plates, and then to the shaking plate, which accumulated a greater amount of amalgam than the second apron.

Amalgam Traps.—To retain any quicksilver or small particles of amalgam that escape inadvertently while dressing or cleaning the plates, traps are generally placed below the sluice-plates, and are made of various patterns. The general idea is for the pulp to drop to the bottom of a deep vessel and flow out at or near the upper edge; in some cases, passing over a series of inclined shelves of copper plates during the descent. A simple and very efficient contrivance for an amalgam trap is to suspend a narrow box by one end and attach the opposite end to a rod connected by a pin to an eccentric, through which it receives a gentle shaking motion in the direction of its long side. The tailings are introduced into a stationary box immediately above, from whence, diluted with fresh water, the pulp passes over the top of a partition in an even sheet to the suspended box below. The proper motion for this lower box must be found by experimenting, for which purpose the end of the rod is supplied with a series of holes, to shorten or lengthen the stroke. The motion should be just sufficient to keep the pulp suspended like quicksand, without splashing or caking on the bottom.

Amalgamating.—Quicksilver is charged by hand into the mortars through the throat, at stated intervals, with a small wooden spoon. Automatic quicksilver feeders have been invented that are worked from the cam-shaft in such a manner that, at stated intervals a little cup on a ratchet wheel, in revolving, dips quicksilver from a reservoir and drops it through a tube into the mortar. This insures absolute regularity; but for some reason they do not find much application in California. Retorted or new quicksilver should be used for charging as well as for dressing the plates. It is a good plan to keep the quicksilver used for these purposes covered with a weak solution of cyanide of potassium.

Quantity of Quicksilver.—To form some idea of the amount of mercury necessary to be introduced when handling an ore, the value of which is not known, a horn-spoon test of a weighted quantity is made, and the quantity of gold decided. Gold alloyed with an appreciable amount of silver requires a larger addition of quicksilver than does a purer gold. One ounce of gold of average fineness can be amalgamated with 1 oz. of quicksilver, but for a safety margin, an allowance must be made, so that 2 ozs. will answer better; and with extremely finely divided gold, 2½ or 3 ozs. If the stamps have a duty of two tons each, the amount of mercury requisite to amalgamate the gold contained in one ton of ore should be divided into five parts and introduced at half-hour intervals. If the ore be of low grade, the necessary portion may be added every hour; as the value increases, the stated intervals for charging should be reduced. The larger proportion of California gold ores receive mercury every half hour.

The skilled millman judges from the condition of his plates as to whether he is charging correctly. He places his finger on the apron-plate, and if the accumulated amalgam gives to a gentle resistance, and has a putty-like feeling, the condition is about right; when hard to move, he must increase the charge; or if thin, reduce it. The harder the amalgam, the more it assumes a dead-white color. The matter of correct charging of the mercury requires a constant watching, as on this depends the success of battery amalgamation; hence the ore should be frequently tested with the horn-spoon.

Amalgam retained on the inside battery-plates weighs heavier, for the bulk, than the apron amalgam. There is a diversity of opinion among millmen as to how often the amalgam accumulated on the aprons and sluices should be removed. Thus it is found in the California milling practices that aprons are scraped as often as twice a day in some mills, while in others it is allowed to accumulate from one clean-up day to the next, which sometimes means once a month. Personal experiments by the writer, conducted in various mills, invariably showed a yield of more amalgam from the more frequent removal of the accumulations, but as the clean-up of the apron would require the cessation of crushing, such frequent stoppages would materially lessen the output. To avoid this, as the upper 18 in. of the apron-plate retains about 75 per cent. of all the amalgam on it, this much of the apron-plate may be made separate from the rest, and held in place by wooden buttons on the side, so that it can be removed at any time while the battery is at work, and an extra plate, provided for the purpose, slipped in its place. Once or twice in the twenty-four hours it is advisable to hang up the stamps, one battery at a time, and dress over the surface of the apron-plate, sprinkling, if necessary, a little fresh mercury, and brushing it into the adhering amalgam, after which the amalgam should be evenly spread out again. This takes but very few minutes. Frequently, when dressing a plate, a very fine coating of a brownish or grayish color can be seen adhering to the surface, which, on the application of the brush, is easily detached and thoughtlessly washed off. If this be examined under the glass, it will be found to contain considerable gold, hence should be gathered carefully in the gold-pan.

To remove the amalgam from the plates, the stamps are hung up, the battery-water shut off, and the front of the screen and plates hosed off to remove any sand which would scratch the plate. The surface of the plate is softened by the addition of quicksilver until the amalgam moves readily. Then, commencing at the bottom and working upward, with a piece of rubber, or rubber belting, 4 in. long, with square edges, the amalgam is pushed ahead to the upper end of the apron, gathered in a heap, and transferred to a pan or bowl by means of a scoop. The amalgam is taken to the clean-up room for further cleansing.

Where the amalgam has been retained on the plate for any length of time, as during an entire run, it requires a chisel or case-knife to remove it thoroughly, care being taken not to scratch the plate. In scraping a plate it is not advisable to remove ("skin") all the amalgam; enough should be left to form a thin coating, when ready to commence crushing again.

All mills experience more or less loss of quicksilver, partly through careless handling in dressing the plates, but also from the "flouring" of the mercury (breaking up into minute globules) after charging in the battery. This loss is extremely variable in the different mills, depending on the nature of the ore, high discharge, and low temperature of the battery-water. Ores carrying much talc, black oxide of manganese, galena, or arsenical pyrites, cause a good deal of flouring of the mercury. A further cause of loss is through incomplete retorting, a certain amount of mercury being retained in the bullion, which is volatilized in the subsequent melting. One half ounce to the ton of ore may be taken as near the average loss for California mills, although in a few cases these figures are doubled.

As the amalgam retained in the battery is less liable to loss than that portion adhering to the outside plates, the aim of the millman is to retain the largest proportion inside the screens. The coarseness of the gold has a good deal to do in this direction, as well as the splash and height of discharge. In some mills, as high as 80 per cent. of the total yield of amalgam will be found in the battery; it is always greatest, with the same grade of gold, where the most copper-plate surface is found inside the battery. The average proportion of amalgam retained in this country may be stated as two-thirds in the battery as against one-third on the (outside) plates, depending, of course, on the character of the gold in each district.

As the proper condition of the mercury is a matter of importance to the millman, it is well to become familiar with its different phases. Pure mercury is bright, quick, and does not change its appearance on exposure to the air at ordinary temperature, but evaporates slightly. As the temperature decreases it becomes stiffer, and at low temperature assumes a more leaden appearance; in raising the temperature it becomes more liquid. At 60° Fahr. it emits vapor sufficient to discolor a bright piece of gold when suspended over it in a closed vessel. Pure mercury, if dropped into a porcelain dish or on a table, will form into spherical globules, whereas the impure metal breaks into pear-shaped drops, and if very impure, the particles drag a tail when moved. If containing lead, a skin of metal will remain on the fingernails when passing the hand through the surface. The introduction of grease or unctuous substances, like clay and talc, incline the metal to separate into extremely fine globules—flouring. Quicksilver is attacked by heated concentrated sulphuric acid, but is not affected by it when diluted. Muriatic acid likewise does not affect it. Nitric acid attacks it and forms nitrate of mercury, a white compound. Quicksilver that has been used in gold-milling dissolves and retains a certain amount of gold, which remains with it even after retorting. If quicksilver of this description be left for months undisturbed in a cold place and then carefully poured or siphoned off, a network of fine, needle-shaped crystals of amalgam will be found in the bottom of the vessel, derived from this gold held in solution.

Sodium Amalgam.—As sodium amalgam is frequently added to the quicksilver by millmen, the following method of preparing it is given: Dissolve small, dry chips of clean sodium, freshly cut from a stick, in pure, dry mercury, gently heated in a flask or porcelain dish; add it piece by piece until the mass has attained the consistency of soft putty, which should always be kept dry and well bottled, as it deteriorates rapidly in the air. This preparation is added to the mercury when dressing the plates; and to know when the proper amount has been added, dip a brightened nail into the quicksilver, which will adhere slightly to the edges of the nail if the amount be correct; whereas, if it becomes entirely coated, too much has been used, and more quicksilver must be added; on the other hand, if there be no signs of adhesion, more sodium amalgam must be added.

Nearly all commercial mercury needs cleaning. The handiest way is to digest with dilute nitric acid for twenty-four hours, taking one part of acid to three of water. In retorting foul quicksilver to purify it, the retort should only be half filled and the quicksilver covered with a layer of quicklime or charcoal powder. The heating should then be done very gradually, the retort not being brought to a full red heat.

Cleaning Up.—When ready to clean up a mortar, the feed of ore is shut off, and the speed of the stamps reduced until as much of the sand, etc., as possible has been discharged and iron strikes on iron. The battery water is then shut off, the self-feeder pushed back, the stamps hung up, the splash-board or canvas removed from in front of the screen, and the face of the latter washed off with the hose. The aprons and plates are then scraped, and the aprons, if fixed, covered with planks near the mortar, to protect them while working around the mortar. The keys that hold the screen in place are withdrawn and the screen-frame loosened and slightly raised, permitting the water that is still retained in the mortar to gradually run out; a too sudden raising of the screen-frame from the chock-block would cause the water to escape in a body and possibly wash amalgam from the plates. After raising the screen out of the grooves, the chock block and inside plates are removed and all of them carefully washed over the apron, scraped and set to one side or removed to the clean-up room for treatment. The sand mixed with ore on and around the dies is taken out by trowels and passed through some other mortar, or retained to place around the dies when returned to the mortar. The dies are broken out of their beds with the help of chisels and crowbars; when the centre or end die has been successfully worked loose, the remaining ones are easily taken out, washed, examined for any adhering amalgam (which is scraped off), and placed on the floor, *in the same order* they occupied in the battery, ready to be replaced. The remainder of the material in the mortar is then easily removed, and placed in the clean-up barrel; in small mills it is panned in a water-box provided for the purpose in the clean-up room. In the revolving clean-up barrel, pieces of quartz or old iron, with an additional amount of quicksilver, are added, and the barrel is half filled with water, where it is left revolving for a couple of hours. As all battery sands contain more or less nails and chips of iron and steel, these are removed by a magnet while panning out. The clean-up barrel is discharged through a manhole into a bucket placed over a riffled sluice. The bulk of the quicksilver and amalgam is retained in the bucket and the overflow passes into the sluice.

After all the sand, etc., has been removed from the battery, the inside is washed out, and any amalgam found adhering to the sides or linings is carefully scraped off with a case-knife and placed with the rest of the amalgam for further cleaning. A bed of dry tailings-sand is then spread over the bottom of the mortar, and the dies *replaced exactly* as they were before. The tappets are then set, plates and screens put in, the feeder replaced, water turned on and the battery once more started.

The operation of cleaning-up the batteries is performed usually once or twice a month, and in some mills once a week, at which time tappets are re-set and any necessary repairs made; also, any shoes that are too thin or broken are knocked from the boss and new ones substituted. As one new shoe in a battery of old ones causes irregular working, it is best to replace all the shoes at the same time, and if any of them are not worn down thin enough to discard, they may be set aside and used to replace a broken one at some future time. The same thing holds good with the dies, for if they are of uneven height they interfere with the regularity of "splash," and the higher die will be pounding iron, while the remainder have still a sufficient cushion of quartz.

The amalgam obtained from a clean-up is washed in small batches in the gold-pan, to free it from all sand, fine iron, or sulphurets, and then stirred up with an excess of mercury in a wedgewood mortar, bringing all impurities to the surface; this dross is skimmed off and collected for further cleaning. The superfluous quicksilver is squeezed through a straining cloth or closely-woven drilling, or through buckskin, and the resulting balls of amalgam retorted. This squeezing is best done by hand. After first thoroughly wetting the cloth or skin, it is laid loosely over a cup or bowl, and a convenient amount of amalgam poured in the centre, enough to make, when squeezed, a ball of 20 to 30 ozs. The ends of the cloth are then gathered tightly together, and commencing near the ends, it is twisted until the amalgam is compressed to a hard ball, the strained quicksilver dropping into a pan of water beneath. It is not good practice to squeeze the balls too dry, as the last quicksilver expressed is heavily saturated with gold.

In large mills the retorting is done in pans placed in an iron cylindrical retort built into a furnace, where the flame passes under and around it. But in the majority of cases in California they use the cup-shaped iron retort. These are made in different sizes, numbered from 1 to 7; No. 1 containing 150 ozs., and No. 7, 2,000 ozs. They are made of cast-iron, with flat or half-spherical lids, which are secured to the retort by clamps and wedges or thumb-screws, the flanges being ground together. From a vent-hole in the cover a curved condensing pipe, securely screwed in, extends several feet. The retort is placed in a ring standard, or suspended when retorting, and should always have a space of about 6 in. beneath it. In preparing to retort, the inside is well rubbed with chalk and the balls of amalgam broken up and dropped in loosely; not pressed down into a solid cake, as is sometimes the practice, as that retards the operation. The flanges of the retort and lid are then luted together with a thin paste of flour and water or sifted wood ashes and water (the former is preferable), and securely fastened. The extended end of the condensing pipe is placed in a vessel with water, and as this pipe must be kept cool, fresh water is kept passing over it during the entire operation. The retort should never be filled to its full capacity, to avoid danger of an explosion through the amalgam swelling and closing the vent. At first a light fire should be started at the top, and the heat gradually increased until drops of quicksilver issue from the end of the condensing pipe. The retort should then be kept at a red heat until no more quicksilver is seen to issue from the pipe, when the temperature should be raised to a bright "cherry heat" for a short time. The retort should be kept covered by the fire during the whole operation. If during the retorting the condensing pipe should suck water, it should be raised momentarily out of the water to permit of the latter flowing out. A better arrangement, and one that obviates this difficulty, is to attach firmly to the end of the pipe, a rubber or canvass bag in the water, which will distend itself as soon as the mercury commences to flow, and collapse when the distillation ceases. When the operation is completed, which usually occupies about two hours, if the amount be not very large, the quicksilver is removed and the retort taken from the fire and allowed to cool; the lid is removed and the retort turned over a *dry* gold pan. If the gold adheres to the retort, a few taps with the hammer on the bottom or the help of a long-handled chisel will release it. Well-cleaned and retorted amalgam should show a good yellow color. If black spots be seen it is proof that the cleaning was not thoroughly done, and a pale-whitish color shows that it still contains quicksilver. Care should be observed, when removing the lid of the retort, to avoid inhaling any fumes retained therein. All retorted amalgam should be melted and run into a bar, before shipping, as it saves losses incurred by abrasion where the distance is great to the shipping point. The melting is performed in a black-lead crucible, which, when new, must first be dried and annealed by placing the inverted crucible and lid in the furnace with a slow fire, which is gradually increased until the crucible is red hot. When ready to commence melting, the crucible is placed on a firebrick in the furnace, after introducing the retorted bullion, in not too large pieces, with borax, and covered with the lid, adding, if necessary, more of the bullion as the metal subsides. After all is melted down, the slag is skimmed off carefully from the top of the metal, which should show a bright surface. It is then ready for pouring. Should the surface not appear bright, but show a scum on top, some lumps of borax must be added, the crucible again covered and heated, when the scum will be slagged and skimmed as before, when it is ready to be poured into a mould. Should the second addition of borax fail to produce a bright surface, a very little nitre may be added with the borax. Before using the mould it should be warmed and smoked on the inside by holding over the flame of a lamp or over a dish with burning rosin. The metal in the pot should be stirred before pouring; the stirrer, an iron rod, must be heated before introducing it. The bar, when solid, is turned out of the mould, and any adhering slag is hammered off; it can then be dipped into water to thoroughly cool it, dried, and weighed. Two small chips should then be taken—one from an upper corner, the other from the diagonally opposite lower corner—to be assayed.

