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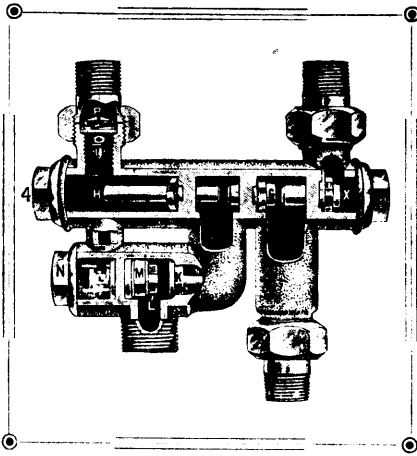
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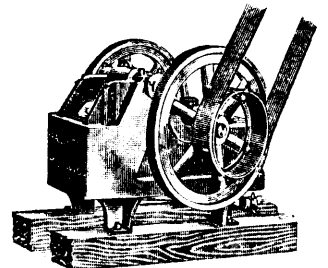
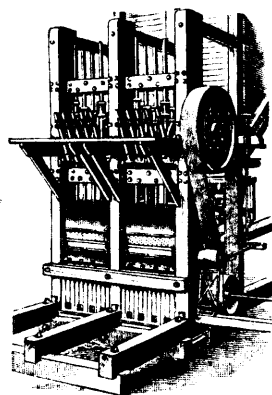
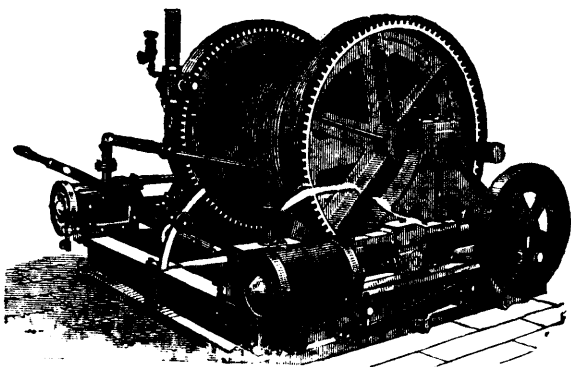
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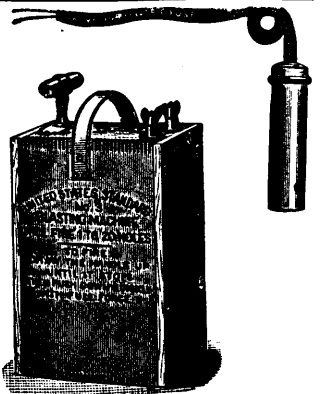
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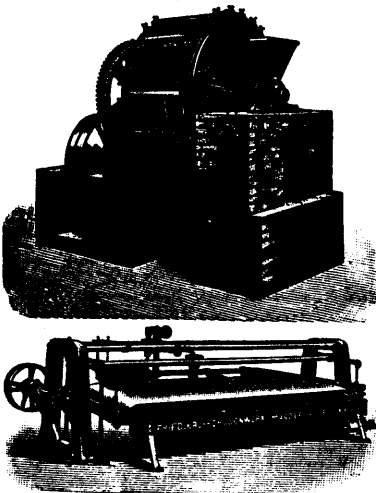
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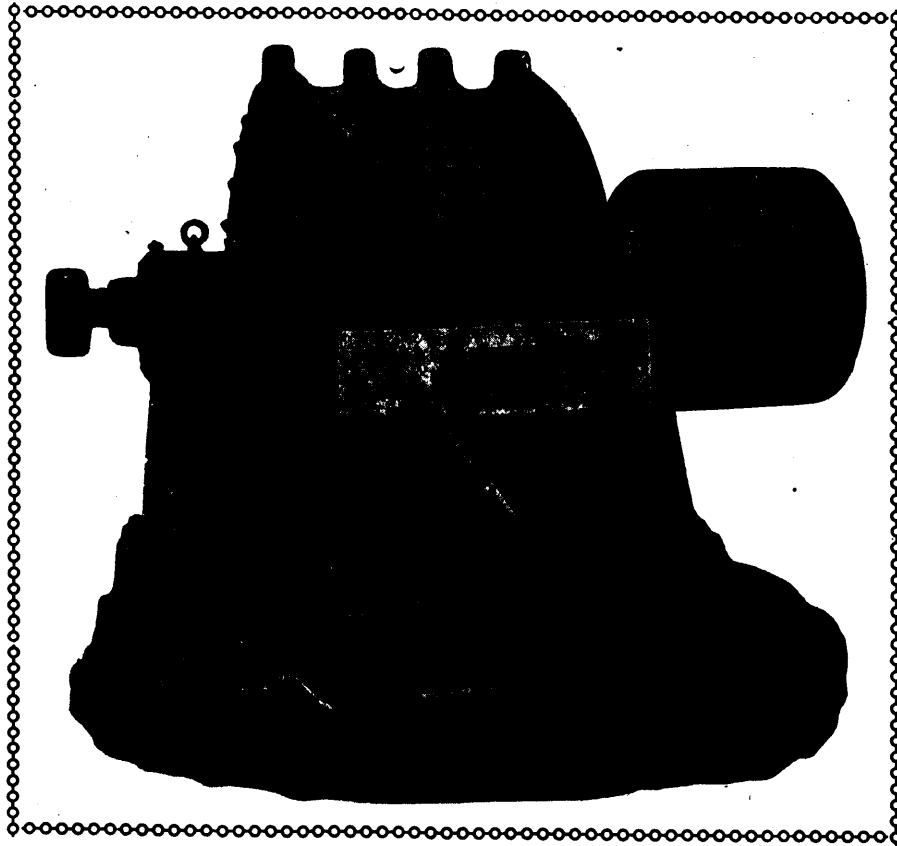
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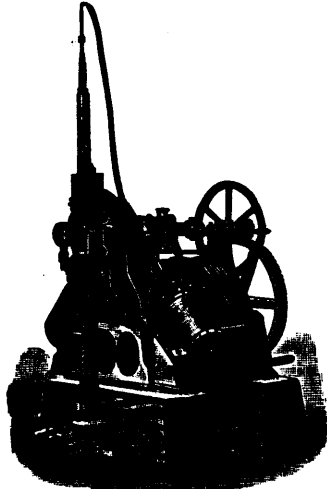