ASSAYING AND SAMPLING.

Although at present most California mills have their own assayers to test the ore and the tailings, the time was not so very remote when it was not considered requisite to do *any* assaying. The expert millman could tell (?) by horn-spoon test how much his ore would mill to the ton; and if a horn-spoon test of the tailings showed no amalgam, he confidently asserted that all was being saved. It was decidedly a case where "ignorance was bliss." No gold milling can be carried on understandingly without light being thrown on the different results achieved, and which can only be given by careful sampling and assaying. It is not sufficient to know that a certain loss has been sustained. It should be accompanied by a knowledge in what particular part of the operation the loss has been incurred, to enable the operator to remedy the evil; hence the necessity of constant sampling and assaying. In some cases the loss will be found entirely in the coarse sands, indicating that the screens are not fine enough; again, the loss may be entirely through sliming of the ore, or the missing percentages of gold will be found mostly in the sulphurets. The assay test alone, *with correct sampling*, furnishes the knowledge.

Sampling.—Samples should be taken regularly of the ore as it comes to the mill, as well as of the tailings *as they pass off*, for without the knowledge derived from these two operations there is no means of controlling the work.

Ore, as it arrives at the mill, is sampled by taking a stated amount (shovelful) from each ore-car or waggon, and throwing the samples together in a pile on a clean-swept floor or into a small bin. The pile should be shovelled over, after breaking the pieces to the size of macadam; or if the pile be too large, cut through it at right angles, throwing the rock from the trench thus made in a pile by itself. This should be crushed or broken to a nearly uniform size, mixed by shovelling, and made into a low truncated cone, which is divided into four equal parts by making a cross on the surface and throwing out two diagonal quarters, which are again reduced in size, made into a second similar cone, and treated as before. This quartering and crushing is continued until a half-pound sample is obtained for fire assay. Great care must be observed when removing the different quarters to see that all the fine dust is swept up and added to the pile each time, as otherwise very defective results will be obtained. The rest of the ore is returned to the main ore-bin. Samples taken in this way from the aprons of the self-feeders are likely to give a more correct average, having been crushed, and the coarse and fine duly mixed. Samples should be taken at regular intervals fror the pulp *with the water* that has passed over all the plates, and also from the concentrators.

Tailings samples should be taken at stated intervals by passing a vessel across the entire width of the discharge, where they leave the mill, without permitting any to flow over, and gathering at each interval an even amount. This is allowed to settle in a bucket and the clear water then poured off carefully or drawn off with a siphon. The residue is dried and thoroughly mixed, and several packages of 5,000 to 10,000 grains each weighed out. In some mills tailings samples are obtained automatically, using their current as the motive power for the sampler, which works by intermittently deflecting a spout through the tailings where they finally drop from the sluices, obtaining the sample across the entire section of the current.

To ascertain the amount of slimes in the tailings sample, put one of the packages into a bucket, add water, and stir it. After settling two or three minutes, pour off the muddy water into a separate vessel; repeat this operation until the water comes off clear; add a little powdered alum in the vessel containing the muddy water, and when the mud has all settled, draw off the top water carefully and evaporate the remainder. Dry the washed sands of the sample, and pass through different sized screens, weighing the different amounts as they have passed, and assay each size; this will show where the greatest loss is sustained.

To ascertain where the loss in sulphurets occurs, it is sufficient to pass one of the 10,000 grains samples through a 60-mesh wire screen; weigh that which passes through and that which remains on the screen, and pan out each lot carefully by itself, from one pan into another, as long as sulphurets can be recovered; then weigh each batch of sulphurets separately.

The use of 10,000 grains is recommended, as every 100 grains is 1 per cent., and each grain is $\frac{1}{100}$ of 1 per cent.; it is also a convenient size for obtaining accurate results. By using pulp samples instead of tailings, the amount of sulphurets in the ore may be ascertained.

If the sulphurets assay $75 per ton, and the quantity per ton is 1.7 per cent., the value of the sulphurets in one ton of ore is found by multiplying $75 by 0.017, which would be $1.27 per ton. If the loss of sulphurets in the tailings is 11 grains out of the 10,000 grains sample, and the value of the sulphurets is $75 per ton, then multiply $75 by 0.0011, and the value of sulphurets in the tailings is found to be $0.0825 (8¼ cents) per ton of tailings.

MILL ASSAYS.

Amalgamation (Free-Gold) Assay.—Take two pounds (being exactly one thousandth part of a ton) of ore, crush in an iron mortar, and pass through a No. 60 sieve; remove the gold and other metallic substances left on the sieve, and place in a small porcelain dish containing a little dilute nitric acid, to remove any adhering crusts of oxide of iron, etc., which might prevent amalgamation; these residues are then carefully washed and thrown into the sifted ore, which is then placed in a wedgewood-ware mortar and mixed with enough warm water to make a stiff paste. To an ounce Troy (480 grains) of new, clean mercury, *free from gold*, add a piece of clean sodium about the size of a pea. The mercury thus highly charged with sodium is then thrown into the mortar containing the sample, and the mass ground constantly for an hour, when amalgamation should be quite complete. The mass is then transferred to a gold-pan and *carefully* washed over another pan or tub, in which the tailings are caught, and re-washed to save anything that may have escaped. The mercury is collected and transferred to a small dish; if it be much floured and refuse to run into globules, stir it with a small piece of sodium held in the end of a glass tube, which will cause it to run together. The mercury is then washed carefully in clear water and dried with blotting paper. It is then re-weighed, and if the loss exceeds 5 per cent. the assay must be rejected and a new one made. The mercury is next transferred to a small annealing-cup or crucible, which has been carefully black-leaded inside, covered with a porcelain or clay cover, and volatilized with a gentle heat. When all the mercury has been volatilized, about 50 grains of assay lead are thrown into the crucible and melted, giving it a rotary motion while in a molten state. It is then removed, cupelled, and the "button" weighed. It may be assumed without sensible error that the mercury lost in the operation carried the same proportion of gold as is contained in the mercury recovered; hence the gold contents of the ore will be found by multiplying the weight of the "button" obtained by the weight of the original quantity of mercury and dividing the product by the difference between the weight of the mercury recovered and the "button." This figure, multiplied by 1,000, gives the weight, in grains, of the free gold and silver per ton of ore, which, for all practical purposes, may be assumed to be all gold. Should, however, greater accuracy be desired, hammer the "button" flat and thin, and dissolve the silver from it with nitric acid, and weigh the gold. The difference in weight represents the silver.

Panning Assay.—Take 2 lbs. of ore, crush, and pass through a No. 40 sieve; any gold in the residue left on the sieve being set aside. The sample is then carefully panned, and the tailings re-panned, to make sure nothing is lost. This operation will show at once whether the ore is rich in sulphurets or not, and the nature of them. The visible gold should be panned as free as possible from all the sulphurets, taking care that none is lost. The pan and its contents, together with the residue left on the sieve, are dried by holding over a fire; the contents are brushed into a cone of lead-foil, rolled up, melted and cupelled. The "button" is weighed, and the free gold determined by multiplying its weight by 1,000.

The tailings produced in the panning operations should be panned over several times to collect all the sulphurets, which should then be dried, weighed, and their percentage in the ore determined.

Another method consists in not separating the free gold from the sulphurets, but in treating them both together by fire-assay, and determining the *total* value of the gold present in them. The operations, as far as described, are all that can be properly considered as coming under the term of battery amalgamation as practiced in California, if we except the use of the riffle and blanket sluices; these are placed below all the plates, and receive a very spasmodic attention in the majority of mills. Blankets are laid in strips, about 16 in. wide and about 6 ft. long, overlapping each other in double sets of sluices, set on a grade of about ¾ in. to the foot, washed in a separate water-box. The material thus obtained, with the contents of the riffles, is deprived of its valuable contents by the aid of arrastras, pans, or Chili mills. But few blanket-sluices are found to-day in California mills.

On the practical development of the Plattner chlorination process, by Mr. Deetken, in the "sixties," it was demonstrated that many of the low-grade quartz veins carried enough gold in their sulphurets to make their working profitable, causing attention to be directed to the concentration of these ores by mechanical contrivances. From the constant and successful use of the gold-pan the mechanical application of a similar motion was sought, resulting in the use of the Hendy and similar concentrating machines.

The Hendy concentrator consists briefly of a shallow iron pan with an annular groove on the outer edge and a waste discharge in the center. It is supported on a central upright shaft passing through the center of the pan, on which revolves, above the pan, a central bowl to receive the pulp, having two tubular arms extending close to the outer edge of the pan; these uniformly discharge the pulp at right angles from their axis. At a point on its circumference the pan is attached to a crank-shaft, making about 220 revolutions per minute. The sulphurets and small balls of amalgam gather in the groove at the outer edge, from whence they are drawn through a gate, which is regulated to be automatic in its discharge. This gate is not opened until the groove is pretty well filled with sulphurets. Two of these machines, driven by one shaft, are required for a five-stamp battery. The machine needs constant attention; one man can attend to twelve machines on a shift. They have been mostly displaced by the endless-belt machines which have developed from the endless blanket and shaking-table.

In 1867 the first patents for the revolving belt were issued.* This was the commencement of the belt concentrators, of which at present the Frue, Triumph, Woodbury, Tulloch, Embrey and Johnston are representatives. To produce the best results on these machines, all the stuff should be *sized.*

The Frue Vanner, which has the largest representation in California gold mills, has been frequently described.† It has a side shake of 1 in., with from 180 to 200 strokes per minute, the belt traveling upward on an incline from 3 to 12 ft. per minute. The belt is made in two sizes, 4 ft. and 6 ft. wide, and in the latest patterns as made at the Union Iron Works, San Francisco, has practical arrangements for easily changing the slope at the upper end. The frames of these modern styles are made of iron instead of wood. The pulp is discharged very evenly over the belt from a distributor near the upper end, just below the point where clear water is discharged in fine jets across the belt. In placing the machine, attention must be given to the solidity of the frame, and that a perfect level be obtained across the belt; further, the pulp and clear water must be distributed in an even depth of about ¼ in.; the grade and upper travel depend on the fineness of the pulp, and must be regulated accordingly.

The following guide for a proper condition of the work on the belt is given by Henry Louis, E.M., F.G.S., etc., in his very useful work, "A Handbook of Gold Milling," 1894, p. 324:—"The working conditions should be so adjusted that a small triangular patch of sand should show at each of the lower corners of the belt. These sand-corners should not be too large, but must be well marked, and the two should be of equal size. Should they be unequal the fault will be found to be either in that the belt is not accurately level across, that the distributor is not doing its work properly, or that some of the working parts have not been properly tightened up, so that there are other motions than normal ones communicated to the belt. Too large a corner of sand shows that the pulp is too thick, while absence of any corner indicates that it carries too much water."

Two of the 4 ft. belt vanners, or one of the 6 ft., handle the pulp from a five-stamp battery. The amount of clear water required to be added is about ⅛ cub. ft. per minute; the vanner requires ½ h.p.

The Triumph differs from the Frue, principally, in that it has an end shake of 1 in., and slightly quicker stroke (230 per minute), the belt making a forward movement of 3 to 4 ft. per minute. It receives the pulp in a bowl containing quicksilver before reaching the distributor, which is all kept in agitation by revolving stirrers.

The Woodbury is similar to the Triumph in extent and number of motions, but divides the belt into seven longtitudinal partitions; an increased output being claimed for this construction.

The Tulloch gives a rocking motion from a fulcrum on the floor, making 140 shakes of 1⅜ in. per minute, using either canvas or rubber belt. This machine, it is claimed, saves a somewhat larger amount of the finer and richer grade of the sulphurets as compared with the former types.

The Embrey is similar to the Frue, but with end shake.

The Johnston, with improvements, and the latest of the belt concentrators placed on the market, claims many points of advantage. It is suspended from four non-parallel hangers capable of adjustment, by which the angle of oscillation can be changed as required, preventing the accumulation of sand at the edges, such as occurs with the horizontal side-shake machines, or the piling of the sands in the center of the belt, that occurs with the rocking motion. The motion imparted to this belt resembles more nearly that of the batea than that of any of the other concentrators. The belt is made of No 6 duck, oiled and painted, but a rubber belt can be used at one-third the cost of those with molded edges, which are short-lived. Small, hollow, brass, side-rollers on the shaking-frame, form the raised edges by curving the flat belt slightly upwards. The pulp is delivered from five slots running parallel with the belt frames, ¼ in. wide and 16 in. long, leaving 10 in. spaces, into which the pulp is thrown when it strikes the belt. Here the separation at once takes place; the sulphurets settling on the belt are carried by it up to the clear water, while the sands are carried down the belt. In neither case are the sands or sulphurets obstructed by the falling water and sands, as in other machines where the pulp is discharged across the belt. The clear water at the head of the table, instead of being discharged from a stationary box to the moving table, is discharged from a distributor, which is attached to and moves with the table, thus stripping the belt of the smallest possible portion of sulphurets. Two widths of belt, 54 in. and 72 in., are used, which are given a grade of ⅛ to ¼ in. to the foot, making about 118 side-shakes per minute. One machine handles the pulp from a five-stamp battery.

Another vanner, soon to be placed before the mining public, consists of the essential features of the vanner, but carries a rubber belt with depressions all over it, 2 in. in diameter and ⅛ in. deep, shaped after the batea, while the entire belt receives a motion corresponding to that given to a batea.

As the motion and grade given to any of these machines can only be correct for a certain size of grain in the pulp, it would be advisable to introduce some method of sizing the pulp previous to bringing it on the concentrators, and feeding the sized material to different machines. The finer the screen that has been used in the battery, however, the less does the lack of sizing affect the product from the concentrators. The concentrators should always, where possible, be attached to power independent from the stamps, and be placed on a floor below the aprons, and in a position to permit the attendant to pass all around and to conveniently transport the concentrated stuff to the covered drying floor, which should be made with a slight incline, preferably of concrete, and exposed to the sunlight.

Canvas Platforms or Tables—Investigation proving that the slimes passing off with the waste from the mill and concentrators still carried an appreciable amount of precious metal, millmen during the last few years have extended their operations, and re-treat the hitherto escaping slimes. This is done by conveying all the waste material from the mill, through sluices, to canvas platforms having the following general features.

A platform is built of clear, seasoned, and planed, 1¼ in. planking, on a solid, level foundation, and given a grade of about ¾ in. to the foot, over which No. 6 canvas is stretched smooth, longitudinally, though sometimes crosswise, with a 2 in. overlap. Particular attention must be paid that the canvas is stretched smoothly and evenly and that no crack opens between the planks constituting the platform. The length and width of the platform required, depends on the amount of pulp to be handled; overcrowding must be avoided. The platform is divided longitudinally into sections corresponding to the width of the canvas, which is 22 in.; the partition is made of wooden strips, 2 in. wide and ½ in. high, covering 1 in. on the edge of two adjoining pieces of canvas. Running along the head of the platform are two sluices, one placed above the other; one containing clear water, the other pulp from the mill, both furnished with ¾ in. to 1 in. plug-holes over each section. Below the lower edge of the platform are two sluices placed side by side, the inside one to convey the waste, the outer one for the concentrates (sweepings) from the platform. When ready for operation, the plugs are withdrawn, and both pulp and clear water commingled flow down in an even current and are discharged through the bottom waste sluice. After one hour or less, the plug is inserted in the pulp-box over the first section, and the clear water permitted to run for a few minutes longer, during which time quartz sand may be observed passing off the canvas, leaving a dark, partly metallic appearing sediment on the canvas. A tray or board is then placed over the waste sluice, connecting the lower edge of the section with the outside sluice, and the sediment is removed from the canvas, either by sweeping or with the aid of a hose with a flattened nozzle, to be worked later by chlorination or cyanide process.

The following is a description of an improved canvas plant erected and operated in Amador County, by the patentee, Mr. Gates. In this case, the pulp and waste water are conducted from the mill in a flume to the plant, and there divided into two equal streams by the insertion of an adjustable division plate in the flume. The divided pulp passes into boxes 4 ft. long and 1 ft. wide, and having steel screen bottoms with ⅛ and 1/16 in. perforations, set on a reversed grade of 6 in. to the box. The object of these screens is to prevent any chips, leaves, lint, or foreign substance from passing into the sizing-box beneath, which consists of a wooden V-shaped trough, 6 ft. long, 15 in. broad at the top and 2 in. in the bottom, constructed of 1½ in. boards. A piece of canvas is tacked on the bottom for packing; underneath is nailed a piece of scantling 4 x 6 in., at one end of which, reaching within 2 in. of the end of the box proper, a slot, 14 in. long and 2 in. broad, is cut; here a flattened, galvanized-iron funnel, ending in a 2 in. pipe, is attached. The pulp falls through the screen with some force and is considerably agitated in the separator-box. Naturally the coarser and heavier particles have a tendency to settle toward the bottom. Were the outlet there large enough, all the pulp would pass down and out. Its size of 2 in. causes the box to fill to the height of a sluice-box in the end, through which the finer pulp flows to the canvas-tables. To facilitate the separation, a device is placed in the lower end, consisting of an iron pipe, ½ in. inside diameter, connected with the main pipe above the screen, and divided into two sections, which are connected by rubber hose for ready detachment. The lower 6 in. of the iron pipe has small perforations, through which clear water is ejected, causing an agitation of the pulp. The end of the pipe is stopped with a wooden plug, easily removed. The agitation at the end of the pipe causes the fine material to be carried upward and into the sluice at the end of the separator-box. Only coarse sand passes through the bottom pipe, and on examining this with a magnifying glass, very few particles of sulphurets are discernible. This separator works well, and disposes of a lot of coarse, valueless material that would otherwise interfere with the subsequent working of the slimes on the canvas platforms. The fine pulp flowing from the top of the separator is conducted in a sluice to a broad, flat box, in which the stream is divided by partitions into ten separate currents, each terminating over a canvas-table, ten in a row. The pulp goes over a spreader made of strips of galvanized iron, ¾ in. in height, radiating from a common center to the farthest side of the table, which is 12 ft. wide. These strips are nailed to an inclined board extending across the canvas-table, having an iron strip, 1 in. high, fastened to the lower end, perforated or notched, with indentations 1/16 in. deep and 1 in. long, affording a perfect distribution. Twenty tables are arranged in two rows of ten each,

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*From the records of the United States Patent Office.

No. 61,426, January 22, 1867. T. D. & W. A. Hedger, Meadow Lake, California. "Revolving sluice for saving metals."

* * * "The endless apron is made of fabric sufficiently coarse to retain the heavier particles which it receives from the feed spout, beneath which issues a stream of water." * * *

Claim 3. * * * "Separating the ore by passing the valuable portion up the incline and the debris down to the foot, as waste matter, as described." * * *

No. 66,409, July 9, 1867. George Johnston and Edwin G. Smith, Auburn, California, "Amalgamator and Concentrator."

* * * "The pulverized ore or tailings passes to an endless traveling and shaking canvas belt, which ascends against a stream, carrying the heavier particles to be discharged into a box, while the lighter ones are carried off." * * *

Claim 1. The revolving belt or apron, with its raised edges, having a shaking or rocking motion from side to side, substantially as used for the purpose herein described.

No. 239,091, March 22, 1881. Judson J. Embrey, Fredericksburg, Va., "Ore Concentrator."

†See 6th Report of State Mineralogist, p. 92, article on Concentration, by J. N. Adams, E.M.; and 8th Report, p 718, "Milling of Gold Ores," by J. H. Hammond, E.M.

covered with canvas laid crosswise and overlapping about 2 in. These tables have a grade of 1½ in. to the foot, are 13 ft. long and 12 ft. wide. After receiving the flow for an hour, it is shut off from the table and a flow of clear water turned on, which in a few minutes washes away the sand, when it is also stopped; then with a hose ending in a flat nozzle, the accumulated sulphurets are washed from the canvas into a trough below, extending along the base of the entire series. In order to secure sufficient fall for this sluice, each succeeding table is set 4 in. lower than its predecessor, giving 40 in. fall on 125 ft. of sluice length. Two extra tables are arranged, one at the end of each row, to take up the surplus flow during the time one of the tables is shut off, to avoid overloading, as each table already carries the proper amount of pulp. The effectiveness of the canvas-tables depends on maintaining an even flow of pulp during a given time; it will not do to overload them. All the pulp that leaves the table is considered waste, and is collected in a flume, to be used a short distance off as power on an overshot wheel, by means of which the patentee runs a vanner of his own invention. This waste water is caught up again and used on a second wheel, which also runs a vanner. The sulphurets washed from the tables flow through a sluice to a box outside the building, 12 ft. long, 2 ft. wide, and 12 in. deep, with a cross-piece 2 ft. from its upper end, reaching within 2 in. of the top of the box; in this upper section the coarser grade of the material is retained, while the finer flows over the weir. The two grades are shoveled out separately and placed in separate V-shaped boxes, over which are perforated iron pipes, from which small streams of water trickle, gradually carrying the pulp down and passing it through sluices onto the spreaders of separate vanners. These two machines work with different motions, doing excellent work on this impalpably fine stuff. The slimes flowing from the washing-boxes beneath these vanners are conducted, with the overflow of the two compartment boxes above referred to, to two other canvas-tables, below which they are allowed to escape as waste: not that they have given up all the precious metal they carried, but because the point is reached where it is more economical to lose the remnant than to attempt to save it.

As the slimes from most of the canvas plants, as usually operated (especially where the ore crushed carries a heavy percentage of sulphurets, or has been stamped with a high discharge), are still valuable in gold, they can be conveyed to so-called slime-settlers, or tanks. These tanks, for there are generally several, are placed below the canvas platforms, and are about 2 ft. deep, 2 ft. wide, and 12 to 20 ft. long; they are divided into sections of 2 ft. square, by 2 in. plank set on edge, extending alternately from each side, leaving an opening 4 in. wide and 2 ft. deep, causing the slime water to take a serpentine course in passing through. The tanks stand level, and the slimes, in settling, form their own grade as they enter at one end of the tank, and passing through the successive sections, issue at a diagonally opposite point only slightly clouded. These tanks require cleaning only at long intervals.

Up to the present time, the concentrates in the California mills have been generally handled by the chlorination process, to free them from their gold, but within the last year several plants are successfully working them by the cyanide process.

The tendency in the construction of mills at the present day is to a substitution of steel for iron, where possible, and to an increase in the weight of the stamps.

A greater application of grinding and amalgamating machines, in place of or subsidiary to the stamp-mill, is also noticeable, the most popular of which will be shortly described.

For a more thorough appreciation and knowledge of the work done by mills, records should be kept, by the amalgamator, of all transactions connected with mill work, showing every item, loss of time, consumption of mercury, iron, fuel, water, amount of rock treated, etc., in addition to the records kept in the assay office. This is already being done to some extent, but such records should be kept in the small mills as thoroughly as in the large ones.

(To be continued.)

The Treatment of Timber for Use in Mines.

By Robert Martin.*

The treatment of pit wood to render it durable and incombustible, though apparently a small matter, is of great importance for the safer working of mines, and deserving of the attention of mining engineers.

Falls of roofs and sides are, as is well known, one of the most prolific sources of accidents in mines, and probably no one will be disposed to deny that many of these are due to decay or dry rot in the timbering. But in addition to loss of life and injury to person there is considerable expense at every colliery due to falls, such as stoppage of plant, clearing the rubbish from the roadways, and the replacing of timber. Systematic propping is good, and to be insisted upon, but the propping and securing of all main passages with timber as free as possible from decay is surely better.

Circular shafts lend themselves to lining with brick and cement, which are of such an enduring nature that anything else is scarcely ever thought of. Rectangular shafts, so common in Scotland, are almost universally lined with timber. It is very evident that this wooden lining should be so treated as to preserve it from decay or fire as long as the colliery is likely to be in use; the more so if the sides of the shaft are of soft materials. Those in charge of old shafts filled with winding cages, pumps constantly in motion, haulage ropes, pipes, etc., know the difficulty of carrying out thoroughly the repairs which may be absolutely necessary. The danger to all concerned from decayed timber in a shaft may be very great.

The writer knows a colliery, the pits of which were sunk through 60 ft. of sand, containing very little water. The barring was 6 in. thick of good pitch-pine, and was water-tight. The colliery had been in existence for about sixteen years. A portion of the area of one of the two pits was spaced off and used as the upcast shaft for both. The ventilation was produced by three furnaces and the furnace of a steam boiler, all situated near the shaft in the various coal seams being worked. After a long spell of wet weather, one forenoon without the least warning, at a depth of about 30 ft. from the surface, the barring of the up-cast shaft suddenly gave way through decay; a large quantity of sand and water rushed into the pit, and falling down the shaft reversed the air current. Fortunately the miners were idle on the day of the collapse, and the furnaces were burning low, or the consequences might have been much more serious.

Underground fires in mines and fires on the surface at the pit-mouth are of frequent occurrence. These are sudden, destructive, and frequently fatal. This is largely due to the use of ordinary timber in the engine-, pump- and lamp-rooms underground, and in the erections which are situated near the pit-mouth on the surface. This timber is often so dry and sometimes so saturated with oil and grease, especially the floors, as to be readily inflammable; and an overturned lamp, a lighted match thrown carelessly down, or a spark from a passing locomotive may give rise in a few seconds to an uncontrollable mass of smoke and flame. It is not uncommon to see, in the midst of a lofty and extensive series of wooden erections at a pit-mouth, an open fire-lamp or brazier burning, the ashes and cinders from which fall on an iron plate resting close on the planks of the staging. It would seem to be the correct thing wherever machinery is placed, or stationary lights of any sort are fixed underground, and in surface erections at the pit-mouth, that only iron, stone, concrete, or timber rendered practically incombustible should be allowed.

A method of treatment of timber known as the Henry Aitken method is in use at Niddrie collieries. In this process the idea is to soak the timber in hot or boiling water containing a strong solution of common salt and chloride of magnesium. The timber treated should be free of bark, well seasoned and thoroughly dry. For this purpose it is kept under cover for a time. The props that have been found most suitable are those free of bark and natural sap. These are mostly shipped from Sweden, and from several ports in Norway. The ordinary good class of battens and deals from Sweden can also be treated to great advantage.

The plant at Niddrie collieries consists of two malleable iron rectangular boilers made of ½ in. plate, each 19 ft. long, 4 ft. wide and 3 ft. deep, built into a brick seating, with a furnace under each, a flue along the bottom and sides, and a chimney. There being no waste steam, the boilers are fired with dross coal, and kept as nearly at the boiling point as possible. The tanks are covered with loose boards. The proportion of common salt to chloride of magnesium should be as 7 to 1, and there must always be unmelted salt at the tank-bottom. One tank is emptied and filled daily with props, crowns, sleepers, wooden bricks, wedges, ladders and bratticing. This gives nearly two days' boiling for each tank. The props, being mostly 6 in. in diameter, require boiling for this length of time, in order that they may be thoroughly penetrated by the salts. One days' boiling is quite sufficient for 4 in. prop-wood. Pitch-pine and larch require longer boiling than the softer woods. Each tank holds about 50 cwts. of all kinds of timber. About 15 tons of treated timber can be produced per week at a cost of:

	£	s.	d.
Dross, 2 tons, at 3s. per ton	0	6	0
Salt, 18 cwts., at 21s. 6d. per ton	0	19	7
Chloride of magnesium, 2½ cwts., at 3s. 7½d. per cwt..	0	9	1
Wages of one man attending	0	18	0
Total	£2	12	8

or, say, 3s. 6d. per ton. This adds about 1s. 5d. per 100 ft. to the cost of 6 in. prop-wood. The royalty charges have to be added to this cost. When the timber is removed from the boiler it is soft, and not in a condition for immediate use. It is dried by being put into a covered shed or stacked in the open air. A few days' exposure brings it back to nearly its original strength. When stacked on end, the props dry more rapidly than when placed horizontally.

The average life of ordinary prop-timber at Niddrie collieries is about ten months, thus involving frequent and costly renewals in brake-inclines, return-airways, and horse-roads. In some parts, where the decay is very rapid, timber treated as above described has stood since the latter end of 1893, and it is still as fresh as when put in.

The temperature of the air varies from 68 degrees to 80 degrees Fahr., in some parts dry, in others moist. It is found that hutch-sleepers of home-grown fir, spruce, and, in fact, every kind of wood subject to decay, used in a pit, is made much more durable by this treatment. In the mine passages, salted timber is easily distinguished from other timber by its damp appearance.

No experience has been gained at Niddrie as to the behaviour of salted wood in case of fire; happily there has been no occasion. As a precaution against fire, if salted wood were used for lining or flooring engine-rooms or pit-head erections, being always damp, it would not catch fire so readily or burn so fiercely as ordinary timber does.

The cost of the plant is about £100.

Mr. Fisher (Newton) asked whether the incidental charges over and above the mechanical process were included in the cost given?

Mr. Martin said that the man was not fully employed, but his whole wages were included in the cost.

Mr. J. B. Atkinson asked whether Mr. Martin could give them an idea as to the non-inflammability of the salted timber.

Mr. Martin said that the only thing he could refer to was the case of a miner who hung to a treated post his coat and vest, containing his tobacco pipe; they took fire, and the whole were burned to ashes, scarcely making any impression on the treated prop on which they were hung.

Mr. Donald (Cambuslang) said that it seemed somewhat surprising that one man was able to handle all the timber necessary in connection with a large colliery, and dry it thoroughly at so low a cost.

Mr. Martin said that the quantity of timber handled was 15 tons, being that used in the horse-roads and return air-ways.

Mr. Forgie said that the special object was to make mine timber non-inflammable. Hitherto it had always been found that such attempts caused it to become brittle, and it did not stand the weight so well as before, while, as regarded pit-sleepers, the nails would not hold. At Messrs. Baird's collieries, ten years ago, they commenced to creosote the timber for underground purposes; and as regarded two pieces of timber in the return air-course, one of which was so treated and the other not, he saw the former a fortnight ago and it was as perfect as when put in ten years ago. The process had been discontinued, because there was a certain amount of danger connected with it. No doubt the timber was made more liable to take fire than in its natural condition. Then, when used as crowns, it was found to get quite brittle. He asked Mr. Martin if his process had the same effect on the timber, and how he dipped it?

Mr. Martin said that one man did not seem to have any difficulty in filling the tank. They had no complaints from the miners as regarded the timber, and did not observe that it was any more easily broken than other timber. They tested a batten 7 ft. long, 9 in. by 3 in., for its breaking strain, and found that 45 cwts. broke it. They tried a salted one and it broke at 42 cwts. This difference might have been due to the timber itself.

Mr. Watson (Cadzow colliery, Hamilton) said that with hutch-sleepers treated by this process they found the nails corroded easily, but since using galvanized nails there had been no complaints.

Mr. Menzies (Blantyre) said that some two years ago they tried this system, but unfortunately he was not in a position to say much about it, for they had had to renew the timber before it was done. They gave up treating the sleepers because they would not hold the nails. He must say that in the preparation of the wood he could not do so much work as Mr. Martin stated with one man. It took two men, and they were not dipping a quarter of the wood that they were using. He admitted that it was a good idea, but unfortunately it did not suit Auchinraith colliery, for there the wood was broken in a few months. At the same time there was a piece of timber which had been standing in their return air-course for seven years.

* A paper read before the Mining Institute of Scotland.

MR. AITKEN remarked, as to the objection to the sleepers not holding nails, that he never heard before of their not holding.