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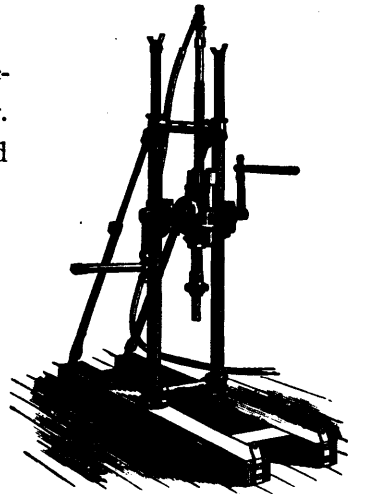
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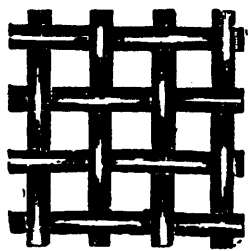
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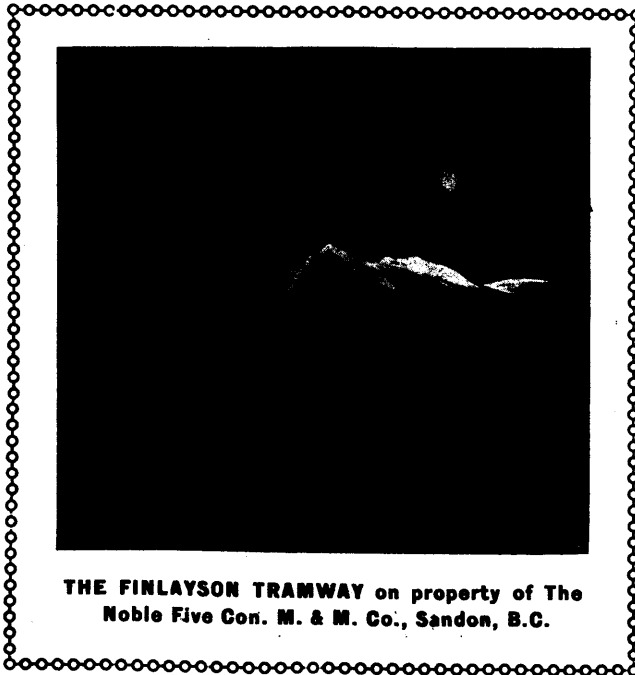
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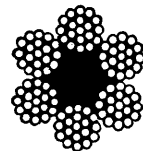
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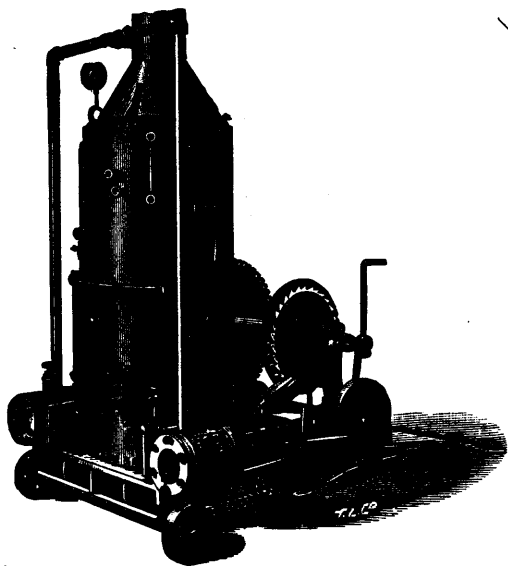
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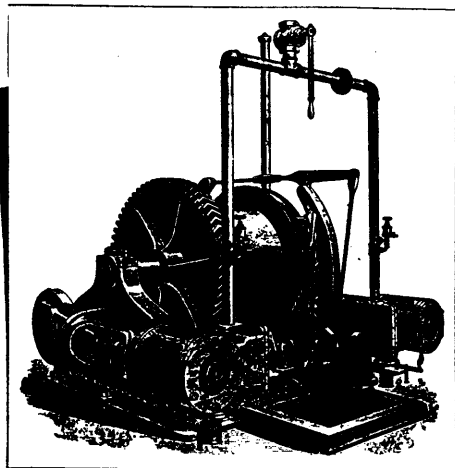
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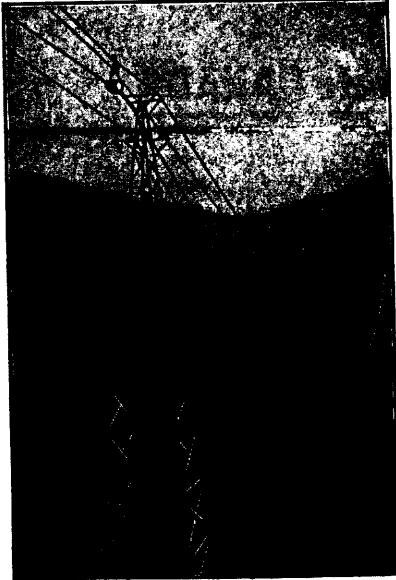
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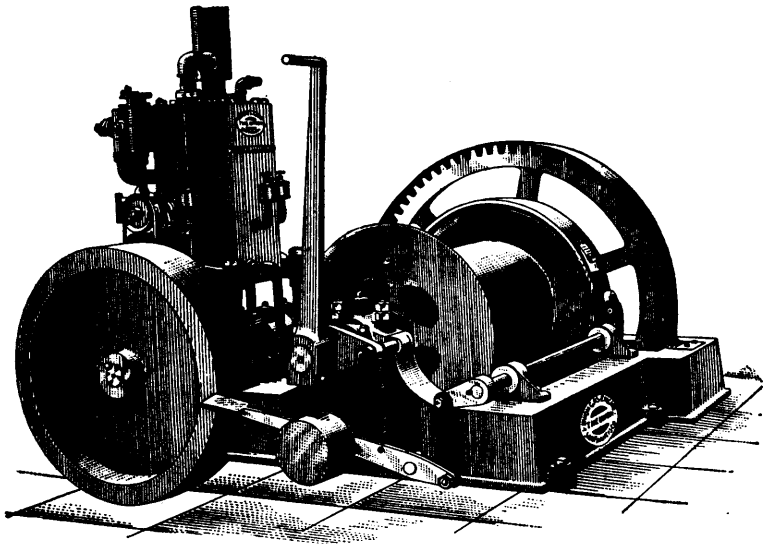
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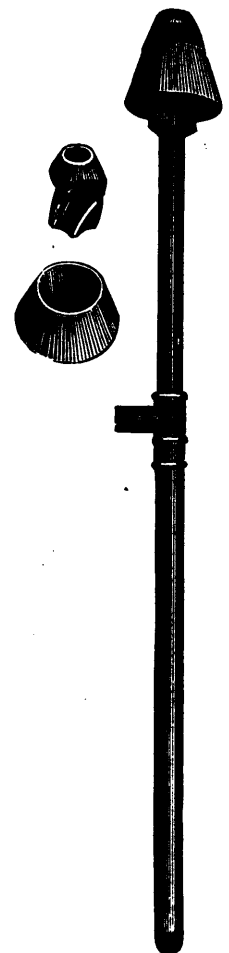
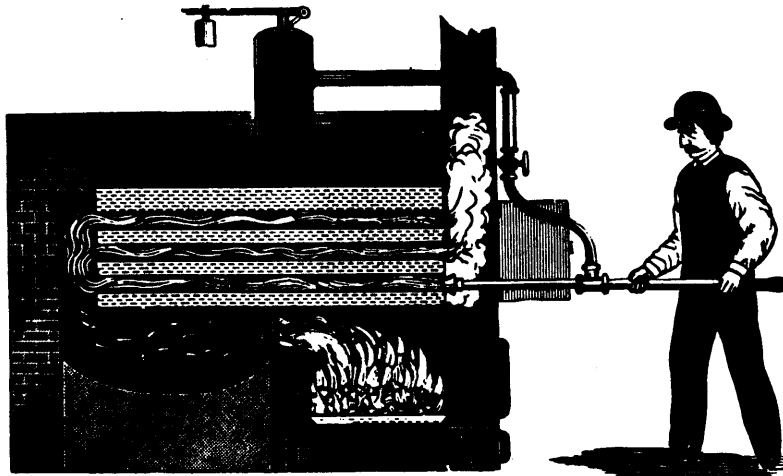
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All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire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

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

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

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

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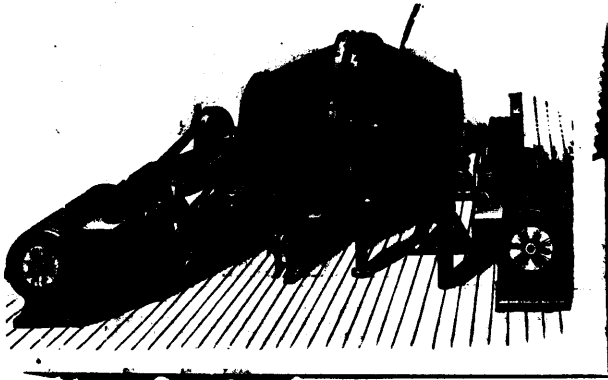
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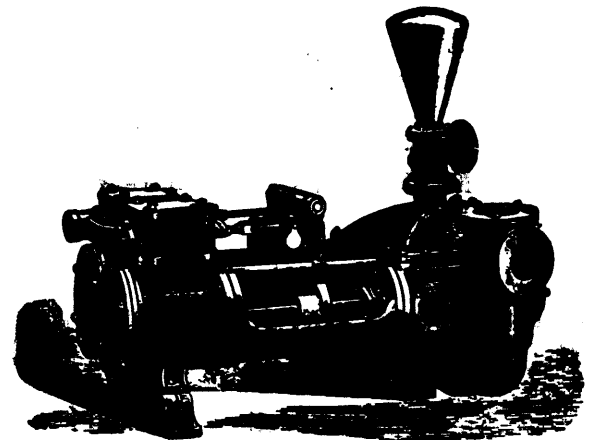


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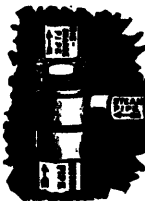
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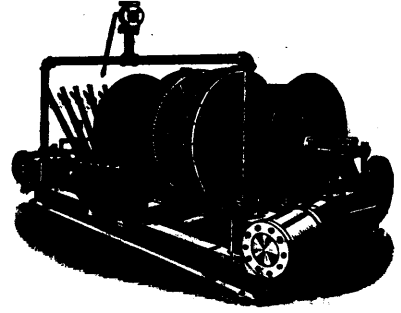
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VOL. XVI, No. 9.

SEPTEMBER, 1897.

VOL. XVI, No. 9.

The Proposed Export Duty on Canadian Ores.

The proposal that the Dominion Government shall levy an export duty upon ores, has been revived with additional emphasis since the adoption of the new U. S. tariff, under which the new U. S. import duty has been raised from $\frac{3}{4}$ c. to $1\frac{1}{2}$ c. per lb. on lead in ores, and from 1c. to $2\frac{1}{8}$ c. per lb. on lead in bullion. So far as this metal is concerned, the increased duty on ores should be an argument against, rather than for, a duty on the Canadian side, since it certainly tends to discourage the importation of lead ores into the United States. In our judgment, it is distinctly injurious to both countries, and to the mining industry in both. The notion that a Canadian export duty (increasing the injury to all parties), would be a neat piece of retaliation, need not occupy us. Retaliation is not the best object of statesmanship. The controlling argument in favor of such a measure should be, not that it will damage our neighbors, but that it will benefit ourselves. We propose, therefore, to offer some suggestions as to the proposed export duty on Canadian ores from the standpoint of the interests of Canada.

The present magnitude of these exports is not yet such as to promise a large revenue from the duty. The principal ores to be affected by it are the following:

1. Copper-nickel matte from the Sudbury region. The value of the nickel in this matte, exported to the U. S. for further reduction, was estimated for 1896 at \$1,155,000—the figures having been \$2,755,976 for 1891 and \$2,071,151 for 1893.

2. Copper pyrites, mined in the eastern townships of the Province of Quebec, and exported to the extent of something more than \$100,000 worth per annum.

3. Silver-lead ore from the Slocan and other districts of British Columbia. The output of 1895 contained lead to the value of \$532,255, and 1,496,522 oz. of silver, valued at \$977,229. In 1896, it contained \$721,384 in lead and 3,135,343 oz. of silver, valued at \$2,100,689. Nearly all, though not quite all, of this product was smelted in the United States.

4. Auriferous pyrrhotite, mined in the Rossland region, B.C. The value of this product was \$629,940 in 1895, and increased in 1896 to \$1,104,500. It has been principally treated at Trail, in works built by an American company; but it is stated that the owners of the principal producing mine, the Le Roi, intend, on the termination of their contract with the works mentioned, to treat their own ore in works erected by themselves, and that these will be situated in the State of Washington. One object of the proposed export duty would be to prevent this disposition of Rossland ores. We therefore include

them among the exports to be affected, though they have not been, thus far, actually exported.

The total exportation is thus about \$5,000,000, and, if the proposed duty should be effective, would fall somewhere between that value and zero. If it should not be effective in restraining exportations, it would be merely a useless burden on the miner, and would defeat every possible purpose of its creation. In any event, therefore, we may omit as trivial all considerations of revenue, and consider the duty as a measure of protection, pure and simple.

As a life-long protectionist, we are ready to admit that a policy which has been, in our judgment, advantageous to the United States, might well prove a blessing to Canada likewise. But the advantage has come, and must come, in either case, not from a cast-iron formula of protection, and not from the indiscriminate application of the greatest possible number and the highest possible rates of duties, but from the intelligent adjustment of protective measures to the conditions of industry and the interests of the whole country. Indeed, the ideal protective tariff includes both low duties and a free list, as well as high duties.

In considering this question, therefore, we need not be embarrassed by academic considerations as to protection or free trade. We have only to inquire what would be the effect of the proposed measure on the industries and prosperity of the country. If any sweeping proposition could be fairly laid down in this discussion, it might be said with considerable confidence that export duties are always mistakes. We think a strong argument could be made in support of that contention. But we prefer to avoid general dogmatic statements, and to confine ourselves to the grounds upon which we base our opinion that *these* duties, at *this* time, would be detrimental to Canada.

The question narrows itself to this form: Which would be of greater benefit *now* to Canada, more mining, or less mining and some smelting?

The advantage of diversified industries is a familiar argument to the protectionist; but its force is smallest when the additional industries promoted by protection are indissolubly connected with those already existing unprotected. It is indeed well for a nation not to "have all its eggs in one basket"—so that if one industry languishes, another may restore the balance of prosperity. But the mining and the smelting of ores are not two baskets, but two eggs in one basket. If mining falls off, smelting declines proportionately. If mining ceases, smelting dies—and there is nothing quite so dead as the corpse, the tombstone of which is an abandoned smelting plant.

There are hundreds of such tombstones in the United States. They mark the graves of "local" smelting enterprises, undertaken in

the fallacious hope of stimulating and assisting the mining industry by planting the smelting industry close by it. Experience has shown—that for successful smelting much more is required than the neighborhood of a mine, and the concentration of smelting works at a few points, where suitable fuel, market connections, and variety of ore supply can be combined, is a proof that this lesson has been learned.

It cannot be disguised that if an export duty is now needed to prevent Canadian miners from exporting their ores to the United States, and induce capitalists to build furnaces in Canadian mining districts, such a duty would directly diminish the net value of the ores to the miners. The extent of this diminution might not equal the amount of the duty, but we think it would do so. If domestic smelting works cannot now compete with those of the United States under the protection of the American duty, the addition of a further duty by Canada would be absorbed in the costs of a local reduction and an inconvenient and difficult marketing of product.

In the case of lead, for instance, the problem of disposing of base bullion (the U. S. market being made unfavorable by the U. S. bullion duty), would be a serious one—so serious that in the argument advanced by a British Columbian advocate of the proposed export duty on ores, it is assumed that refining, as well as smelting, would have to be established on Canadian soil. But this only makes matters worse. The expenditure of large capital, in order to bring it to pass that a concern in the wilderness, thousands of miles from market, shall have refined lead and refined silver to sell, is a piece of folly which has been seen in the United States, but which nobody here cares to repeat. If silver is to be shipped a long distance, it had better be shipped in ores or in base bullion than in more costly form. It cannot be so safely packed as in lead. And if lead is to be sold, it had better be produced where it is within reach of the market.

In short, the mining industry of the Dominion cannot yet bear the burden of creating prematurely and by main force all the other industries which may become desirable hereafter. Additional duties laid upon it will only weaken it, without producing the benefit intended. Neither the copper mines nor the nickel mines can stand the proposed exaction. As for the silver lead and gold mines, we think some of them could stand it without dying; but they would thrive better without it, and in many cases the difference would be fatal. Let the mining industry have a free chance to develop and strengthen itself; to gather a population of consumers around it; to give natural birth to associated and auxiliary industries. Then the situation may be different. Today, it seems to us, the proposal of an export duty is distinctly unwise because premature—to say nothing of all other reasons for opposing it.

A Significant Movement.

It is now stated on direct authority, that the Canadian Pacific Railway Company means, at the earliest possible moment, to establish by rail and steamship communication an all Canadian route to the Yukon gold fields, via Vancouver. The Company's intention is to inaugurate a first-class coasting steamship service, running in connection with its world famous trans-continental route, and making from Vancouver for Glenora, on the Stickeen River, whence a railroad, probably of narrow gauge, will be constructed and operated to a convenient point on Teslin Lake, thence another C.P.R. steamship service will convey passengers and freight down the lake and the Yukon River to a point of debarkation, convenient for the Klondyke gold fields. By these means travel to the Yukon, even if and when projected from far points in Eastern Canada, the New England States or the United Kingdom itself, will be rendered comparatively easy, and

certainly much cheaper and more convenient than now, the complete connections of Canada's great railway in every possible manner facilitating freight and passenger transport. The proposed route will, moreover, prove both safe and speedy, and avoid the many discomforts, annoyances and dangers at present involved in entering the Yukon through American territory, which is so laxly governed that a lynch law system alone prevents the commission of the worst of crimes, whilst vexatious customs regulations and the constant presence of a horde of the most dangerous rascaldom of the Pacific States' cities, make a really formidable undertaking of a journey to the Klondyke by any of the partly American routes now usually chosen. Preparations for the necessary survey of the Glenora-Teslin railroad are already being made by the leading officials of the western division of the C.P.R., under directions from headquarters, and with the cordial co-operation of the Provincial Government of British Columbia; hence there is every reason to expect that at the earliest possible date, probably in less than a year, the whole of the Company's scheme will be successfully accomplished, as the route of the proposed railroad is comparatively easy, and the establishment of the necessary river and lake steamship connections will present but little difficulty to such a company as the C.P.R. When all this shall have done, the great railroad's all-Canadian route will assuredly become the favorite means of reaching the Klondyke and other points of the Yukon during the usual months of travel, when lake and river navigation is feasible in the far north. The conjoint services of the C.P.R. will consequently then attract almost every Canadian and British prospector and trader making for the Yukon, and in addition secure the patronage—for business is heedless of sentiment—of an even larger number of travellers from the States. The new railroad-steamship connection will also, in particular, strengthen greatly the position of Vancouver as a mining entrepot, and in all probability secure for the terminal city the best of the outfitting and general supply trade of the Yukon. The proposal is therefore most popular in Vancouver itself, where there has hitherto been, from various causes, much friction between the general community and the C.P.R., whilst the effect on the Dominion at large in securing for Canada all possible advantage of a big volume of travel to the far north gold fields, can scarcely be overestimated.

EN PASSANT.

A meeting of the members of the Mining Society of Nova Scotia was held at Halifax on 28th instant, when the following papers were read: "Some boiler tests at Drummond Colliery," by Mr. Chas. Fergie, M.E.; "Patent Fuel," by Mr. Chas. Archibald, Halifax; "Mine Plans," by Mr. A. Dick, C. and M.E., Halifax. A verbatim report of the proceedings will, as customary, appear in our next number.

Our next illustrated supplement will show a number of views of the works and equipment of the Lanark mine of the Lillooet, Fraser River and Cariboo Gold Fields, Ltd., at Laurie, B.C., together with photos of the new Cheticamp alluvial diggings in Nova Scotia, and the extensive copper pyrites mines at Tilt Cove, Newfoundland. These views have been taken specially for the REVIEW by its representatives in these districts.

Hereafter the extensive mining machinery establishments at St. Henri and Montreal, operated for many years by the Ingersoll Rock Drill Company of Canada, will be operated by the James Cooper Manufacturing Company, Ltd. As indicating the expansion of the mining industries of Canada, it is worthy of note that these large shops

are being worked to their full capacity on a heavy list of orders for mining plants. Mr. James Cooper, President, and Mr. S. J. Simpson, Secretary-Treasurer, of the old Company, continue in these capacities with the new concern, which is practically a reconstruction on a larger scale of the Ingersoll Company. A fine line of air compressors, rock drills, hoisting engines and coal cutting machinery is being turned out.

The seventh edition of our *Canadian Mining, Iron and Steel Manual* has been completely sold out. A larger edition of this popular and serviceable record of Canadian Mining undertakings is in hand, and will be issued early next year.

An occasional correspondent from the Wahnapietoe district informs us that the mill recently erected for the Crystal Mining Company, Ltd., is working most satisfactorily, and it is understood that from the 1st September Mr. Daniel Morrison, formerly of Nova Scotia, will have full charge of both mine and mill. It is expected that under his management the work will be pushed more vigorously than in the past, and that shareholders may look for speedy and satisfactory returns from the mine. Recent crushings from this property have shown values ranging from \$12 to \$18 per ton obtained from the mill, at which figure the Company can earn satisfactory dividends.