MR. MCVEY (Cadzow colliery, Hamilton) said that after using galvanized nails in the sleepers, they had no difficulty as regarded oxidation. With reference to the cost of salting wood, they heated the tank with exhaust steam, and only used two cages per day, each containing about 2½ tons. Two men did the work. As to the cost, they did not reach Mr. Martin's figure. They simply used salt, and the cost did not amount to 1d. per cubic foot.

MR. FERGUSON (Blairadam) wrote that the Aitken process had been in use at the Lochore and Capledrae collieries for upward of six years, and during that time it had proved a great saving, not only in wages, renewing broken timber, but also in the price of wood used, which is now nearly all foreign timber. The treated wood had stood in the return air-way for six years, and was quite sound. If this wood had not been treated it would have been replaced twice during the above period, even if it had been larch. No tree which had been treated had shown the slightest decay during the six years.

MR. CARLOW (Leven) wrote that the Fife Coal Company began to use the Aitken process in January, 1893, and had continued to do so ever since. The following experiments have been made with the process:—Two pieces of ordinary Norway fir, 3½ in. in diameter and 3 ft. long, both weighing 10 lbs. before being treated, were selected. One of the pieces was treated by the salt process, and the other was not. After being treated it weighed 12 lbs. Both were taken underground and placed in a return air-course, and after eleven months were examined and re-weighed. The untreated timber then weighed only 5 lbs, whereas the treated one weighed 12 lbs., being exactly the same weight as when it was put in. They were put back into the mine, and allowed to remain eleven months longer, and again weighed, with the result that the untreated timber weighed 6 lbs. and the treated timber weighed 11¾ lbs. They were again replaced in the mine, and after a total exposure of three years they were examined, and while the treated piece was sound the untreated one was decayed. Two pieces of similar timber, that is ordinary Norway fir, were tried at the same time, but placed in a different pit. The weight of each before treatment was 9½ lbs., and weight of treated timber was 11 lbs. After being two years underground, the weight of the untreated prop was 6 lbs. and the weight of the treated prop was 9 lbs. After three years they were examined, and while the treated prop was quite sound the untreated prop was decayed. Besides these tests, observations were made on the treated timber put into main roads, alongside the other timber not treated, and the treated timber remained damp and fresh, while the untreated crown-trees were dry and soft on the outside, showing that decay was in progress. The amount of salt that timber will absorb depends on the firmness of the wood and its dryness at the time of treatment. Norway fir absorbs from 15 to 50 per cent. of its weight, that is, it becomes 15 to 50 per cent. heavier after treatment, while larch crown-trees absorb only 10 per cent. The cost is about 1d. per cubic foot for salt, and ¼d. for labor, a total cost of about 1¼d. per cubic foot exclusive of royalty.

Experiments on Coal Cutting Machines.

By H. F. BULMAN.*

These experiments, recently published, are of special interest, as showing the *power* used by coal cutting machines when under-cutting coal, in a number of instances, and over a considerable area.

Mr. Haseltine, a chief inspector of mines, made observations on twelve separate machines in seven collieries situated at various points in three of the most important coal fields in the State of Ohio, U. S. A. Of the machines five were Jeffrey bar machines, and the other seven were chain machines—four Jeffrey, two "Independent," and one "Morgan-Gardner." They were all driven by electricity, the tension of current being about 220 volts. Meters were inserted in the circuit near the machine, and their readings registered every fifteen seconds whilst the undercutting was proceeding. The volts and amperes being known, the actual horse power developed was readily calculated.

The hardest coal cut was at the Congo colliery in Perry County, and here, at the same mine, a Jeffrey bar machine, a Jeffrey chain machine, and an Independent chain machine were all tested under equal opportunities. The hardness of the coal is apparent from the fact that the knives or cutting chisels had to be renewed ten or twelve times during a shift. The operators manufacture their own knives, the cost of which has been estimated at 2½ cents per ton† of round coal produced. At this mine a Jeffrey bar machine was tested whilst making five cuts, each 5 ft. 6 in. deep by 2 ft. 8·4 in. wide, equal to an area undercut of 14·8 sq. ft. The time occupied averaged 4 min. 31 sec. for each cut; the maximum h. p. averaged (on the five cuts) 26·9, the minimum 17·3 and the average 22·7.

The Jeffrey chain machine was also tested over five cuts at the same mine, each cut in this case being 5 ft. 9·6 in. deep by 2 ft. 7·2 in. wide, equal to an area undercut of 15 sq. ft., nearly the same as the former. The time occupied averaged 3 min. 37 sec.; the maximum h. p. 17·2, the minimum 12·3, and the average 14·5.

The Independent chain machine also made five cuts, each 6 ft. 2 in. deep by 3 ft. 3·6 in. wide, equal to 20·4 sq. ft. Time occupied averaged 3 min. 29 sec.; maximum h. p. 22, minimum 14·1, and average 18·1.

Twenty-seven h. p. may therefore be taken as about the maximum power likely to be required in undercutting coal by a rotary bar machine; this coal being, as already stated, of exceptional hardness. The difference in the power required by the machines is striking, the Jeffrey chain machine doing the same work as the bar machine with 8 h. p. less expenditure of power.

Taking the whole of the experiments at the seven collieries, the five bar machines consumed (on an average over the number of cuts made) 18·7 h. p., and the seven chain machines 14·4 h. p.

The power required to overcome the frictional resistance of the machine (that is to start the machine when not cutting coal) averaged, with the bar machines, 6·85 h.p., and with the chain machines 4·22 h. p., leaving the net average h. p. consumed in cutting the coal 11·8 with the former, and 10·2 with the latter. Reducing the terms of comparison to the common denominator of one square foot undercut in one minute, the five bar machines used, on an average, 10·1 h. p., and the seven chain machines 0·4 h. p. Deducting the power expended on the frictional resistance of the machines, these figures become 3·2 h. p. and 2·2 h. p. respectively. The power expended by the same machine, undercutting in the same seam at the same mine, varied greatly, the variation in one instance being from 10 to 30 h. p.

As regards ease in working and economy of power, these experiments show the advantage of the chain machines.

*Transactions, British Society of Mining Students.

†The ordinary method of calculating costs at these American mines, as described in Mr. Haseltine's paper, is on a ton of 2,000 lbs. of lump or round coal, which is equivalent to about 3,000 lbs. of unscreened (run of mine) coal.

With reference to the produce of coal and the cost of getting it by machines in comparison with pick mining, the data about reciprocating machines appear to be more abundant than about rotary bar and chain machines.

Produce of Coal—With reciprocating or projectile machines, as Mr. Haseltine calls them (such as the Ingersoll-Sargeant or the Harrison) the undercutting is done in much the same way as with the pick, being made about 18 inches thick in front and diminishing to a few inches at the back, and the produce of round coal is much the same in both cases, as might be expected. Thus in a seam 4½ ft. thick, with pick mining, the proportion of round produced was 65 per cent., and with the reciprocating machine 66 per cent., and in another instance, in a 3½ ft. seam, the proportion with the pick was 72·4 per cent., and with the machine 70·8 per cent.

In the 4½ ft. seam the daily output with the reciprocating machine was 28 tons round coal, or 42¾ tons unscreened, and the area undercut 170 sq. ft. daily. In the 3½ ft. seam the daily output was 21¾ tons round, equal to 30·7 tons unscreened, and the area undercut 168 sq. ft.

With the rotary bar and chain machines the thickness of the undercut is only a few inches (5 in.) throughout, and the coal got in the cutting is practically lost. The amount of small coal is therefore less than with pick mining. In one instance the figures are as follows:—

Machine.	lbs.	Pick.	lbs.
Lump coal, 72 per cent....	2000	Lump coal, 66 per cent....	2000
Nut " 12½ "	347	Nut " 14 "	424
Pea " 1½ "	42	Pea " 6 "	182
Slack " 14 "	389	Slack " 14 "	424
	2778		3030

That is, for every 2,000 lbs. round coal, 778 lbs. small are produced at the same time by the machine, and by pick mining 1,030 lbs. small, or 252 lbs more. With the reciprocating machines, as already stated, the results are practically the same as with pick mining.

Cost—With reference to the cost, Mr. Haseltine gives the following figures, calculated per ton of unscreened (run of mine) coal filled into tubs in the working face, the ton being the weight of coal got in producing 2,000 lbs. of lump or round coal.

The cost is exclusive of the power driving the machines.

	NO. 1 INSTANCE.	NO. 2 INSTANCE. (Taken over two years.)
Reciprocating machine.....	27·7c. = 1s. 1·8d.	29·7c. = 1s. 2·8d.
Pick mining..............	39c. = 1s. 7·5d.	43·5c. = 1s. 9·7d.
Rotary bar & chain machines.	29·7c. = 1s. 2·8d.	
Pick mining..........	39·6c. = 1s. 7·8d.	

These figures show a saving in favor of the machines of about 6d. a ton in getting the coal. From this, however, should be deducted the cost of the power, which in one instance of reciprocating machines, driven by compressed air, the only instance given, is estimated at 5c. = 2½d. a ton.

Gold and Silver Ores of the Slocan, B.C.

By J. C. GWILLIM, B.A. Sc.*

One of the most striking physical features of the interior of British Columbia is caused by the great system of lakes and rivers which almost surrounds the Selkirks within their Canadian limits.

These waterways form long north and south depressions and are connected by low transverse passes, which drain to the east and west.

This region is, therefore, fairly accessible to the explorer or prospector. The geology has not as yet been fully worked out, but enough has been learned to show it to be a region of intrusive and of uplifted rocks of undetermined age.

The western portion of this watershed is largely of a granitic nature, but there are several large areas of metamorphic rocks, such as quartzites, schists and calcareous slates. The eastern portion is mainly composed of slates and schists.

Up to the present time the most richly mineralized belt appears to lie along the summits of this watershed. Yet the whole region is well stocked with economic minerals and offers to the mineralogist a rich and varied field for study.

The existence of the chief galena silver districts appear to be determined to a great extent by the large areas of impure limestones and calcareous slates. Such districts are the Slocan and Lardeau. Of this mineral, so abundant and valuable, there are three principal varieties, and these have come to be recognized as bearing certain relations to one another in their silver bearing capacity. *Cubical*, well crystallized galena, is by far the most common; it forms the backbone of the silver mining industry and assays, in the Slocan district, from 50 oz. to 200 oz. in silver. Here it occurs in fairly massive impure limestones and slates. Galena differing in no way in appearance, coming from Lower Kootenay Lake or the Lardeau country, carries far less silver. The same is true of the great galena bodies of East Kootenay.

This variety forms the largest ore bodies; it seems to be the mother mineral of the chief fissure veins. Calcite crystals and chalcopyrite are sometimes intimately mixed with it, as in the great "Slocan Star" mine.

Steel galena is of a granular texture, with some resemblance to broken iron. It occurs in patches through the cubical variety, but is seldom found in large bodies. Assays made upon this usually show it to carry a higher percentage of silver than the preceding.

Wavy galena is of much the same texture as steel galena, but is more lustrous and is foliated, giving it a somewhat laminated appearance. The value of this variety often exceeds that of the others mentioned. The relative values of these varieties, together with the fact that locality bears such a strong relation to their silver value, may go to show that the silver itself exists outside of a chemical combination with this mineral. Silver is found throughout the whole range, pervading all formations and associated with so many different minerals that the question of the form in which it is present becomes interesting.

Tetrahedrite, or "gray copper," is widely represented and much sought after. It is usually of a dark gray color with a faint irredescence and a texture like steel galena. Specimens of this carry from 200 oz. to 800 oz. of silver. It occurs associated with galena, zinc blende and calcite, giving upon decomposition, very beautiful ores of azurite and malachite. Silver has entered into many curious relations where the absence of galena has caused its association with some other mineral. One case occurs near Slocan Lake, where little bunches of native arsenic have been found containing 1,000 oz. to the ton.

* Can. Record of Science.

In one of the principal producing mines, the "Alamo," upon Silver Mountain, it is found with antimony, giving a very rich ore. This is known as "antimonial silver." The mineral is very dark gray, sometimes faintly streaked, and occurs as small patches included in a matrix of cubical galena.

Silver is found in combination, as sylvanite in one mine near Slocan Lake, as "ruby silver" in several places and as native silver filaments and silver sulphides all about the limits of the Slocan area of limestones, in granite.

These latter constitute the dry ores of the district, and are rarely found in the main galena limestone belt.

Argentite is usually associated with iron pyrites in a coarsely crystallized gangue of quartz. Often this mineral is well crystallized, but in most cases it occurs chiefly as a fine black dust or stain. The veins, having a comb-like structure, easily open to decomposing agencies.

Usually a paying quantity of gold is associated with the argentite ores. Some of the veins are banded. A notable example occurs at the "Exchange" mine, near Slocan city. Here there is first a band of opaque milky quartz, some inches in thickness. Next to this comes an inch band of iron pyrites (always well crystallized) mixed with silver sulphide dust. An inch from this, in a clearer quartz, there occurs a distinct broken lamina of native silver. This arrangement is repeated four times. The pyritous band assays 270 oz. in silver. There are no pyrites with the native silver band. It would be interesting to find what relations exist between the pyrites and silver sulphide and if the silver exists as a sulphide below the line of decomposition.

As regards gold, there is little evidence of its occurrence in a free state. It does occur so in a few places along the east side of Slocan lake, in a quartz gangue, but even here the ore body carries so much pyrites that it would cause it to become unfit for free-milling. Usually the gold is intimately associated with pyritous matter, such as arsenical iron, chalcopyrite and pyrrhotite, as in the Trail Creek country. One of the deposits carrying gold in a free state also carries it in combination as sylvanite, but this is rare.

Very little gold is found in the galena mines. What is produced seems to be derived from the pyritous matter contained therein.

The Trail Creek gold ores are a mixture of chalcopyrite and pyrrhotite, greatly resembling the Sudbury nickel ores. They carry from half an ounce to five ounces of gold. Assayers of this ore have come to the conclusion, that there is a direct proportion between the amount of chalcopyrite present and the gold contained. Some such relation as exists between the copper and nickel in certain nickel ores.

As this region becomes more developed, there will doubtless be found many rare and interesting mineral combinations. It is but four years since it was a wilderness, in which some stray prospectors found the first galena lode.

Nova Scotia Gold Tailings.

Mr. W. L. Libbey Interviewed.

We recently had a call from Mr. W. L. Libbey, who has just returned from South Carolina, where he has had the concentrates from the Brookfield mine treated by Mr. Adolph Thies. Mr. Thies has probably done more than any other man to reduce the process of chlorination to the sound scientific basis on which it now stands. Originally adopting the Mears process, he has so altered and improved it that amongst metallurgists all over the world it now bears his own name. That Mr. Libbey could not have gone to a higher authority on the subject, all who know anything of the past history of the chlorination of gold ores will readily admit, and he has again shown that wisdom and foresight which has brought the North Brookfield mine to the proud position in which it now stands.

On being asked how the chlorination process worked on his concentrates, Mr. Libbey replied: "It was entirely satisfactory; in fact, the tailings after chlorination only contained 2 dwt. of gold per ton. Mr. Thies (he said) was fascinated with the way the concentrates roasted and chlorinated."

In reply to the question, "How did Mr. Thies's experiments tally with those made by Mr. F. H. Mason in the laboratory at Halifax?" Mr. Libbey said, "In every important detail, the results of the two sets of experiments are almost identical. This was particularly noticeable in the time given for the chlorination. Mr. Thies gives his own ore four hours' subjection to the action of chlorine; the Brookfield concentrates required longer. This was pointed out in Mr. Mason's report; each also gave the percentage of gold saved as 94 per cent.; in fact the two reports bear a wonderful similarity to each other, and we are all of us more than pleased with the results."