Location W. R. 35 has recently been acquired from Mr. Chapin. A road leading from the property to Markstay Station, on the C.P.R., has been completed, and permanent winter quarters established at the mine, which will be developed through two shafts this winter.

It is reported that Mr. C. S. Hubbell, of Spokane, for himself and other western people, has acquired controlling interests in Lot No. 50, joining the Comstock mine. Development of this lot is now in progress.

The boom which was strongly in evidence at Rat Portage in March, April and May, has suffered a decline, like its sister boom in Rosland. Recent information from Rat Portage goes to show that locators, prospectors, and even speculators, are now holding properties in the Lake of the Woods and the Seine river districts, at much more reasonable prices than formerly. More genuine development work is now in progress than during the period of the boom.

Recent discoveries on the north shore of Lake Superior, on Dog Lake and Wawa Lake, indicate that the gold bearing horizon of the Huronian formation in Ontario is much more extensive than has been supposed. It will not do, however, as we have repeatedly pointed out in these columns, to take for granted the statements published in the daily press. Samples from Wawa Lake, to our personal knowledge, have gone as high as \$180 to the ton, but there are many other samples, however, which have gone nothing to the ton. It has been our conviction for some time that this section of the country is likely to produce many permanent gold bearing deposits of the free milling type.

One of the most interesting developments that has come to our notice this month is the reported discovery of a deposit of sand in Ontario, carrying considerable quantities of platinum, and unusually large quantities of osmium and iridium. We are not in a position to give details at present, but may say that samples submitted to a competent Montreal assayer have shown values as high as \$45 per pound. The quantity of this material is not as yet fully known.

In view of the extended area over which gold has been found in Ontario, of this remarkable platinum discovery, of the reported discovery of cinnabar in quantity in Alberta, and the other reported discovery of native quicksilver near Halifax, Canada, may reasonably expect such an interest to be shown in her mineral resources as she has never had before, and which should be sufficient to establish mining industry in the Dominion on a firmer foundation and larger scale than most Canadians have dreamed of.

In connection with the meetings of the British Association in Toronto, Professor Roberts-Austen delivered an exceedingly interesting and valuable address on the subject of "Canada's Metals." After dealing with the precious metals, the lecturer next dealt with the great part Canada might be expected to play, as regards the production of iron and steel, when means of transit were improved. He considered that the resources of the Dominion as regards iron and steel should be made available as quickly as possible for the service of the Empire. This portion of the subject concluded with a few words of warning. It had been pertinently said that the old miners opened holes on a hillside, while modern miners too often merely opened offices on leading thoroughfares. It was of great importance that the highest technical skill and professional knowledge should be brought to bear on the mining and metallurgical industries of Canada. The services of Canadians of much experience were fortunately available, and graduates of the Royal School of Mines of England and of the Canadian Schools of Mines might well be consulted before great projects were set on foot, and there need then be but little fear of the reckless speculation which too often wrecked new mining districts.

The production of pig-iron in the Dominion in 1896 was 60,030 gross tons, against 37,829 tons in 1895, and 44,791 tons in 1894. Of the total production of 1896, about one-tenth was charcoal pig-iron, and the remainder was coke pig-iron. The Bessemer pig-iron produced in Canada in 1896 amounted to 5,211 tons, the production being confined to one company. The unsold stock of pig-iron in Canada in the hands of manufacturers or agents on December 31st, 1896, amounted to 29,320 tons, compared with 17,800 tons on December 31, 1895. At the close of 1896 there were eight completed blast-furnaces in Canada. Of this number two were in blast and six out of blast on the date named. At the close of 1895 there were eight completed furnaces, of which four were in blast and four were out of blast. The production of basic and acid open-hearth steel ingots in 1896 was 16,000 gross tons, against 17,000 tons in 1895, all made by the acid process; open-hearth steel rails, 600 tons, against 600 tons in 1895; and of structural sections, 4,540 tons, against 4,560 tons in 1895. The total quantity of all kinds of iron and steel rolled into finished products in the Dominion in 1896, excluding muck and scrap bar, amounted to 75,043 tons, against 66,402 tons in 1895. The number of rolling mills and steel works in Canada on December 31, 1896, was 16, against 15 at the close of 1895. One new mill was built and put in operation in 1896, at Bridgeville, Nova Scotia. Of the completed plants, two rolling mills were idle during the whole of 1896.

The Journal of the Society of German Engineers contains a useful memoir on mining in the Upper Hartz, by Mr. von Groddeck. The veins, which have been worked since the earliest times, yield argenterous galena, zinc-blende and copper pyrites. Ample water power for working the mines is available, for art has come to the aid of nature by hydraulic undertakings of great magnitude. Conduits, aggregating 75 miles in length, convey the water into 70 reservoirs, with a capacity of 13,000,000 cubic yards. Secondary conduits of 50

miles in length convey the water to motors aggregating 3,500 horsepower, the supply being sufficient to last for 14 weeks of uninterrupted want of rain. The water is economized in such a way that it is led from the higher motors to lower ones, and finally to others deep down in the shafts. The various mechanical appliances used in the mines are passed in review by the author, special reference being made to the man engines and the hydraulic engines. The new Kaiser Wilhelm shaft has been sunk vertically to a depth of 2,840 feet. It has an internal diameter of 16 feet, and is the first, and, so far, the only winding shaft in the Hartz with a circular section and with iron tubing. The sinking was begun in 1880 and finished in 1882, the cost being £90,000. The remarkable feature of the shaft, says the *Mining Journal*, is the absence of machinery from the surface, all the motors being hydraulic engines, placed at a depth of 1,180 feet in the shaft, at the level of the great Ernst-August adit. The water required is brought down in pipes from the surface, and escapes through the adit.

For detecting deleterious reducing gases, such as carbonic oxide, methane, etc., in the air of mines, A. Mermet, who writes in the *Revue de Chimie Analytique*, finds a dilute solution of potassium permanganate, containing a little nitric acid, highly efficient, the effect of these gases being to decolorise the permanganate solution. The reaction goes on more rapidly when the solution also contains silver nitrate, one part of carbonic oxide per 500 to 5,050 parts of air decolorising the liquid in from one to twenty-four hours. The reagent is prepared as follows:—Silver nitrate solution: Two or three grammes of silver nitrate crystals dissolved in one litre of water. Potassium permanganate solution: One litre of distilled water boiled with a few drops of pure nitric acid (free from hydrochloric acid), a little permanganate solution being added until the liquid becomes rose-colored, in order to destroy any organic matter which may have found its way into the water, as dust, etc. When cold one gramme of potassium permanganate crystals is dissolved in the water, and 50 cc. of nitric acid are added thereto. For use 20 cc. of the silver nitrate solution, 1 cc. of the permanganate solution, and 1 cc. of pure nitric acid are mixed together and made up to 50 cc. with distilled water freed from organic matter. The reagent must be used immediately. To collect a sample of air from the gallery of a mine, a flask is filled with pure distilled water and emptied into the gallery, the air entering the flask by displacement. When the air is dusty the flask should be fitted with a paraffined cork with two tubes, one for the outflow of the water, and the other filled with cotton wool to filter the ingoing air. The bottle must be closed by a glass stopper, since the organic matter in cork would decolorise the reagent and spoil the test. A second flask being filled with normal air, some of the reagent is poured into both, and they are then placed side by side on a sheet of white paper. After some time the impure air will decolorise the liquid, whereas that in the flask of normal air will retain its original rose color. This decoloration is more rapidly effected in proportion, as the quantity of reducing gases is greater. The actual nature of the impurity can then be ascertained by ordinary methods, but sulphur if present reveals itself during the initial reaction by combining with the silver salt to form sulphide, which turns the reagent brown.

Mr. M'Arthur, the inventor of the cyanide process for the extraction of gold, has been giving his views with respect to the future supply of that metal. He points out that true mining for gold only commenced about the year 1860, and that up to that time we had only been gathering up the detritus, as it were, alluvial deposits being merely what had crumbled down from the reefs. Now we are going to the sources and attacking the auriferous rocks, of the extent of which we

know very little, while of the depth to which they may descend beneath the earth's surface we know still less. They have been traced for 3,000 feet downward, and geology confesses its ignorance of what may lie below. "There seems to be no limit," observes Mr. M'Arthur, "to possible discoveries." Some years ago the proportion of the precious metal obtained from alluvial workings was as four to one compared with what was won from its rocky matrix. Now these figures are reversed. In Russia, including Siberia, the West Coast of Africa, British, Dutch, and French Guiana, some of the South American States and Borneo, the alluvial output is overwhelmingly greater than that from reefs, which is only a thing of yesterday. How great an increase in the yield may be expected to take place, therefore, in all these countries when the steam-engine and machinery for crushing are brought to bear upon the reefs, of which the alluvial gold is the mere debris? "Gold-mining," concludes Mr. M'Arthur, "is just beginning to take the place that copper or lead-mining has occupied for centuries. One has no more reason to doubt the continuance of gold-reef than one has to doubt the continuance of other metalliferous mines. No one can say what quantities of gold may be concealed in the more central parts of the earth, nor what improved means science may find for extracting it from great depths."

The recent investigations of Guillaume on nickel have shown that steel containing 22 per cent. of nickel expands more when heated than ordinary steel does, while steel with 37 per cent. of nickel hardly expands at all, so that a variation of 15 per cent. of nickel entirely changed the nature of the material.

In a self-igniting arrangement for miners' safety lamps devised by Herr H. Feise, of Hamme, near Bochum, Westphalia, the pricker besides its usual end being turned at right angles as usual, is fitted a little lower down with a small plate, the two sides of which have toothed edges. When the lamp is completely closed and locked, one of these toothed edges can regulate the wick; and, by giving the pricker half a turn, the toothed edge on the other side of the plate can raise the igniting band to a striking surface mounted on a spring, so as to bring about the ignition, while, by a simple turning of the pricker, the wick may be trimmed by the small plate, and the upper end of the igniting band can be cleaned by the horizontal end. Instead of the friction surface for ignition, one for lighting by percussion, also mounted on a spring, may be substituted, being provided with several slits to permit the insertion of the pricker end for drawing out the spring, by a recoil of which the percussion is effected.

An arrangement for the prevention of overwinding, patented on behalf of the Konigliche Huttenwerk, Gleiwitz, Silesia, consists of two uprights, on which slide strikers that are made to move by endless chains simultaneously with the cages in the shaft, but in a certain predetermined proportion. If a given point in the lift be exceeded, the strikers will engage with tappets, and thus shut off the steam of the winding engine and apply the brake. This action is accomplished sooner or later in proportion to the speed of winding at the critical moment, being brought about by a special centrifugal governor that constantly regulates the distance between tappets and striker in inverse proportion to the winding speed. This arrangement bears considerable analogy to the Romer safety apparatus for the same object though the details differ.

E. C. Brice, whose claim to a process for creating gold and silver from chemically pure antimony and other base metals, has been under investigation at Washington by a commission of mine experts, with

only negative results, has made application to the U. S. Commissioner of Patents for another test. In his request he asserts that the commission did not follow his directions in important particulars. Ingredients, he alleges, were used which he said were inimical to his process and that he himself produced gold from chemically pure antimony, sulphur and iron after the commissioners had failed with the same materials, and that they then declared that, by whatever process gold and silver might be obtained from any other materials, it simply showed that gold and silver were in the metals before the process was used.

At a recent meeting of the Manchester branch of the National Association of Colliery Managers, Mr. Tonge, the patentee, described an hydraulic cartridge for breaking down coal. The cartridge consists of a steel rod, 3 inches diameter and 18 inches long, fitted with eight rams or pistons, which are connected with each other and with a tube leading to a small hand-pump. The pump is provided with a pressure-gauge to indicate to the operator the pressure per square inch he has upon the pistons. A stand is provided, to which the pump can be attached at any desired height. The room taken up by the machine is very small, and the total weight is 50 pounds. This size has been found to be suitable and sufficient for seams up to 3 feet 6 inches in thickness, and for seams of a greater thickness slightly larger and more powerful cartridges of the same pattern are being made. Of course, in designing the apparatus regard was had to the difficulties of moving heavy or bulky machines from place to place in these seams, but for thicker seams and larger roads the size will be increased in proportion to the increased power obtained.

The mode of using the cartridge is as follows: The coal having been undercut, and holes having been drilled in the coal near the roof, in the same way and at the same distances as for blasting, the cartridge is brought and placed at the back of the hole.

No stemming is required, but the pump is brought and coupled to the pipe, which is attached to the cartridge, and the apparatus is ready for work. The work of placing the cartridge and coupling the pump to it may occupy two or three minutes. When pumping commences a little time is occupied in filling the tube connecting the pump and the cartridge before the actual pressure comes on. Up to this point the short handle, worked quickly, suffices. Then a longer handle is attached, and the pressure indicated by the gauge is seen to rise at every stroke of the pump. Of course there is a very considerable difference in the character and behavior of different mines, and in varying conditions. In a considerable number of cases, almost immediately after the pressure has reached 10 or 15 cwts. to the square inch, the coal has begun to break off at the back of the hole and the holing, and in some cases it has been parted from the roof and been resting upon the sprags or props in front at a pressure of 1 or 1 1/4 tons per square inch. In other cases, however, it has required two, and even over three, tons to bring it down.

We find that it acts not only in longwall workings, but also in pillar and stall. We have also been told in several cases that no such round coal had been produced in that mine before.

Of course, our great object in trying to produce such a machine was to do away with the dangers of blasting. But the fact that much better coal is also produced by it adds much to its value and to our satisfaction.

Among the mines in which it has been tried with success are the Wigan mines, Arley, Yard, 6 feet: the Tyldesley Black and White, the Wakefield Flockton, Rainford Rushby Park, and Hulton Arley.

The mines tried without complete success are the Wigan 4 feet and the Cannel; but these will undoubtedly come down with the larger-sized cartridge we are making.

The apparatus has proved to be successful, not only in breaking the coal down, but also in lifting it up, where the holing is done on the top of the coal.

We may summarize the advantages of this machine as follows:

- 1st. Absolute safety in its use, and risks attending blasting entirely avoided where this is used.
- 2nd. More round coal, and that not damaged or shaken.
- 3rd. No dust produced.
- 4th. No delay to colliery or interference with pit's working, thus tending to reduce working costs.

At the recent monthly meeting of the Essen Technical Mine Managers' Association, Herr Husmann, underground manager, gave particulars of a haulage plant with horse-gin put up by him at the Salzer-Neuack mine, observing that, as there was no compressed-air plant recourse was had to this method for winning the portions of seams to the dip of the bottom level, while its cost did not exceed that which would have been incurred by a hauling engine worked by compressed air. Above the bottom level is a gin chamber, of 9 m. (29 feet 6 inches) diameter, and of a sufficient height, carefully constructed with railway bars. The gin itself consists of a vertical shaft, carried by a footstep, and, above the water, a pulley of 1.1 m. (3 feet 7 inches) diameter, with specially deep groove, is keyed on the shaft, while above the pulley, and also fast on the shaft, is a cast-iron shoe for attaching the draw beam, which is 3 1/2 m. (11 feet 5 inches) long. At the deepest point of the downbrow, which is 90 or 100 metres—say 104 yards—long, a return pulley is arranged on a tension truck mounted on wheels. The endless rope is led from the horizontal pulley of the gin, over carrying rollers, to the return pulley, and the tubs are hitched on to the rope by clips and chains. To the leading end of the rope are attached three tubs rising with coal, and to the following end three tubs, either empty or filled with rubbish. In this manner as many as a hundred tubs can be drawn by the downbrow 100 m. (109 yards) along the dip, while the horse always moves in the same direction.

An investigation of the fracture of a steel rail on the Great Northern Railway (an English line) recently made has brought out some interesting facts bearing upon the question of the fatigue of metals. On the occasion in question a Bessemer steel rail which had been in use for about 22 years broke into nearly a score of pieces beneath the wheels of a Great Northern express train, causing a serious wreck. Some experiments on the deterioration by fatigue on steel rails give interesting results regarding the broken fragments of the rail, the composition of which was as follows:—Carbon, 0.53 per cent.; silicon, 0.12 per cent.; phosphorus, 0.08 per cent.; sulphur, 0.09 per cent. The microscopic examination revealed a number of fine air cracks, and it is suggested that the continual hammering of the wheels had developed these minute fractures throughout the body of the metal, and produced the remarkable simultaneous failure which occurred at many points of the rail. The occurrence of such hair-like cracks in manufactured steel is not uncommon, and just what it is that causes them is an open question. It is possible they occur in the process of rolling, and that in the case of steel rails they are to be traced to this origin more than to the severe concussion of the traffic which passes over them.

At a recent meeting of the Ohio Institute of Mining Engineers, held at Columbus, Mr. F. W. Fowler described and exhibited a new drill, which has caused great interest among coal mining men. The drill is in one solid piece of steel, 6 feet long, of the shape and

diameter ordinarily used in hand-drilling machines, though probably of better material, and it is split at the point. One-half of the drill point has a semi-circular point of $\frac{1}{2}$ -inch in diameter, while the remaining half of the drill point is made wing-shaped, as in all ordinary drills. The Jumbo auger is designed to follow the ordinary machine drill, the centre of the Jumbo drill following the centre of the machine drill first used, and the hole is widened by the impact of the wing against the solid coal. The centre of the Jumbo, or the $\frac{1}{2}$ inch part, cannot rest anywhere at the bottom of the hole, except at the point where the first drill centre was. This Jumbo drills a $2\frac{1}{2}$ -inch hole back of a 2-inch hole, and will give a $4\frac{1}{2}$ -inch hole if desired. The shot never hangs, and the tamping is never blown, the whole force of the powder being exerted against the coal. An interesting and valuable result attending the use of this drill is the small amount of smoke generated by the explosion. Doubtless all the force is expended against the coal, the powder being exploded all at once. In the operation of the drill, say in a 6-foot hole, the miner first bores a 5-foot $\frac{1}{4}$ inch hole, then introduces the Jumbo, and bores the remaining 8 inches, and then introduces the cartridge.

CORRESPONDENCE.

The Yukon Mining Regulations.