In reply to the question whether they proposed to put up a plant to treat the concentrates? Mr. Libbey said, "In the face of two such reports from men of undoubted integrity and calibre, who have nothing to sell or gain by advising us to erect a plant, we have no alternative compatible with common sense but to erect a plant. We propose erecting a plant to treat 400 tons of tailings per month to start with, making buildings large enough to double the capacity. Mr. Thies is coming down and will advise us as to the kind of plant we require, and we shall follow his advice."

In reply to the question, "What is the value of the tailings in the dump?" Mr. Libbey said: "Now we are going in for treating these tailings ourselves, and have nothing to sell, I don't mind talking tailings with you. It was the dump of tailings that first attracted my attention to the mine; there are about 8,000 tons of tailings in the dump, which nature has partially concentrated for us; these assay from $10 to $60 per ton. Mind you that is not from just one or two assays, but from a large number. These we propose to chlorinate straight without any further concentration. Then there is a lead which we call the "big lead," the ore from which in places is heavy with iron and does not show a particle of gold, and gives very poor returns when milled, but from which we have never had an assay of less than $50 per ton. Then there are the concentrates from our fissure lead which we are milling, and which assay from $70 to $150 per ton. In fact, we are only just beginning to know what we have got at Brookfield."

To the question, "When is the plant to be erected?" Mr. Libbey replied, "First of all, we are going to remodel and increase our mill, which means shutting down for a month. Then, as soon as Mr. Thies gives us details for the chlorination plant, we are going ahead with all possible speed to erect it. You must come down and see us when we are started." To which we replied we would, and we will give our readers the benefit of what we see in a later issue.

The starting of a chlorination plant of an old, tried and successful process, by a sound syndicate like the Brookfield Mining Associates, will, we firmly believe, give a fresh impetus to gold mining in Nova Scotia. That Nova Scotia gold ore is as a rule *not* a free milling ore, the foregoing interview with Mr. Libbey will go far to show, and the sooner the gold miners of Nova Scotia bring themselves down to accept this fact the better for the industry. That it is a hard pill for many of our mining engineers, past and present, to swallow, we readily admit, but it is a pill which must be swallowed sooner or later, and the sooner the better for the industry. That Mr. Libbey's is not an isolated case we are in a position to know, for it extends from the far west to the far east of our Province, and it is the exception rather than the rule to find mines in this Province which are not losing sufficient refractory gold to pay handsomely for treating. It has been contended at various times and in sundry places by mining engineers of repute, that a chlorination plant would not pay in this Province, sundry reasons being given, amongst them, that the cost of chemicals would prohibit chlorination commercially. That such a contention is utter "rot" may readily be seen when we say that in other parts of the world where the chlorination of gold ores is successfully carried on, the cost of chemicals is not one-third, and at times not one-sixth, the total cost of the process, the remaining expenses being made up by fuel, labor, interest and wear and tear on machinery. We in Nova Scotia are as well situated with regard to the latter items as any place where chlorination is successfully carried on, and we are a great deal better situated in this respect than the majority of places.

Another contention is that the majority of mines have not sufficient concentrates to keep a chlorination plant running. This we are willing to grant, but, we ask, why keep a chlorination plant always running? There is nothing so very difficult in the chlorination of concentrates, and our mill men, who are usually a very intelligent class of men, could be readily taught to run a plant, when the conditions of the ore have once been determined for them by an expert, who will tell them the amount of chemicals to use, and the time and heat required for roasting. A chlorination plant capable of treating ten tons a day erected in Nova Scotia would not cost more than a 10-stamp mill, and there is no earthly reason, other than pure cussedness, why the stamp mill should not be shut down for three or four weeks in the year and the valuable concentrates, which are now going to waste, be treated.

In districts where several mines are situated close together, a custom chlorination mill could be erected which would treat the concentrates from the group of mines in its neighborhood.

It has been estimated that the recovery of gold by milling in Nova Scotia has in the past not been more than two-thirds the value of the ore, and from our interview with Mr. Libbey, together with observations which we have had the opportunity of making, we believe that is very much nearer the mark than many of our gold mining men would care to admit.

A word of warning before we conclude. It would be extremely unwise for any single mine to erect a chlorination plant without proper advice on the subject. A plant which is adapted to one class of concentrates is not necessarily adapted to another with the same amount of economy; and lastly, when the plant is erected, and hitches occur, which they must of necessity do from time to time, it will pay infinitely better to have an expert down to tell what is the matter, than muddle out the difficulty and probably spoil several tons of concentrates in so doing. That we have an expert in this Province capable of doing this is proved by the way the two reports on Mr. Libbey's ore corroborated each other.

MINING IN BRITISH COLUMBIA.

(From our own Correspondent.)

Trail District.

The LeRoi mine has started operations in the main shaft once more, and three shifts, with a Rand "Slugger" drill, are making excellent progress. At the very bottom and all four sides of the shaft are in ore of a very superior grade. The raise from the 350 foot level is up nearly 250 feet, and the managers of the mine say that the skip will be in operation by the first of the month. This improvement will practically more than double the present output. Only ten tons (of the very best ore) are being shipped to outside smelters daily.

Charles King, the contractor for the Rossland and Trail Creek Tramway Company, was in Rossland yesterday and positively stated that the road will be at Rossland not later than the 12th inst. Also that the railway company will be in a position to handle all ore by the first of June. The second engine has arrived, and is at work hauling rails from the steamboat landing on the Columbia, as well as moving heavy bridge timbers to the front. The work this engine is doing greatly facilitates track-laying, and now about four thousand feet of track are being put down daily. The bridge construction is behind, and will cause three or four days delay. It is proposed to celebrate the formal opening of the line on the Queen's Firthday by a monster celebration in Rossland.

A strike of vast importance has just been made in the main tunnel on the Josie, the face of which is again a solid mass of high grade sulphide ore. In the back of the tunnel the ore is not quite solid, but is a copper and iron sulphide, with a quartz gangue. In the bottom the ore is perfectly solid the full width of the drift. The Josie compressor and hoist are daily arriving on the instalment plan from Trail Creek Landing.

Work is still progressing on the cross-cut tunnel on the Tiger, which adjoins the Crown Point. The ledge has not yet been struck, though the face must be close to it.

The Delaware on Granite mountain, near the celebrated Jumbo mine, has just been purchased by David and Chester Glass, of Spokane, for $6,000 cash. The average samples ran over $40 in gold to the ton, and the assays that the claim was purchased on yielded $40, $54 and $56 in gold per ton. The ore body is a large one, the ledge itself being fully 90 feet wide, and extends for 1,000 feet up the hill in a north-westerly direction, which slopes at an angle of 45 degrees, making great tunnel sites. The property will be incorporated under the name of the Delaware Gold Mining Co. It is without doubt a wonderfully good legitimate mining proposition.

Messrs. Williamson and Doherty, the owners of the Crown Point, Hidden Treasure and White Swan, have commenced operations on the first named property and are engaged in running a drift to the east from the shaft at the 65 foot level. Already the face of the tunnel is in ore, the value of which has not yet been ascertained, though in appearance it closely resembles the best ore yet found in the mine. The work at present is necessarily slow owing to surface water. The owners of these claims, and in all likelihood the owners of the Kiwi group, will build a wagon road to the tramway line at the crossing of Tiger creek. Mr. Williamson says he has from 1,000 to 1,500 tons of ore on the dump already that will net a handsome profit. The owners of the Kiwi group, which lies to the east of the Crown Point, intend prospecting their property with a diamond drill.

A good strike has just been made in the north cross-cut of the Centre Star. The owners are of the impression that it is the great War Eagle vein that has been encountered. Should this prove correct the Centre Star, already a great mine, has had an element of wealth added to it that will make it a bonanza of the first order. The ore in the main drift is getting a larger gold value as the ore chute is penetrated.

Victoria capital has succeeded in getting hold of another splendid Trail Creek property in the Georgia. The final payment of $15,000, due on 26th May, was met during the past week, and steps will be taken at once to form a company to systematically mine the property. The face of the tunnel is all in ore of a very satisfactory grade. The steam drill which is being used in this tunnel is giving eminent satisfaction.

W. J. Lascelles, who has a bond on the North Star, which adjoins the Georgia on the east, and the Columbia on the north, returned from Victoria on Friday last, and it is said that everything has been arranged for the consummation of the deal.

The rapid construction of the Red Mountain railway into the camp from Northport, Wash., is now assured beyond all reasonable doubt. Already a large camp has been established at the Falls of Big Ship Creek, and the work of clearing the right-of-way has commenced. It is stated that already 200 men are at work. Grading will be started in the near future. The road is very badly wanted, as the impassable state of the wagon road, caused by recent rains, makes ore hauling and general freighting almost an utter impossibility.

Last summer Gen. Chas. S. Warren, of Butte, secured an interest in the Paymaster group on Murphy creek, in consideration of doing a certain amount of development work. The property has shown up remarkably well, and has been under option to some English capitalists for a month or more. A tunnel was started this spring running for the vein which has been struck at a depth of 50 feet, and shows promising ore. Development work will be started on a large scale as soon as the details of organizing a company are completed.

A number of Trail Creek prospectors have left on a prospecting trip to Deer Park, at the lower end of Arrow lake. Some fine sulphide ore, with free gold plainly visible, has been brought into camp. Many men are leaving daily for the new camp.

That Monte Cristo mountain will be covered with prospect shafts and tunnels this summer is a foregone conclusion. On this hill alone, which is but half a mile from Rossland's main street, the following properties will be mined:— The Monte Cristo, Eddie J. Enterprise, Colonna, Georgia, Iron Horse, Great Western, C. and C., and Evening Star. There are admirable showings on all these properties, and it is confidently expected that development work will prove some of them, at least, mines of no ordinary magnitude.

Frank P. Hogan and S. S. Bailey, of the Evening Star company, are expected to arrive in Rossland this week from Spokane, to commence active operations on this wonderful property. It has a fine surface showing, and the smelter returns from the two [illegible]rloads of ore shipped last fall prove beyond doubt that this claim will make a shipp[illegible]

Work on the Highland, situated to the north of Rossland, and under bond to Mason S. Thomson, of San Francisco, has been suspended for the present. The chaotic state of the weather, and the consequent inability to get supplies to the mine has rendered this move necessary. The mine is looking first class in every opening. Mr. Thompson states that work will be resumed by the first of June.

Since my last writing both the Le Roi and War Eagle have paid dividends to their stockholders. The Le Roi paid 10 cents a share, or $50,000; and the War Eagle 5 cents a share, or $25,000. Considering the great disadvantages that both properties are working under, this is a very, very wonderful showing. No ore is leaving the camp to speak of on account of the roads. However the Le Roi Company has $300,000 worth of ore (nett) piled up on the dump at the mine, and the War Eagle is only doing very necessary development. Both mines will, the managers say, pay $50,000 to $75,000 per month as soon as the railroad can handle their output. This makes a total of $307,500 paid by these two mines in dividends in thirteen months. The Iron Mask will declare a dividend on the 1st of June.

The Commander, which was under option for a short time to a syndicate of C.P.R. officials, has just been stocked in Spokane. W. J. Harris and Frank Watson, with the locators and original owners of the property, Messrs. Lynch, O'Neil and McFaddden, form the board of directors. Already a force of men have been put to work on the property building cabins and pumping out the shaft, which is down 53 ft. There is a fine showing of high grade copper in this shaft, and work was started on it again this morning. Pumps and hoisting machinery have been ordered and are expected here shortly. Thirty thousand shares of the treasury stock of this company were sold in one block for 25 cents per share.

The tunnel on the Lily May is now 85 ft. and the breast presents a most handsome appearance, the ore streak being fully 4 ft. wide and of a most handsome grade, latest assays ranging from $60 to $85 in gold, silver and lead to the ton. Seven men are at work building ore houses and quarters for the men. Eighty tons of ore are on the dump, a wagon road will be built to the tramway line at once, and the ore will be shipped as soon as the road can handle it.

A. W. McCune, principal owner of the Nickel Plate, has just arrived from Salt Lake and reports himself as being much pleased with the general appearance of the mine. About 300 tons of the highest grade ore in the district lies on the dump, awaiting shipment. Water is very troublesome at present in the shaft, and the pumps are taxed to their utmost to handle it. Mr. McCune announced his intention of installing a larger pump and hoist as soon as it can be gotten here.

C. W. Callahan, the London expert, who secured a bond last winter on the Deadwood in the South Belt, has just returned from London. He says that the mines of British Columbia, and Trail Creek in particular, are beginning to awaken interest over there, though up to date the reports received are vague and hazy. He predicts, however, the investment of much British capital in the district this summer and fall.

Probably the largest price yet offered for a non-dividend payer in the Trail Creek district was made yesterday (Monday) to General Warren, John M. Burke and J. B. Jones, the owners of the Great Western, for 600,000 shares (a controlling interest) of the stock of this company. It is said that 25 cents a share was offered. Messrs. Burke and Warren accepted the offer, but Mr. Jones declined to entertain it.

Rossland presents the most encouraging field for the use of the diamond drill of any camp discovered for many a day. The hardness of the rock, the heavy cost of exploitation work, and very often the low grade of the surface ore, proves a heavy burden on individuals and small companies. Already it is a certainty that four drills, in addition to those already in use, will be in operation by the first of June.

T. C. Collins and partners, the owners of the well known Free Coinage group on Champion Creek, have given a fifteen days' option on the property for $12,500 cash. The lead is an exceptionally strong one, and shows solid ore wherever it has been opened. The ore is an auriferous arseno-pyrite. It is said that values in gold ranging from $6 to $51 to the ton have been obtained by fire assay. Should the deal be made, natural location makes the claims very easy ones mined.

Trail Creek stocks have been very active during the past month and there has been perceptible increase in the value of all stocks listed, and especially so in Poorman, Josie and Iron Mask. Large blocks of the former have changed hands during the month. Below is a list of the stocks and the prevailing selling prices:—

[NOTE.—No stocks are listed in this table unless the property on which they are founded has been fully paid for and the title perfected.] Quotations corrected weekly by Reddin & Jackson, mining brokers, Rossland, B.C.

Caledonia Con.	.10	Monte Christo	.15
Evening Star	.16	Paris Belle	.09
Gertrude	.10	Phœnix	.10
Great Western	.12	Poorman	.16
High Ore	.09	Silverine	.09
Iron Mask	.87½	St. Elmo	.15½
Josie	.55	Virginia	.30
Jumbo	1.10	War Eagle	1.85
O. K.	.34		

No Le Roi, Gentre Star, Idaho or Trail Mining Co. on the market.

Boundary Creek.

The Skylark mine, Skylark camp, with its north extension, the "Denner," has been sold to the Lexington Mining Company, Montana, for $15,000. It is understood that the terms of the bond make it practically a cash sale.

The "Skylark" was discovered in July, 1893, by James Atwood, bonded to the Spokane and Great Northern Mining Co. A lease of part of the vein was secured by other parties, who, during that fall and winter shipped ore to Tacoma. A fault was encountered at the 50 ft. level, and the lessor ceased operations. The S. & G. N. Mining Co. then continued the shaft some 50 ft. further, drifting east from that point about 15 ft. The vein, however, was not found. Abandoning the search they returned to the 50 ft. level and stoped out the ore nearly to the surface for the length of the old levels. The year being up and the final payment due, the company threw up the bond and condemned the property. As this was, at that time, the claim best known on the outside, the supposed non-continuance of the Skylark vein brought the other promising prospects of the district into disrepute.

The original owners, however, began work, and drifting east at the 50 ft. fault, struck the vein in less than 10 ft. Sinking on this 25 ft. the vein again faulted. They again drifted east and found the vein in place at a distance of 42 feet; the depth from the surface being about 90 feet.