To the Editor:

SIR,—Before us is a copy of the Government's new mining regulations for the Yukon country. A comparison of these regulations with the old ones disclose the striking changes which the Legislative Council of Canada has seen fit to make within a few days after the recently reported richness of the now world-famed Klondyke camp.

The portions which we will consider bear more directly regarding the license fees, royalties, reservations, and our "generosity," as the American press have so far condescended to put it, in non-discrimination in citizenship.

The advisability of putting so many restrictions on the miner may well be questioned. First, the prospector is required to pay \$15 of his hard-earned savings for his entry fee, while he may labor for weeks or even months before he knows whether his fee and labor are not lost on a useless claim, and which they usually are. Granted he finds his claim encouraging enough to hold another year, he must pay a further fee of \$15, and from year to year thereafter. These sections of the regulations are hardly calculated to encourage enterprise in looking for new diggings, where success is at all doubtful. True, they provide an extra claim of 250 feet for the discoverer of new fields. But there is an old and true saying here amongst placer miners, that if a claim is good 100 feet is enough, and if worthless is too much.

In further prosecuting work on his claim, the miner must have water, and more licenses and fees are required, until at last having successfully run the gauntlet of red tape, he is, we will say, in shape to sluice his dirt and realize something on his hard work. But on the output of his claim ten per cent. royalty must be paid to the Government where the claim produces any amount up to \$500 per week, and twenty per cent. when above that sum.

The idea of drawing revenue in this way may be unique, and we would not say it was unjust. Yet there is no more right to tax gold mining than any other industry. Imagine the manufacturers having a tax put on their product, or the farmer having to pay a royalty on his wheat. The comparative conditions of these industries as compared to gold mining are not dissimilar. Both farming and manufacturing are indebted to the government for being fostered, and in the latter instance bolstered up.

Unlike manufacturing, placer gold mining does not make millionaires by compelling the people to pay through their nose for their products, but are genuine creators of wealth. It is a long established fact that one dollar per day for each man engaged in the work is more than the value of the gold taken at this precarious calling. Taking then this estimate as a basis, the royalty collected for such a country as Yukon is surely to the limit the industry will stand.

On first reading the regulations, the section providing a reservation of every alternate claim for the government seems praiseworthy. But when all the possibilities suggested by this reservation are given due consideration, the results are not flattering to those who are responsible for the law. All in all, these sections of license fees and reservations are extremely distasteful to all miners, and can only be regarded as an avaricious policy, and one which might also be suspected later to harbor political crime.

Is not the royalty exacted high enough, that the miner must needs also be hampered, ay, persecuted by the numerous fees for imagined privileges? Again, is not this royalty high enough but that every alternate claim must be reserved—for what is not recorded, although we may surmise. It is officially stated they are to be sold at public auction. It behooves the government that they see to it to place themselves above the suspicion of extortion and cancel the obnoxious fee system.

Placer mines have heretofore been regarded as "poor man's mines," a chance for the poor to earn a competency. We now have the spectacle of the last free gifts of nature withheld from those who most need them, and placed at the feet of those who already have more than their share of wealth. To the poor and hardy prospector we are indebted for the discovery of this

wealth. It is by his skill that the claims on either side of the one reserved are shown to be valuable, and by which its actual worth can be accurately estimated. Thus will these reserved claims be held in trust as a sure investment for those who did not lend their aid in unearthing these treasures of the north. If these reservations are made with a view of getting still more revenue, such a greedy policy is worthy of honest condemnation. We hold that a government has a higher duty than that of revenue collector. It does not by its extortion safeguard the interest of the country at large by seriously discouraging this great wealth producer. To each prospector, whether of the Yukon or other parts of Canada, is credit due for his successes and failures alike, and to these people belong the placers without reservations.

The placer mining laws of British Columbia are commendable, and have only attained their present excellence after years of constant improvement. The Dominion Government might do worse than adopt a few leaves from the provincial law, and should they wish to collect a reasonable royalty in addition, no serious objections would be met from the miners.

Here is a clipping from the *New York Mail and Express*. "Even if the new Klondyke gold fields are in British territory, the gold taken out of them is coming right into the United States to grow up with the country. It matters not who owns the mines so long as the product comes our way."

It is true that the larger part of the Klondyke gold will go to the United States, and the failure of the government to provide protection in its regulations to its own citizens, is not the least of the present evils. Some of the United States press have referred to this overlook as our "generosity." Others ascribe the reason that the American miner is an absolute necessity to the opening of the mines, and don't even give us credit for our forbearance. Let not the people be deceived, we can do without the horde from our neighboring republic who are now rushing to Klondyke. It is safe to state that much more than half of them are not miners, and for matter of that don't need to be in order to succeed. There is no reason for believing the American miner superior to our miners of Canada, who are just as good as those to the south of us, notwithstanding the general opinion to the contrary in the east. A class of foreigners who help themselves to all they can reach, and leave with all they can get, and who seldom or never become citizens, should not be permitted to despoil us of our natural wealth. The royalty is not an adequate return for taking what belongs to our own people, while it lends a very mercenary aspect to the situation. The distribution of the gold of Klondyke through Canada would materially benefit not only the original accumulator, but the people at large, and prove incidentally a perpetual source of revenue to the country. The recent hostile legislation of Congress against this country would make the enforcement of alien restrictions particularly opportune, and at the same time deter an undesirable class from coming within our borders. The possibilities of the whole question are large, and we have but lightly touched on it. From the standpoint of the prospector who has tasted the bitterness of disappointment, and endured the hardships of the craft, do we make this plea for their rights.

E. P. BREMNER.

NEW DENVER, B.C., Sept. 13th, 1897.

COMPANIES.

Ontario Government Gold Concessions.—The first ordinary general (statutory) meeting of the Ontario Government Gold Concessions, Limited, was held on September 3rd, at the offices, Finsbury House, Blomfield street, London, E.C., under the presidency of the Hon. C. M. Knatchbull-Hugessen (the chairman of the company).

The secretary (Mr. H. St. John Hodges) having read the notice convening the meeting the chairman said. This is only the statutory meeting of the company, at which practically no business has to be transacted and no accounts have to be presented, but the Board is very glad to have this opportunity of calling you together to inform you of the steps which have been taken since the formation of the company for the systematic prospecting and development of your properties in Ontario. Within a few hours of the allotment of the capital of the company, Mr. James Reid, accompanied by another gentleman—one of the largest shareholders—left England for Canada, to take the proper step for the prospecting and development of the company's properties there, and for making all the necessary arrangements. I do not think you would thank me for wasting your time if I made a long speech, composed of generalities and vague forecasts as to the future value of your concessions, when I hold in my hand a written report, made by Mr. Reid from information derived through personal inspection, and from persons in Canada best acquainted with the concessions, and if you will allow me to read that I think it will, far better than any words of mine, enable you to judge for yourselves of the value of the concessions of which you are the owners. This is the report.—"I would like to impress upon you that the Ontario Government Gold Concessions should not be put upon the same level with nor classed among ordinary speculative prospecting and mining undertakings, as the company was formed to carry out an arrangement made with the Government of Ontario, having for its object the bringing of British capital and the mining industries of the province into direct touch with each other, to the mutual advantage of both. There is no longer any doubt about Canada possessing some of the richest mineral lands in the world; and the western part of the Province of Ontario, particularly that portion known as the Lake of the Woods and the Rainy River districts, in which our concessions are situated, has during the last two years come prominently to the front, owing to the proved richness of the gold deposits, the free milling nature of the ores, and its convenient position—being easily reached by steamer and rail in nine days from London, sixty hours from New York, forty-eight hours from Toronto, thirty-six hours from Chicago, and five hours from Winnipeg—for all kinds of supplies, provisions and mining materials, while an almost inexhaustible supply of water, fuel and timber for mining purposes is found throughout the length and breadth of the districts. The Canadian Pacific Railway runs within 20 miles of the 'B' concession, and a direct line, in addition to this, which runs so near to the property, is in course of formation, which, it is expected, will run actually through and over the lands included in both concessions. I had some talk

with influential men in Ontario with a view to bringing this about, and in their own interest I believe they will find it necessary to run over our land. This highly-favoured mining region only requires the liberal and judicious expenditure of capital on it to bring about satisfactory returns to the investor, and to place it in the front rank of the goldfields of the world. The people in the Province of Ontario look upon this district as a most valuable one, and the concessions have been very largely discussed by the press there of both shades of political opinion. It is a pity that, following upon the reception the people of this country gave to the representatives from the colonies, our press here should not keep the English public more fully informed than they do of the progress that is being made in this rich colonial possession. Articles that are written in the leading journals there probably never reach the eyes of our people here, because our papers are, no doubt, too full to admit of their commenting much upon them; but possibly this is a state of things that time will remedy, and in the meantime those Englishmen who do take an interest in the Greater Britain would do well to read sometimes such journals as the *Canadian Mining Review*, the *Toronto Daily Mail*, and the *Toronto Globe*, that they may thereby make themselves more familiar with a country which bids fair to prove one of the richest of all England's colonies. In order to attract British capital and public attention to this district the Government of Toronto granted a concession, to deal with which this company was formed, over two townships—one in the Lake of the Woods and the other in the Rainy River district—covering together an area of about 100 square miles. The Government, naturally enough, hesitated before making this unique and special grant, and it was only on being fully satisfied that the exceptional step was entirely in the interests of the mining industry of the province, and on the assurance that a strong financial group would be formed to deal with it, that they consented to ratify it. No doubt, you are also aware, that the grant was made the subject of a long and animated discussion in the Provincial Parliament in March last, the opponents of the Government asserting that the large tract embraced in the concession was the very cream of the gold-bearing lands of the province. The Government, in granting this valuable concession, made certain reasonable conditions with the concessionaires, such as stipulating for a deposit of \$20,000 as a guarantee of good faith; and, further, that a certain amount should be spent each year in exploratory or development work; but during the currency of the concession the company has the exclusive right to deal with, locate, or purchase any portion or all of the lands embraced in the grant on very easy terms. The first issue of £30,000 for working capital was, as you are aware, offered privately, and I have pleasure in stating that the list of subscribers comprises a great many strong and influential names.

"The company went to allotment on July 2 last, and the very next day I sailed for Canada in order to make arrangements for starting operations on the properties. I was accompanied by a gentleman who has taken great interest in the business from the first, and who, with his friends, subscribed for a considerable portion of the capital, and I think it only right to state here that he rendered the company most valuable service in assisting me throughout, and at no expense whatever to the shareholders. On our way to the concessions we stayed a few days in Toronto, where we had several interviews with the head of the Government, the Hon. Arthur Hardy, who expressed to us his entire satisfaction with the financial arrangements made and with the list of subscribers to the first issue of capital, and, further, gave us the assurance that the Government would extend to the company its cordial support, and wished it every success, remarking that the success of the company would be of paramount importance to the mining industry of the province. We were also much indebted to Mr. Blue, the chief of the permanent staff of the mining department, for much valuable information and advice. We had also every courtesy and consideration shown to us by the press of Toronto, and by many of the leading citizens interested in the future of the mining industries of the country. On reaching the Lake of the Woods, we took immediate steps to find two thoroughly good men to look after the interest of the company and the exploration of the concessions. During the time spent in these negotiations we paid a visit to one of the properties, the one situated in the Lake of the Woods. On our way up we had the privilege of inspecting the two leading mines of the district, the Sultana and the Mikado. The Sultana is the oldest working mine in the district, is in a very advanced state of development, and a very valuable property indeed. It is owned by Mr. Caldwell, who gave us very interesting information about its rise and progress. He stated that the mine is now developed to a depth of 350 feet, and the main reef at that depth is 56 feet wide, and has continued to improve all the way down. A new 30-stamp mill of the best description is about completed to replace the old 10-stamp one, and altogether the Sultana appeared to be a very prosperous concern. We next visited the Mikado. This mine is owned in London, and the progress made during the eleven months since work was commenced certainly shows a record in mining. The main shaft is down 120 ft., with two levels and hundreds of feet of drives on the lode; 60 men are at work. A first-class 20-stamp mill by Fraser and Chalmers has been erected, together with the most modern machinery for hauling, pumping and other labour-saving uses, and I understand that crushing commenced on August 1 with every prospect of its continuing, as there is a considerable amount of ore on the dump and large bodies ready for stopping, the assays ranging from 14 dwt. to 4 oz. to the ton; in fact, 300 tons from the outcrop were crushed some time ago, which yielded over 900 ozs. of gold. I mention this to show what is being done in the immediate neighbourhood of our property, which is situated within a few miles of the Mikado and other mines of promise, more or less advanced. We found that nearly every part of the concession could be reached by water. We sailed along the shores of it for eight or ten miles, and everywhere the rocks were visible at the water's edge, which will help the prospectors to form some idea of the various geological formations of the ground they have to explore.

"The Rainy River concession is also most favourably situated as regards working mines in its immediate neighbourhood, and, as far as common report went, it appears to be most promising. On our return to Rat Portage we were fortunate in being able to come to terms with two very high class men—Mr. Sullivan and Mr. Deacon—both young men of excellent reputation, full of energy, both well acquainted with the district, and having extensive experience in prospecting and development work. Mr. Sullivan is the son of Bishop Sullivan of Ontario, and has devoted his attention for

some time to the mining wealth of this district, as well as being engaged in very important engineering work. Mr. Deacon is a gentleman, who at Rat Portage (the nearest town to the "B" Concession) is well known for the thoroughness of his work, and the skill that he possesses in it. He has thrown up important and lucrative work in order to ally himself with us, and both gentlemen have entered heart and soul into this undertaking. It speaks volumes for our future prospects, that men who are familiar with the district, and who have done extensive and responsible surveying work for the Provincial Government, are willing thus to throw in their lot with us. They recognize the importance of every effort being used to make this business a success, and from the last letter I received, you will be glad to know that they repeat their assurances that nothing shall be left undone which they can conceive is necessary to be done in order to make it so. The terms of their engagement provide for a fixed salary, and such an interest in results as to give them every inducement to have the properties thoroughly and carefully prospected. Both men commenced at once to get their prospecting parties engaged, and within four days each man was on his way to his concession, together with a number of men fully equipped for work, and I hope very soon to hear of some valuable discoveries being made. I think you will agree that no time was lost on our part in putting the necessary machinery in motion, as within three weeks from the time we left London we had two well equipped parties at work under thoroughly competent managers. I have little more to say, only that on all hands we heard glowing accounts of the great possibilities of the properties. Personally, I have the greatest faith in our prospects, and if we are successful in our efforts this company is bound to take the leading position in the districts referred to. We have strong and influential people connected with it, and we have the hearty good wishes of the Government and those interested in mining matters in Ontario. I would just add that ample provision has been made in the way of working capital to thoroughly explore the properties; but in the event of discoveries being made, subsidiary companies may have to be formed to develop them, but this is a matter we need not seriously consider now. I would also state that the directors will keep the shareholders in touch with the work, and whenever there is anything of interest to communicate it will be sent to them at once." The chairman, continuing, said: I think you will agree with me that that report is of a most satisfactory nature, and that the thanks of the shareholders at large are due to Mr. Reid for the promptitude with which he placed his services at the disposal of the company, and altogether I think you may look to the future with a large amount of confidence. I repeat what Mr. Reid has said in the last paragraph of his report, viz., that any information that the company may receive at any time will be promptly and immediately placed at the disposal of the shareholders. Since the date of Mr. Reid's report letters have been received from the managers appointed by him on the spot, which are of a very encouraging nature, and I think it is not too much to say that before the winter falls we may hope to have such information as will place beyond all doubt the future of this company. If there are any questions which any shareholder would like to ask, I need hardly say that we shall be only too glad to answer them.

Mr. H. F. G. Weber proposed a vote of thanks to the directors, and to Mr. Reid for his very prompt and energetic work on behalf of the company.

The motion was seconded by Mr. F. Bullock, and carried unanimously.

The Chairman expressed the acknowledgments of the Board, but remarked that, in their opinion, the motion should have been confined to Mr. Reid, because up to the present time he had had all the work to do.

Mr. James Reid said he was very much obliged for the vote of thanks. He was very well pleased with the prospects so far, and the letters which he had received from the managers gave the Board every reason to hope that it would not be long before they had something very substantial found upon the concessions. There was on the table a sample of the ore, which one of the prospectors had thought of sufficient importance to send home to this country. The Board would have it assayed, though he did not attach much importance to the result, although he thought, from the appearance of the reef, it would be worth following it up. The serious work of prospecting would be going on from this forth, and he hoped soon they would have some very satisfactory results.

The proceedings then terminated.

British Columbia Financial Trust and General Corporation—Report from the agent respecting the development of the company's property, the "Donald" mine, in British Columbia: Donald Mine—Have let contract for continuation of tunnel at \$14.50 per ft. Have to drive about 200 ft. to meet the 84 ft. shaft sunk on main body of ore, but expect to intercept another lode during progress. Have let contract for log barracks for men, and rails and car for tunnel. Have staked out adjoining claims, Maple and Glacier; total area, 156 acres. Maple likely to be very valuable. Have an offer two full-sized valuable gold claims, Alps and Altura, Slovan district, bed rock price. Taken samples for assay. Particulars next mail.

Mikado Gold Mining Company—Mine Manager reports, under date August 9th. "Twenty-stamp mill running now in full force. Started with low-grade ore, and shall continue for twenty-four hours till everything is adjusted and every crevice filled. Mill works well."

Goldfields of British Columbia—Mr. John Grant, managing director of the Waverley Mine, Limited (the first subsidiary company of the Goldfields of British Columbia, Limited), reports under recent date as follows: "The tunnel has been driven in 190 ft.; the width of the vein is 75 ft. at present, but we have not yet reached the hanging wall, where we expect to find the richest ore deposits, as the opening above shows that on the footwall there is about 6 ft. of solid galena ore. The ore body consists of 45 ft. of solid carbonates, intermixed with large nodules of solid galena; the other 30 ft. of the vein consists of quartz, lime, and galena, with more or less carbonates—purely a concentrating ore. I am daily expecting that we will strike this rich ore on the hanging wall."

Le Roi Mining and Smelting Co.—Notwithstanding that this company is erecting smelting works, and has made three payments for machinery,

another dividend of \$50,000 was declared on September 7th. It could have been made \$75,000, as there were \$90,000 in the treasury, but the directors preferred to keep a good balance on hand. The pay roll contains 200 names, and the daily output is 300 tons. On the 500-ft. level there is 3 feet of solid ore, said to assay \$70, showing a great improvement in the values with depth, as at the 150-ft. level the average value of first-class ore was said to be \$51, and of second-class \$27 a ton.