The vein here is 30 inches wide, well mineralized, with an intimate mixture of fine grained galena, blende, pyrite, and arsenopyrite, with considerable ruby silver. On the hanging wall is a pay streak of three to eight inches of "clean" mineral, assaying as high as 800 ozs. silver and 2½ ozs. gold. A shipment of 70 tons gave 268 ozs. silver and 1 oz. gold.

Previous to completing the purchase Mr. Ranger, Manager of the Lexington Company, was in and made a personal examination of the property.

A hoist will be brought in and work started on a new shaft as soon as possible.

The "Skylark" would undoubtedly have sold for a larger sum if the first bonders had not left it in such a bad condition.

A large body of pyrrhotite was discovered on the property last winter. No work has been done on it, but it is said to assay about $7 in gold on the surface.

Colonel John Weir returned to the district two weeks ago. He has already bonded the "Copper," Copper Camp; "No. 7," White's Camp, and has under consideration a number of others. The "Copper" is an extremely large deposit of copper oxide (cuprite) with some native copper. The ore is disseminated throughout a silicious gangue in fine grains and laminae and carries some gold and silver. The deposit appears to be a contact between limestone and porphyry.

Developments so far have been confined to surface work. The bond on the "No. 7" is for $12,000. There are three veins on the property, the only one developed being a quartz vein 2 to 2½ ft. wide, heavily mineralized with a fine grained mixture of pyrites, galena and blende, carrying a high value in gold and silver. A shaft is down 50 ft.

Two shafts are being sunk on the "Gold-drop," Greenwood camp, and a diamond drill has been operating continuously for the past month on the "Snowshoe."

Work has been suspended on the shaft of the "North Star," Long Lake camp, on account of water. The telluride hessite occurs quite plentifully throughout the whole length of the shaft. (It will be remembered this is the first occurence in Canada).

A tunnel is in 95 feet on the "Lakeview," Long Lake camp, and a shaft is to be started at the mouth of the tunnel on the rich ore chute uncovered last fall. In this chute occur both hessite and altaite (?) and, what is rare in auriferous quartz veins, leafy and filamentous native copper.

The road from Greenwood city to Copper camp has been completed.

Mr. Tye, engineer for the Columbia River and Western Railway, has been in camp for the past few days with a party of surveyors, locating the passes for the projected road from Rossland to Penticton. The supposed route, after crossing the north fork of Kettle river, is along Fisherman and Ebolt creeks into the Boundary creek basin, down Boundary creek through Greenwood city to Midway, thence westward into the Okanagan valley, entering at the southern end at Osoyoos by way of Myers creek or else further north by way of the pass north of camp McKinney, thence up the valley to Penticton.

A vein 10 ft. thick of excellent coking coal has been struck at Rock creek, 11 miles west of Midway. On the surface the ash does not run higher than 15 per cent. It is a perfectly level road from there to Midway. Different coal beds have been found in this valley in the last few years, but this is the best coal so far found.

MINING IN NOVA SCOTIA.

Mr. Thompson has 50 tons of quartz on deck in his property at Cow Bay ready for crushing. The new mill built by the Truro Foundry Co. has been erected and crushing will be started shortly. The trial crushing from this property gave 2 ounces per ton.

Mortar and assay tests have been made of the Peter Dunbrack find adjoining the Brookfield Mining Associates' property at North Brookfield; 60 lbs. mortared with mercury gave 16 oz. 8 dwt. of gold, or 546 oz. per ton, while the fire assay gave over 2,200 oz per ton. The gold in the quartz is very fine, no nuggets showing. This is probably the most remarkable find made in this Province. The lead is 10 inches wide and should turn out a real bonanza. The drift in the neighborhood of the lead also contains a large quantity of gold. Mr. J. E. Asquith, contractor, of Ottawa, who is at the present time in Halifax engaged on a large contract, and who is an old gold miner, has taken a bond of the property.

The property owned by Miner Foster and others, which also butts onto the Brookfield Mining Associates' property, has been bonded to an American syndicate, and a gang of men are developing the property.

Turning from Queen's County—where there is undoubtedly a real boom just now—to Sherbrooke, we find things rather quiet. There are, however, three pits in full blast. The Stellarton Gold Mining Company is said to be rather more than paying expenses. The New Glasgow Company is doing well. In the Coburg areas a 20-ton test yielded 6 dwt. per ton free milling gold; the lead here is from 8 inches (worth about $10 per ton) to 4 inches (worth about $3 per ton). The shaft is down 157 feet and 60 feet of tunnel has been driven east and west of the shaft.

There have been two serious explosions of dynamite recently, one at Crow's Nest in which the foreman was killed and two other men injured, and one at Goldenville in which several men were injured.

John McQuarrie is starting up the Johnston's Brook mine in Country Harbor again.

The new discoveries at East and West River, Guysborough County, have been given a mill test which is said to be highly satisfactory, but no reliable information is obtainable. There appears to be a certain amount of friction amongst the owners, which is preventing any headway being made.

A company is to be formed to work the deposits of tripolite in Victoria, C.B. The provisional directors are J. D. Copeland, J. T. Le Moin, and W. J. B. Bingham.

A company is to be formed to take over and work the Modstock mine and do a general mining business in Nova Scotia. The provisional directors are J. D. Copeland, Robert Dixon, and Charles N. Wilkie.

Work has been started on the deposit of selenite near Elmsdale, under the management of J. McCallum.

The Brookfield mine produced a brick of 361 oz. last month.

Mr. John Anderson's crusher at Lake Cacha was destroyed by fire last month.

The Oak Island Treasure Co. have started mining (?) operations in search of Captain Kidd's treasure. If this company would invest their money in gold mining instead of wasting it looking for hidden treasure, the existence of which is extremely doubtful, they would get a good chance of returning a dividend to their shareholders.

It is reported that the Golden Group Co. will start operations at Montague next month.

The value of assaying is generally a good deal more than the cost. Some parties in Nova Scotia not very long ago sent some antimony ore to New York and were paid for the antimony. We were shown the letter from the Smelter Co., and it struck us that they showed an undue anxiety to obtain further quantities of the ore, so we asked for a sample, which was given to us; an assay of that sample showed that it contained 1 oz. 3 dwt. of gold per ton, a fact which the smelter ommitted to mention. Neglect in the matter of assaying and analyses is generally cent wise and dollar foolish, to reduce an old proverb to the metric system.

Visit to the People's Light and Heat Co. Plant, Halifax.

(By our Halifax Correspondent.)

We recently paid a visit to the new gas works and were conducted round by Mr. Young, the engineer in charge, who explained everything to us very clearly. The plant, which will probably be completed next August, will consist of 11 ovens, built very much after the style of the Simon Carvè coke oven, with the exception that instead of being heated by either slack coal or by the volatile products of the distillation of the coal which is being coked, will be heated by gas from a Mond producer. The products of combustion are led through a series of flues, so arranged that they will heat the air and gas coming into the combustion chamber, and thus a higher temperature will be obtained. The dimensions of the coke ovens are 30 ft. x 6 ft. x 18 ft.

The Mond producer has several advantages over ordinary producers, the temperature at which the gas is made is below 600°C and therefore ammonia gas is not split up and a yield about five times in excess of the ordinary gas works yield of ammonia is thus obtained. There are also several very clever contrivances for bringing into use heat which is ordinarily wasted. The ammonia scrubbers are also another special feature of this plant. They consist of a number of circular discs which are perforated in such a manner that the perforations of any one disc will not coincide with the perforations of any other disc. These discs rotate, and the lower part of them being in water, they always present a cool surface for the gas to pinge upon, the gas thus broken up loses the whole of its ammonia and carbonic acid. The ammonia liquor is subsequently concentrated by fractional distillation with lime water.

Another special feature of the plant is the cyanide scrubber. This substance is usually lost in gas works, but in this case it is collected in a solution of caustic potash and iron, potassium ferro cyanide being formed.

The gas will be stored in a Gadd gasometer, made by R. & J. Dempster, of Manchester, England, and will be the first of its kind introduced on the continent of America. The peculiarity of this gasometer is, that instead of the columns usually used in gasometers, a series of curved rails are arranged around the lifters fitting into the tank, or the lifter immediately below it; thus the whole gasometer will shut up like a telescope when empty, and on being charged opens with a twisting motion like a huge multi-threaded screw. The gas will be purified from sulphuretted hydrogen and carbon bi-sulphide by ferric oxide and lime, and the ferrous sulphide thus formed will be once more converted into ferric oxide by blowing air through it, the sulphurous anhydride thus formed will be converted into sulphuric acid.

There is a benzole scrubber which will remove nearly the whole of the benzole from gas which may be required for heating purposes around the works and for the electric light and tramway company, who will use all the gas for which a market cannot be found. This benzole will be used for enriching the lighting gas supplied to the people.

When the destructive distillation of the coal is completed the coke will be removed from the ovens by opening the doors at each end of the oven and pushing it out with a steam ram on to a concrete floor, where it will be quenched with water.

The coke will be crushed, screened and sized for household purposes, for which it is estimated it will largely supplant hard coal, while the larger pieces will be used for metallurgical purposes.

It is the intention of the company to coke about 20,000 tons of coal a year, which it is estimated will yield about 12,000 tons of coke, 60 million feet of gas, allowing for leakages and not including that supplied to the tram company, 800 tons of tar, 300 tons of sulphur, 300 tons of low grade and 550 tons of high grade sulphuric acid, 41,500 gallons of benzole, 41,500 lbs. of potassic ferro cyanide, and 375 tons of sulphate of ammonia.

That several of these by-products will find a use in this province there can be no doubt. Sulphate of ammonia is coming more into use as a fertilizer, and the highest authorities agree that plants are better able to obtain nitrogen from ammonia compounds than from alkaline nitrates. Tar is a commodity with unlimited uses, and the same may be said of sulphuric acid.

There has been considerable agitation in the city and a good many letters in the newspapers about the nuisance this plant will be to the neighborhood. After going carefully through the drawings with Mr. Young, and having them clearly and concisely explained to us, we unhesitatingly say that there is nothing in our opinion which can be likely to come under the head of a nuisance, the products of combustion will be carried up a high chimney stack and will issue from it probably with considerably less smoke than from the chimneys of an ordinary house because the combustion will be complete.

What this plant will do for the people of Nova Scotia and Halifax in particular will be to give them a cheap fuel, a cheap illuminant and a cheap fertilizer. It will develop the coal industries and give employment to a large number of men, both directly and indirectly. This Halifax plant is only an experimental plant. Mr. Whitney's bill has now only to pass the Senate and a 250 oven plant will be erected in Boston which will be followed by the erection of plants in the other large cities of New England, and the coal deposits of Nova Scotia will thus be tremendously further developed.

MINING IN QUEBEC.

Dr. James Reed is working a small force on the old Harvey Hill copper mine at West Broughton, and is about to start his concentrating plant.

The asbestos industry gives promise of a busy season and the shipments from the mines will be quite equal to, if not better than those of last year (8,316 tons). The general impression seems to be that prices have now got as low as they are likely to go, and we are told on very good authority that two of the leading "smashers" have done some parleying together with a view to establishing an upward tendency.

The American Asbestos Company have been making important additions to their plant, and work at the Black Lake pits will be pushed more vigorously than of late.

King Bros. and the Johnson's Company will turn out a fair quantity of their high grade asbestos during the season.

The Bell's Company, at Thetford mines, have between two and three hundred men at work and the output will, it is expected, reach 5,000 tons.

The United Asbestos Company has been prospecting a property at Broughton and some important work will be done there this season.

The Anglo-Canadian Asbestos Co. is opening up some very promising deposits of chromite at Black Lake.

Mr. T. J. Watters, Ottawa, is understood to have leased to F. J. White of Boston the principal mica properties of the Lake Girard System. A new company, styled the Dominion Mica Company, with Mr. F. W. Webster as manager, has commenced active work both at the mines and at the factory and cutting shops.

The Walker Mining Co. and the North American Graphite Co. are doing a brisk business at their respective mines in the Buckingham district. There is good demand for the various grades, and improvements in the methods of milling lead one to believe there is a good future for this industry.

MINING IN ONTARIO.

Mr. F. Cirkel, M.E., of the Ontario Graphite Co., has returned from his visit to Germany, and is now engaged in the construction of a milling plant at Ottawa for the treatment of the output from the Black Donald mine.

Mr. W. G. Motley, M.E., manager of the Regina mine, has resigned. He has been succeeded by General Wilkinson, C.B., chairman of the company. Mr. Motley remains in the district.

The Regina gold mine is now down 115 ft. with drifts opened 525 ft. At the second level very rich ore was struck, showing coarse gold. The 10-stamp mill is running night and day. A run on stopes just before Mr. Motley left gave an average of 19 dwt. per ton.

The Dominion Mining and Reduction Co. has started work on the Gold Hill and other properties acquired by the comyany.

With respect to the Lake of the Woods gold mines a correspondent writes:—"The work now going on has fully established the value of the Lake of the Woods as a gold producing district. The Sultana mine is running very successfully and produces in the neighborhood of $3,000.00 per week. The Regina mine is also proving itself a steady bullion producer. The Golden Gate mine, which is one that only started operations within the last month, is already producing its bricks of bullion (the first mill test showing $62.00 per ton), and bids fair to be as rich if not richer than anything so far operated on the Lake of the Woods. There are, I am pleased to say, three new English companies of well known financial standing about to take hold of properties in this district and fully use them."

CORRESPONDENCE.

The Quebec Gold Field.

The Editor:

SIR,—The discussion in the April number of the REVIEW over my paper on "The Gold Deposits of the Eastern Townships" seems to be largely wide of the mark. The paper was intended simply to call attention to two points, viz., the great value of the gravels along the Upper Chaudiere and the Du Loup, and the desirability of exploiting these properly by the hydraulic method; and second, the presence of the many intrusive masses of granite, greenstone, etc., seen in the vicinity of the Bras, on the south side of the Chaudiere and in the area between the Des Plantes and the Gilbert on the north side of that stream. No comparison was made between the quartz veins of the Chaudiere and those of the Nova Scotia gold field, nor was any comparison of all the rocks of the two localities attempted, since that would have been absurd. Mr. Hardman has doubtless examined the geological map of the Chaudiere district, and has seen that no less than three geological formations are there represented, viz., the Cambrian, Cambro-Silurian, and the Silurian or Siluro-Devonian; the latter occupying a small basin-shaped area to the north of the river between the Famine and the village of St. George. The only rocks I compared with the gold series of Nova Scotia were the slates and associated beds of the Cambrian area which extends on the Chaudiere from the Famine river to below the village of St. Joseph. These are well seen on the Gilbert, the Millstream and elsewhere, as also to the south-west in Ditton, and to the south-east on the upper part of the Du Loup. The point I wished to make in regard to these rocks which underlie the richest gold alluvion of the district, in so far as yet known, was in relation to the intrusive masses, since we find at most mining areas that diorites have had an apparently marked influence upon the presence of mineral lodes, and it is presumable that the same favorable conditions may prevail in that portion of the Chaudiere where these intrusives are especially numerous.

I am, &c.,

R. W. ELLS.

OTTAWA, May 4th, 1896.

Safety in Colliery Winding.*

By C. M. PERCY, M.I.M.E., F.G.S.

The writer has often felt that considering his long association with the mining industry of Lancashire and with the Wigan Mining School, in common with a good many of the other members of the mining fraternity, he had hardly taken his fair share in the admirable work of the Manchester Geological Society; which work is more arduous and less successful than it would be if distributed amongst a larger number. The Manchester Geological Society is not peculiar in this respect; it has unfortunately become almost a rule with mining societies and institutes to let the real hard work of preparing papers and originating discussions devolve upon sadly too few. He had intended reading a paper at the January meeting, but insufficient time and notice prevented: perhaps the most satisfactory apology and explanation was by the paper presented that day.

The subject selected was one in which they were all interested; because, generally, they all aimed in their respective capacities to make mining operations safer; and, especially, because, whilst unfortunately many causes of accidents in mines were beyond their control, accidents with colliery winding appliances were capable with means already at their disposal of being made well nigh impossible.

What they required was a thorougly good equipment; and his intention was, so far as he was able in the short period that he would trespass upon their indulgence, to present for their consideration what in his opinion could fairly be termed a really good equipment.

THE WINDING ENGINES.

The all important and fundamental essential was a good pair of winding engines; not liable to get out of order, amply sufficient in power to deal with the load; capable of the easiest possible handling, the load made uniform throughout the winding, and brake power sufficient to hold the engines in any position. What he had always been bold enough to lay down as "sufficient power," was to have a pair of engines; and, even allowing one-third for overcoming frictional and general resistances, to calculate upon the possibility of only one engine being available. The margin might, and to many did, appear excessive; but the work of getting up a very high speed in a very few seconds was very great, and in his opinion what ever else they might be hampered with at collieries, they ought not to allow themselves to be hampered by an insufficiency of winding power. The matter of easy manipulation was very important, because a winding engineman cannot be considered a mere manual operator, but more of the character of a skilled expert who has very different duties than those which fall to the lot of the ordinary engineman; each operation, of which he has hundreds in each working day, occupies less than a minute, comprising starting, stopping and running at mail train speed. And at a busy colliery every few seconds are valuable, as they represent that amount of time multiplied by the number of windings.

BALANCING THE LOAD.

More attention to balancing the load would assist in easy working, and efficient winding machinery should have a uniform load. In the earlier days of coal mining, and with inferior machinery, our forefathers devoted more attention to balancing, and even the otherwise defective flat rope assisted in this direction; amidst all its vices this was a virtue, almost the only one. The ordinary cylindrical drum is a great sinner in this respect if applied without the tail rope. Suppose we have each winding 2 tons of coal, and that each rope weighs 3 tons; the load against the engine commencing the winding is the coals plus the rope=5 tons, and, ending the winding, the load against the engine is the coals minus the rope=one ton less than nothing. The remedy is in the tail rope, or in the spiral drum, against which there has been much foolish prejudice, but which is correct in principle and efficient in practice. A spiral drum well made and the arrangements properly set out, is as safe as any other, and the ropes wear as long. In the example named without a balanced load, not only would the engines be less easy to handle, but they would have to be of double the size and power as compared with having a balance. Whatever the work of a winding, and during a winding, may be, and however much the load against the engine may diminish as the winding proceeds, the engines must evidently be calculated for dealing with the load where it is greatest.

STEAM REVERSERS.

To assist in the handling of engines, steam reversers which are virtually smal engines in themselves, have been applied with advantage, and with ordinary slide valve engines are essential. Many endeavors, some characterized with a good deal of ingenuity, have been made from time to time to overcome the inherent defects of such valves and their mechanism, but the highest authorities are of opinion that none of the attempts have eradicated the defects, and the high pressures of steam coming into use have aggravated the defects. To reverse a slide valve engine under steam requires an almost superhuman effort, which a winding engineman should not be called upon to make. It is quite true that properly balanced valves avoid this, but we have to deal with winding engines as they are, and many of them have ordinary slide valves. Thi being so, good steam reversers, and there are several, play a useful part.

ARRANGEMENT OF CONDUCTORS.

The arrangements in the shaft are important for safe winding, especially where, as is most common, two cages work in the same shaft, and collision has to be guarded against. The general preference is for wire conductors, as being less likely to become disorganized and allowing freer winding, and alogether more convenient in a pit shaft. The weighting should always be by dead weights; screws are very dangerous, and ought not to be allowed. A dead weight exercises a known and unvarying strain, and is not affected by contraction and expansion. A screw makes no provision for either, and produces no well-defined strain. The writer was engaged in a case in which lives were sacrificed because the wire conductors had been over-tightened by screws, and broke. Insufficiency of depth in the sump is not a sufficient excuse, and in at least one instance the dead weights have been applied by leverage in the headgear. This arrangement would only suggest itself under very exceptional circumstances, such as a large number of conductors and insufficient diameter of shaft, because weighting at the top deprives us of the benefit for weighting purposes of the conductors themselves. As to the number of wire conductors to a cage, that will depend on the depth and the load, but three is a good arrangement, or four; in either case, if one gives way the remainder will keep the cage in position. When we have only two conductors to a

*A Paper read before the Manchester Geological Society, at Wigan, 8th May, 1896.

cage, and one happens to break, the remaining conductor becomes a pivot on which the cage is free to swing round and get greatly out of position. The cages may be prevented coming into collision by having them placed sufficiently far apart, but that is not possible in a good many shafts; here again we have to deal with arrangements as they are, and are not always prepared to increase the diameter of the pit shaft; and results quite as good are obtained by having safety wire conductors between.

GOOD WINDING ROPES.

Then for safety, also, good ropes are absolutely necessary, and ought to be easily obtainable, but many ropes are not good. The material for the wire h.. now a strength up to 140 tons per square inch, and the high qualities should always be used. Provided the wires are good and uniform; and they can easily be tested for strength and uniformity; and the rope itself, a portion of it is tested to breaking strain; and the load upon it, including itself, not allowed to exceed one-tenth of the breaking strength, it is very difficult to see how ropes can break with fair usage. A rope maker's card is all very well as showing what the strength of a rope should be; the actual strength can only be determined by actual test. They do not always get fair usage; rope users are frequently as great offenders as rope makers; the head gear pulleys and the drums are not round, and not properly set for the efficient performance of their work, and the engines are placed too near the pit, necessitating too much side travel. The Wigan Coal and Iron Co. have got over this excessive side travel at one of their collieries at which the rope coils back upon itself, and the working results are good and the ropes themselves not affected; this plan was adopted not so much on account of excessive side travel as insufficiency in width of drum. A factor of safety of ten seems high, but it must be well borne in mind the very peculiar and ever-varying strains to which winding ropes are exposed. Take every single winding; whilst getting up speed, the amount of strain exceeds the load; whilst running at a uniform speed, the amount of strain is equal to the load; and whilst slackening speed the amount of strain is less than the load. Even in starting a winding steadily, the amount of strain is double the load; sudden jerks, which are very frequent, intensify this strain. It will probably not be thought either desirable or necessary in this paper to criticize the various makes of ropes—those known as "Lang's," and "Elliott's Locked Coil," possess great strength and flexibility and freedom from twisting, and power of wear; and after long experience have proved very successful.

SAFETY APPLIANCES.

Even supposing that all the conditions laid down as to winding engines and conductors and ropes are complied with, accidents may still occur. What we term overwinding may take place. The cage may be drawn too high, either by not being stopped in time or by being started the wrong way; and when we consider the enormous number of windings at each colliery each year, an occasional occurrence of this kind is to be expected.

DETACHING-HOOKS.

The useful appliances known as detaching-hooks have long been in use, but not at all extensively till after some very serious accidents causing considerable loss of life. The prejudice against them, which was overwhelming at one time, has not yet entirely passed away. The favorite argument is that they make winding enginemen careless. The actual fact is that they operate exactly the other way—where they are not applied an overwind may take place, and unless something breaks nothing is said about it; but where applied every overwind makes its own record. It would be as sensible to say that policemen increase the amount of stealing, and that our mine inspectors increase the danger of mining. The opinion of the writer is that detaching-hooks are very useful and necessary appliances, and probably are most effective when they combine detachment and suspension in themselves, and also have supplementary catches in the head gear. It is not thought necessary to enter into any description of detaching-hooks; there are many good ones, and some of the most successful wi.l be illustrated.

DETACHING-HOOKS DO NOT PREVENT OVERWINDING.

But accidents with winding machinery are possible with the most efficient of detaching-hooks, and that is the reason that this paper has been prepared. Suppose the engines to be running at a high speed, and to make our illustration more striking let us assume that the engineman from some cause loses control when going at full speed, which may be 60 miles an hour. There is no exaggeration in taking this speed as an illustration. Twenty years ago it was the practice at the Rose Bridge Collieries, and is now accomplished at many important collieries in many counties. A maximum speed of 60 miles an hour probably does not represent more than an average speed of 30 miles an hour, and looked at in that way is less startling. The cage at that velocity would dash into the head gear with a force equal to that of a steam-hammer of the same weight falling through 120 feet vertical. The detaching-hook might detach and probably would detach, but the ascending cage and the descending cage would operate with uncontrollable force, and the mere detachment would be useless; and the engines might go on racing and accumulating force till they dashed themselves to pieces and cast devastation all around. The real safety appliance is evidently one which will not content itself with acting *after* an overwind, but *will prevent* one, and will act upon the machinery so as to stop the whole arrangement before going too far. Starting in the wrong direction is much less important, because virtually no speed has been got up, and the maximum harm would be to overstrain the rope and break the pulley. The running away is a very serious matter, and it is a high tribute to the skill and care of enginemen that the occurrence is so seldom.

THE "VISOR," WHAT IT IS, AND WHAT IT DOES.

Several years ago the attention of the writer was drawn to the safety application known as the *Visor*, invented and patented by Mr. Alexander Bertram, and applied by the Wigan Coal and Iron Company at many of their collieries. Recent events drew the writer's attention to the appliance again, and in the presence of the students of the Wigan Mining School he made a series of experiments with it at the Alexandra colliery. The first series of experiments dealt with the case of winding engines being started the wrong way, and on the cage rising a few feet above the bank the *Visor* acted, and stopped the engines dead. The second series of experiments dealt with engines running away at full speed. After setting the engines in motion the engineman left the handles, and the engines rushed on their career, attaining a cage speed of 60 miles an hour. At the appointed place the *Visor* automatically came into action, and shutting off the steam and applying the brakes, stopped the engines in about three revolutions. The distance in which the machinery is brought to a stand gives rise to two considerations. The first is that so far as the engines only are concerned, that distance depends entirely upon brake power, and the brakes must not be too powerful, or the engines will be stopped too suddenly, and a serious breakage may result. The second consideration is that the ascending cage by reason of its velocity will rise a given height whatever the brake power may be; and to stop the engines in a less distance than that would be a source of danger, because the cage would continue to rise, slack rope would accumulate, and the cage falling back would exercise such a strain that the rope would break. At a speed of 60 miles an hour, if at any moment the engines were stopped dead, the cage would continue to rise 120 feet, and at a speed of 30 miles an hour 30 feet. For the general convenience the detailed and technical description of the *Visor* is attached as an appendix to this paper, and time will not be occupied in reading it. A few words, together with the model and illustrations, will explain clearly enough the general principle. Under the ordinary conditions of winding the *Visor* interferes in no way with the engineman and his work, and might be non-existent; it is a great reserve force, which acts only when the dominions of safety are invaded. An essential part of the mechanism is the governor arrangement worked from the winding engines, and this governor determines the speed at which the cage will be allowed to pass a given point. If the speed is exceeded, a catch is automatically liberated, and falling weights apply the brakes and shut off the steam. The limit of speed is a determinable quantity, and the point of action can be fixed at will. The starting the wrong way arrangement is no essential part of the *Visor* patent, except in so far as when the cage gets too high it relieves the catch referred to regardless of speed.

THE OBJECTION TO SAFETY CAGES.

The writer hopes that in the paper with its appendix and the illustrations and model he has made himself clear. He has always appreciated the fact that so-called improvements which complicate winding-engines, or interfere with the engineman's freedom of action are neither to be desired nor recommended, and the same remark applied to appliances which may act when they should not, and provoke dangers they are intended to prevent. Safety cages were well enough when winding was slow and conductors were of wood, but are doubtful appliances for quick winding and wire conductors; there is a constant risk of safety cages which are affected by "slack" coming into action when they should not, and actually in this way causing the accident they are intended to prevent; and the dangers which they could deal with are fully preventable by good ropes. Suppose a rope does break, and a safety cage does act, the rope itself, perhaps, two or three tons in weight and several hundred yards in length, will fall upon the suspended cage, and destruction will mark its track.

ABSOLUTE SAFETY WITH THE "V.. OR" AND THE DETACHING-HOOK.

But efficient detaching-hooks and the *Visor* have the writer's strong approval, because they do not harass and do not complicate; they do not act when not wanted. There are two directions in which the very excellent colliery winding appliances of the United Kingdom, in which the county of Lancashire is well to the front, a forward movement may be made—one in the direction of economy.

ECONOMY AND SAFETY IN COLLIERY WINDING.

The combined horse-power of the winding engines of the collieries of the United Kingdom is probably not much less than 1,000,000, and the coal they use is probably not less in value, even inferior qualities at moderate price, than £1,000,000 each year, which could be substantially reduced by economical appliances. There would naturally follow a further saving in diminished number and wear of boilers, and diminished labor, and something like £250,000 a year of economy in winding operations is not an item to be despised under any circumstances, and is worth special and sympathetic attention when the tendency of the age is that we shall have to look for a profit more and more in the direction of economy. That may form a substantial subject for a future paper. The second direction is that of safety, dealt with in this paper; and at a small cost for detaching-hooks and the *Visor*, practically absolute immunity would be ensured from accidents in winding. Lancashire mining has led the way in many improvements; it can do much to give a further impetus to economy and safety principles, always dear to all our hearts. The diminishing proportion of colliery accidents over half a century is a noble chapter in our English records. What has been accomplished should be an incentive and an inspiration to continual effort. All accidents preventable in reason should be made impossible.

COMPANIES.

Lightning Creek Gold Gravels and Drainage Co., Ltd., has been incorporated with an authorized capital of $1,000,000, to acquire the placer mining claims held under leases, or for which leases have been applied for, on Lightning creek, in the district of Cariboo, in the Province of British Columbia, by the following:—James Peebles, Robert McLeese, John A. Fraser, James Reid, William Adams, Stephen Tingley, J. J. McKay, John Boyd, Oliver Harvey and F. S. Reynolds, either for money or fully paid up shares of the company. Directors: R. G. Tatlow, W. D. Burdis and Thomas Dunn. Head office: Vancouver, B.C.

Main Quesnelle Gold Dredging and Mining Co., Ltd., has been registered at Victoria, B.C., under the Foreign Companies Act, and an authorized capital of $250,000, to carry on mining in British Columbia.

Modstock Mining Co., Ltd.—This company is seeking incorporation with an authorised capital of $300,000 to carry on gold mining in Nova Scotia. Directors: J. D. Copeland, R. Dickson and C. N. Wilkie. Head Office, Antigonish N. S.

General Mining Association—The half-yearly general meeting of the General Mining Association was held at the offices, New Broad street, last month, Mr. James Duke Hill presiding. In moving the adoption of the report and accounts, the chairman observed that the total shipments and sales of coal were less than in 1894. However, it should be remembered that the latter year was a record one; also that the markets in places were suffering from the depressed trade, and in Newfoundland the financial shock of 1894 was still making itself felt. Prices in some instances had been less than in 1894, and, with a smaller total shipped, had told against the year's results.

Many factors of not much importance in themselves, but considerable in the aggregate, had also adversely affected the profit and loss account. It was proposed to pay a dividend of 12s. per share, or nearly 11 per cent., which he thought would be considered satisfactory. The question of interim dividends was one which the board had been considering for the last two years, but the matter was attended with more difficulty than appeared on the surface, for in the month of October—when the dividend would have to be paid—it was often impossible to forecast the financial results of the year, and unknown contingencies might probably affect the calculation. Referring to the Newfoundland disasters of 1894, the chairman remarked that the company had already received some substantial amounts from the estates in which they were interested, and, though liquidation might be prolonged, he felt more or less confident that the amount written off in 1894 to provide for the company's loss would prove ample, and, indeed, if all went well, that they might eventually receive something to the good. So far as could be seen at present, the prospects for the current year were quite satisfactory. The motion was seconded by Lieut.-Col. W. C. Western, and was unanimously adopted.

Dominion Gold Mining and Reduction Co.—A recent meeting of this company was held in London, Eng., at which special resolutions were passed converting the priority shares into ordinary shares, and increasing the capital from £170,000 to £200,000, divided into 200,000 ordinary shares of £1 each. The object of increasing the capital is to provide funds to acquire other properties and to carry on extended operations.

Big Valley Creek Gold Mines, Ltd.—The prospectus has been issued during the last few days of the Big Valley Creek Gold Mines, Ltd. The company was formed with a capital of £125,000 in shares of £1, to acquire and work four gold mining leases for a total area of 640 acres, in the district of Cariboo, British Columbia. The purchase consideration was fixed at £100,000, payable as to £6,000 in cash and the balance in shares.

MICA MINING NOTES.

The exports of Canadian mica from the port of Ottawa, as reported by the Collector of Customs, from 1st Jan. to date (26th May) amounted to 157,812 lbs., of a value of $19,818.

That the value of our exports as declared in our government blue books is much underestimated, has long been recognized by those in the business. An instance of this came to our notice the other day in the seizure at Boston of a consignment containing 20,832 lbs., the value declared for duty being only $200 per ton. As a matter of fact the car was found to contain on examination by an expert the following lots: 15,485 lbs. of a size 2 x 3 in.; 3,000 lbs. of 3 x 5 in.; 7,811 lbs. 4 x 6 in.; 3,196 lbs. 4 x 10 in., and 1,340 lbs. of extra large mica, the total value at the standard prices agreed upon by our producers for the sale of these sizes bringing the value of the shipment to $12,668.50, a difference of $10,585.30 in favor of Canada. We mention this instance to show that the volume of our mica trade is very much larger than we would gather from the meagre and incomplete official statistics compiled from customs entries.

At Templeton, Mr. F. R. White, of Boston, has had a force at work cleaning up the pits on the old Jackson Rae mine. There are some excellent shows on this property, and the lessee will commence mining immediately.

The Blackburn mine has been worked during the winter, and a steady output realized. We are informed that drifting from the main shaft is being successfully carried on. Mr. Baker, who had an ugly fall in the pit and a miraculous escape from serious injury, if not death, is, we are glad to say, around again. A force of thirty men are employed here, and an excellent output of good quality is maintained.

The Phosphate King mine, operated by Mr. T. J. Watters, which has been closed since January, is, we understand, to be opened again and worked on a large scale next month.

The McLaurin mine at East Templeton has resumed working.

At the Wallingford mine, which continues to maintain its reputation as our principal producer, work has been steady during the winter. Considerable prospecting has been done on the property, revealing reserves of value. The property is in excellent shape for working a large force.

The mining of mica in the Western country is a new business and but few really understand its management, and also are of the opinion that it requires expensive machinery and other appliances to handle it.

At Bakersville, in Western Carolina, forty miles from any railroad, is the centre of an important mining interest. The mica business is so commonplace and affords such small show of machinery that it is not unusual for one to be skeptical when told of its actual magnitude. It looks insignificant, and yet it is one of the greatest industries in the state, and has yielded fortunes to those engaged in running it. It requires no capital to set going; all that is needed is to own or get control of a deposit. It can be mined cheaply, as the labor of that region is low in prices. The dealers who handle mica occupy little shacks, which are amply furnished with a crude work bench and a pair of shear. This is all that is needed; a million dollars would not secure a better outfit for the work. The wild and apparently worthless mountain region, of which Bakersville is the metropolis, is the main source of supply for the United States. The town looks as if it might have been built of mica, or else stands on the site of a ruined city that was erected of it. It can be seen scattered in more or less quantities all about the city and suburbs. The river is full of the shining particles, and the streets and alleys are strewn with heaps of the refuse. Its formation is like that of stone, and can be seen cropping out in cliffs.

In the granite, however, it seems to have taken great pride in making its fancied eternal home, but it has been disturbed by the volcanic eruptions of the earth in ages past, and now it is being surprised by the agencies of man. It can be found in all sorts of blocks of various thickness and shapes, and can be split and resplit almost ad infinitum, or until it becomes the thin, transparent, flexible wafer of commerce. It is imbedded in or scattered through the feldspar in blocks large or small, close together and far apart, and is blasted from the rocks with dynamite. The purer veins are found between walls of slate. It is taken from the mines to a little shop by means of various conveyances, from the shoulder of a native to the cart drawn by a bridle and harness steer. Here it is split into thin sheets, trimmed into regular shapes and is prepared for the market. The price varies with the size and color of the sheets. The Barkersville product is known to trade as rum mica. A two-by-four sheet, good, clear quality, is worth about 50 cents a pound, while ten-by-twelve will bring $4 to $6. Sheets of these dimensions are extra size, as the average is only about four-by-six. Rare sheets twenty-four by eighteen inches have been found. Occasionally a mine is found where the mica is too much scattered in the bedrock to make its operation profitable, hence there is a possibility of a man sinking a little money without the expected tenfold; but generally the expert mountaineer can tell in a few shots whether there is any use of fooling with a bed or not. It is not an uncommon thing for a couple of natives to leave in the morning with a box of dynamite and return at night with $50 worth of mica. Blocks worth $200 have been found after a shot.

The Dominion Mica Co., a new organization, has taken over, on lease, the properties of the Lake Girard System (T. J. Watters). The manager of the new concern is, we believe, Mr. F. W. Webster, formerly identified with the American Mica Co. Mr. F. J. White, of Boston, is understood to be the principal in the new concern.

A new and important use for the lower grades of mica is in the manufacture of coverings for boilers and steam pipes, and within the past couple of months large quantities of Canadian mica have been used for this purpose by the Mica Boiler Covering Company of Toronto. In the United States patent office there are over one hundred patents in which mica is mentioned as a non-conductor, but it is always included amongst other ingredients, ground and mixed together. In this instance, the inventor, after long series of trials and experiments, had discovered that the real virtue of the discovery lay in the mica itself, and not in any admixture of cements, etc. It was found that when the mica crystals were split and divided down until the films were as light as tissue paper, and then sewn or quilted together, that a fireproof, porous mat was produced which could not be equalled. It formed a cushion of innumerable fireproof leaves, each in itself an almost perfect insulator, and, when quilted together, an endless succession of barriers to the heat waves radiating from the boiler, cylinder, or pipe. It was found that no amount of vibration or sudden expansion affected it; that it was wonderfully elastic, and expanded and contracted as easily as rubber. Unlike the old-fashioned cements, wools, and cottons, used as boiler coverings, the mica mats were uninjured by water; a mat could be soaked through and through until sodden with water, but as it dried it rose crisp and elastic and good as ever. The great secret is that it is a natural product worked up for practical use without the addition of other ingredients, which are quickly washed out and disintegrated by damp, or shaken asunder by ordinary vibration.

The Lake Girard mine, in the Township of Wakefield, one of the principal producers of the Lake Girard system, has been re-opened by the Dominion Mica Company. A strong force has been put to work for active development during the summer.

Mr. R. L. Blackburn has acquired the mining rights over a property in the township of Hull, adjoining the Vavasour mine. A large deposit of fine mica has been uncovered here and a working force has been put to work for its exploitation.

During the past month there has been a marked improvement in the demand for Canadian mica, and all the mines are busier than they have been for some time.

Mining Camp Civilization.

The glamour and the romance and the deviltry of the Western mining camp are fast fading into history. The rip-roaring scenes that inspired Bret Harte's ballads will soon, like the Argonauts, be but memories of a golden dream, when all men were rich, when fortunes were made and lost and regained in a day, when life was cheap and mining communities were ruled by savage chivalry, vigilantes and "red-eye." The tenderfoot who, from histories of the early days in the West, has gained the impression that a mining camp is made up chiefly of dance-halls, sombreros and six-shooters, and that life is one lurid round of killings, hangings, dissipation and disorder, is now astounded, upon coming to the mines, to find himself in a quiet, well-behaved and peaceable community, as well supplied with churches and schools and all the outward signs of Christian civilization as any New England village. While Satan has not been entirely banished from the mining camp, he is kept quite as closely in restraint as in the average agricultural community. Saloons still flourish and the tiger is sometimes exposed to public view, and gilded palaces of sin are tolerated, as elsewhere. But the bad man from Bitter Creek no longer kills a man each morning for breakfast; no longer is the stranger's silk hat made the target of every six-shooter in camp, nor the tenderfoot compelled to dance the double-shuffle while the bar-room floor about his feet is being plugged full of bullet-holes. The "bad man" of the early days long ago passed in his checks, and the drunken tough who now goes forth to terrorize a mining camp is promptly thrown into the "bug-house," like any other unruly tramp.

An old forty-niner returned from Mercur the other day, downcast and dejected. "It may be a good camp," he explained, as he squirted tobacco-juice at a far-away cuspidor, "but its gol durned quiet and peaceable. None of the mining camps ain't so lively as they was when I was mining." And this old man actually sighed regretfully over the changes that have been wrought by these God-fearing days.

The old boys will never again witness the high-pressure excitement of the days that are gone. Although there is occasionally some new camp in which the old spirit of reckless abandon holds sway for a brief period, it is quickly suppressed by the encroachments of civilization. Mining camps are no longer made up of bands of reckless, roving adventurers, in quest of sudden riches and ready for deeds of darkness and daring. In the older camps the bulk of the population is composed of wage-earning miners, many of them men of families, who are as frugal and industrious as any other class of workingmen. Prospectors lay the foundations of the newer camps, and the prospector of to-day is a man of intelligence and good sense, with little money to spend on dissipation and riotous living. When his labors are finally rewarded by a rich discovery, and he desires to spend his money on a "good time," he usually seeks one of the larger cities.

And thus the romance and barbarism of Western mining camps have given way to a spirit of cold-blooded business and Sabbath observing respectability.

The Compressed-Air Apparatus at the Reschitza Coal Mine, Hungary.

The compressed-air apparatus installed a few years ago at the "Szecheny" shaft of the Reschitza pit has been very successfully used in working a couple of inclined headings and for separate ventilation on the von Steindl system. This is particularly the case in driving the hauling winch in both headings.

For producing the compressed air a horizontal twin steam engine, situated in the engine-house and having one steam and one air cylinder, with a flywheel fixed between them, is employed. The engine is fitted with circular valve motion, and the air cylinder is provided with a water-jacket for cooling and a return-stroke plate, no suction-valves being required by this arrangement.

In diameter the steam cylinder measures 0·45 m. and the air cylinder 0·40 m.; the common stroke is 0·45 m. and the number of revolutions per minute 120. A pressure of 5 atmospheres is obtainable, and as soon as this height is reached the compressor is set in work until the pressure has receded to 3 atmospheres, whereupon it is disconnected from the machinery. Near the compressor, but outside the building, is the air reservoir, capable of containing 6·8 cubic metres.

Hitherto the greatest length of the compressed air pipes is 1,050 m., of which 320 m. traverse the shaft and 730 m. pass through the hauling roadways. Drawn iron pipes of 70, 80 and 100 mm. internal diameter are used, and are fastened to the scaffolding in the shaft and by wire to the "first" in the roadways. Where considerable variations of temperature are experienced, copper compensating tubing is inserted in the system.

The hauling winch No. 1 is constructed in accordance with Hanarte and Balant's patent, and is driven by a compound motor with intermediate tooth gearing; the winding drums (0·20 m. wide and 0·70 m. long), are arranged for round rope, and fitted with a band brake. The diameter of the large cylinder is 0·360 m., and that of the smaller 0.180 m., the throw being 0·250 m.; the receiver is 0·290 m. diameter and 0·750 in length, and the ratio of the intermediate gearing is 1 : 5. The winch occupies a space of 2·80 m. long, 1·80 m. wide, and 1 m. high. Crucible cast steel cable is used, 10 mm. in thickness, and the maximum load drawn is about 12 cwt., the rate being 1·25 m. per second. The air regulator of the winch is of 2·01 cubic metres capacity. In the whole length of pipe (1,050 m.) the loss of pressure amounts to 0·25 kilogs.

No. 2 is of the Bano and Szuts pattern, and only came into work last year. It is driven by a horizontal twin engine with bayonet guides, and has, with a cylinder diameter of 0·20 m., a stroke of 0·260 m.; the valve motion is plain. Like the winch No. 1, the winding drum, which in this instance is 0·800 m. by 0·42 m., is made to take round cable, is fitted with a band brake, and driven by tooth gearing with a ratio of 1 : 4·5. The gross load amounts to 12 cwt., and the speed per second 1·2 m.

This installation has behaved in a very satisfactory manner during the sinking of subsidiary shafts and the inclined headings, and so far no inconveniences nor objections to its use have become manifest.

How to Thaw Dynamite.—One of the main sources of accident is from thawing powder, and the only safe plan is the use of heat from hot water. The powder should not be dipped in the hot water, but placed in a water-tight vessel and the vessel set in hot water, or a reg.' powder warmer should be made. These vessels can be obtained from any of the mechanical firms or from the powder companies, at nominal cost. Do not place powder under or on a stove, or in the oven. Do not lay on boiler wall or on back plate of a boiler. Do not heat around a blacksmith forge, or over a burning candle. Do not lay on hot sand, or, in short, do not thaw powder with dry heat. Do not consider these precautions unnecessary, or reason that because you have done so many times there is no danger.

Powder freezes at from 40° to 44° F., explodes, when confined, at from 320° to to 360° F. From a quick application of dry heat, powder is liable to explode at 120° F. A stick of powder heated to 120° F. can be held in the hand with little inconvenience, and this degree of heat is soon reached when placed under or about a stove.

That frozen dynamite is liable to explode from heat quickly applied has been demonstrated many times, and to ignorance, non-appreciation or carelessness of this fact, most accidents are due. If you have heated powder about a stove for years without harm, consider yourself fortunate and stop it. If the warning of those who make the powder has no effect, let the accidents constantly occurring from this cause convince you. If you cannot procure a powder-warmer, take a 5-lb. lard bucket, fill it with powder, and set in warm water. If you have no warm water, put some sharp rocks in the bottom of a larger vessel to keep smaller vessel off the bottom, surround the inner vessel with water and set two lighted "snuffs" about an inch long under the big can, throw an ore sack over the whole, and in a short time the powder is in good condition for use and no risk has been incurred. With slow heat thus applied, dynamite may be heated to temperature of boiling water with safety. Do not use frozen powder to load a hole. It is unfit for use. If it explodes at all it will do poor work. If it does not seemingly burn or explode, it may be smouldering or decomposing, and the dropping in of a spoon, a drill or the stroke of a pick or hammer may be sufficient to explode what is left.

Electrical Underground Haulage.—At the annual general meeting of the northern section of the Societe de l'Industrie Minerale, held at Douai, M. Baily gave an account of the progress achieved in underground haulage by electricity at the Marles Colliery, in No. 4 pit of which the first experiment in underground haulage by electric locomotives was made in 1890. At first nothing but difficulty was encountered; but in 1891 everything worked satisfactorily, and after three years' practical experience it was decided to apply the system on a much larger scale to No. 5 pit. A 500-horse compound steam engine will drive four 80,000-watt dynamos, making 350 revolutions per minute, for actuating 11 locomotives in Nos. 3 and 5 pits. In the roads are laid rolled joists weighing 8.75 kilos. per metre; and each locomotive, weighing 3.2 tons, is actuated by a Gramme-wound dynamo making 10,000 revolutions per minute, receiving the electric current at 500 volts, and giving out a useful work of 15 horses. Each locomotive draws a set of 30 tubs, each holding half a ton of coal, and moving at a mean speed of 14 kiloms. (8½ miles) per hour.

Delicate Mechanical Feat.—An expert tool juggler in one of the great English needle factories, in a recent test of skill, performed one of the most delicate feats imaginable. He took a common sewing needle of medium size, length one and five-eighth inches, and drilled a hole through its entire length from eye to point, the opening being just large enough to permit the passage of a very fine hair.