The Fairview Gold Mining Co., Ltd.—Capital \$100,000, divided into 100,000 ordinary shares of \$1 each. This company has been formed for the purpose of acquiring and working the Fairview group of mines, situated at Fairview, in the Yale district, British Columbia, some 30 miles by road from Penticton, with which town there is a direct service in connection with the Canadian Pacific Railway. The issue is made by the "B. C." Development Company, but the prospectus does not tell us how many years "B. C." it was formed, but anyway it must be getting a bit ancient. As regards the "Fairview," the property consists of the Joe Danby, Daisy Dean, Atlas and Belmont claims, and covers a total area of 130 acres, originally acquired by the issuing company in August, 1896, since which considerable development has been made upon the various properties. Three parallel lodes have been found, which are claimed to traverse the whole length of the properties, and which can easily be opened up by tunnelling. The assays are fairly satisfactory, but investors in these days want something more tangible than mere assays, but it is fair to say expert opinions on the whole are favourable. The purchase price is arranged on the "just as you like" principle, viz., £70,000 in full paid shares or cash, leaving £30,000 available for working capital. Taking a "fair view" of the scheme, the company would appear to have a future.

The Wonderful Group Mining Company on July 31st received a cheque from the Tacoma Smelting Company for \$1,544.47, returns from 19 tons of ore, which assayed 70 per cent. lead and 123 ounces in silver, and netted, exclusive of duty, \$99.92 per ton. On August 3rd they received from the Kootenay Ore Company of Kaslo a cheque for \$1,051.28, returns from 14 tons of ore, which assayed 73 per cent. lead and 124 ounces silver, and netted, exclusive of duty, \$92.55 per ton.

The Hall Mines, Limited, of British Columbia—Smelting operation, during the four weeks ending August 28th, 1897—28 days' smelting; 5,766 tons of ore were smelted, yielding 522 tons matte, containing (approximately) 232 tons copper, 157,360 oz. silver, and 215 oz. gold.

The Poorman Mine.—Mr. Charles Leftchild, the Secretary of the Company, gives the following statement regarding the expenses and receipts since its reorganization, January 1st, 1896, to July 15th, 1897: Receipts—Returns from ore shipments, \$5,489.52; assessment No. 1, \$4,864.92; total, \$10,354.42. Expenses—Mining account, \$6,895.67; general expenses, including organization and 1897 licence, \$655.22; office expenses, \$511.22; assaying account, \$239.50; hauling account, \$602.48; cash on hand, \$1,453.33; total, \$10,354.42. The Poorman was shut down when the War Eagle was sold, it being then controlled by the same people. From the surface, however, this claim had shipping ore.

Granite Creek Mining Company.—On Thursday, August 19th, 1897, an application was made by H. B. Cameron, to the Minister of Justice, for permission to issue a writ of *scire facias* to set aside and cancel the charter of the Granite Creek Mining Company, Limited. The grounds on which the application were based were that the company had not complied with the provisions of the Companies' Act, Chap. 119 R.S.C., sections 43 to 47, requiring that certain books be kept and that these be open to inspection by the shareholders. After hearing argument judgment was reserved. Subsequently the Department handed out a written decision granting Dr. Cameron's application on condition that he furnish \$500,000 security for costs. We understand that this condition has been complied with, and that the merits of the case will now be ventilated in court.

MINING NOTES.

British Columbia.

WEST KOOTENAY.

The total output of West Kootenay for 1897, up to September 1st, is approximately \$5,000,000 according to Customs returns. The Nelson *Miner* tabulates the production as follows, under date of August 28th:—

Ore, 32,889½ tons at \$70.31 per ton. Total value, \$2,312,090.90.
Matte, 5,132 tons. Total value, \$2,543,746.64.
Total value of ore and matte, \$4,856,437.54.

In the Slocan, during the month of August, there has been a weekly output of over a thousand tons of silver-lead ore, as against a weekly output for the same month last year of seven hundred tons.

The total production of West Kootenay, for August, is valued at \$700,000, this being greater than for any previous month in our mineral history. The next best month being last March with a Customs credit of \$677,681.

Of the Slocan ores about 1,000 tons per week go out over the Kaslo and Slocan Ry. and some 200 tons over the Nakusp and Slocan Ry. On the completion of the Slocan River Ry., about October 15th, it is not unlikely that the C.P.R. may control a larger share of the traffic.

An effort is being made by the Vancouver agent of the Vivians to induce Kootenay miners to ship their ore to Swansea. The offer allows 75 per cent of the assay value to be paid over in Vancouver, and the remainder, less cost of freight and treatment on receipt at Swansea. The freight is said to be \$8.50 per ton.

There seems to be no great opening for more lead smelters in the district yet awhile. The Pilot Bay smelter now being re-fitted by Braden Bros. can handle a majority of the output of silver-lead ores, should it do custom work at even rates with the United States smelters.

A Scotch syndicate now control the Slocan Milling Co.'s late possessions, including concentrator, tramway and some 18 mines and prospects, chiefly in the neighborhood of the Idaho and Alamo Basins. The old company was one of the first to come into the Slocan to operate on a large scale. It built the first concentrator and gravity tramway in this district, and had declared good dividends before the late transfer.

Amongst the developments being carried out this season are waggon roads up Cariboo Creek and Four Mile Creek; also to Montezuma mine and Great Western.

Concentrators are being built at the Highlander near Ainsworth, at the Montezuma, on the south fork of Kaslo Creek, and probably in several other cases. Tramways for the Payne, Reco, Montezuma and Lucky Jim, in the Slocan. Sampling works at Rosebery on Slocan Lake.

Also there is an advance being made in railway matters. During the late visit of the C.P.R. officials these gentlemen professed an optimistic view of matters. The C.P.R. has had engineers in the field between Three Forks and Bear Lake, also between Trail and Robson. Their Slocan River connection is soon to be completed. Also there is a party under Engineer Tye now working westward from Robson for a continuation of the Trail-Robson road to Penticton.

As a general statement, things are quiet in Kootenay compared with last year. There are but few elements of the boom left. Yet there has been a healthy and hopeful progress in every division. Production has increased generally, and several new sections are opening up well. Notwithstanding the low price of silver, no mines have yet closed down, neither is it probable that the industry will be much affected should silver keep above 50 cents.

The recent issue of \$58,000 debentures of Nelson was taken at 98 cents, interest bearing 5 per cent. The Rossland issue for the same amount brought a somewhat higher price with interest at 6 per cent. Sandon has now sent in application for incorporation.

Nelson and Kootenay Lake points generally have been fairly brisk. Kaslo commands most of the Slocan trade and transfer. Ainsworth has been actively developed by several strong companies, and Nelson draws trade from the whole district, being a geographical and judicial centre. Besides this the Nelson division has during the past year come forward as a known mineral-bearing area. Special interest being shown along the line of the Nelson and Fort Shephard Ry. and along the ranges west of Kootenay Lake.

The opening up of the well known Alpine group, now controlled by the Maritime Province Co., appears to have turned attention to the possibilities of Lemon Creek gold belt as a feeder to Nelson. Already a road is being made up Six Mile Creek or Kootenay Pass, from Kootenay Lake, which road may be continued to tap the head waters of Lemon Creek.

VANCOUVER.

The precious metal mining interests of the coast and island districts are likely to benefit very considerably by a general standing offer, recently made by Messrs. Vivian & Sons, the great ore smelters and refiners of Swansea, South Wales, who propose to make most effective use in British Columbia of their exceptional capital and other facilities. The Vivians intend first to buy, delivered at Vancouver, trial shipments of from one to twenty tons of either argentiferous auriferous lead ores or argentiferous auriferous copper ores or matte, at values, ascertained per sufficient test samples in Vancouver, by Mr. Pellew Harvey, their agent. The Welsh firm will further facilitate these trial purchases to mine owners who may happen to be in need of ready money for development or other business purposes, by advancing, so soon as the ores or matte are shipped at Vancouver, 75 per cent. of the assay value, together with all freight charges between Vancouver and Swansea, from which last place, on arrival of each consignment, payment is to be promptly made through the Bank of Montreal, Vancouver, of the remaining purchase money. Mine claim owners of but moderate means, to which class belong most of those interested in properties on the coast of and in the islands of the Gulf of Georgia, including Vancouver island itself, will by the means proposed be able at a minimum of cost to themselves to test their ores and receive very promptly the cash values thereof, as ascertained by a most responsible metal treating concern. This will prove of the very greatest advantage in the absence of smelting and refining facilities in Vancouver, and even when these shall be supplied on a doubtless moderate scale, there is reason to believe that such a concern as the Vivians will continue to receive a goodly share of precious metal mining patronage, especially in the case of matte requiring refinement, for which even should a smelter be set up in or near Vancouver, there is not likely for a considerable time to be great provision made. Hence, whilst Messrs. Vivian & Sons expect all these trial shipments to be forwarded early in October by the steamship Tekoa, which then leaves Vancouver, they also fully expect to receive such encouraging support in return for their offer, as to justify themselves in erecting sampling works in Vancouver, and running in connection therewith a regular line of steamers between Vancouver and Swansea.

This last addition to Vancouver's shipping undertakings would, it is needless to say, prove very valuable, and probably bring to the port much general British business, via one of the most enterprising ports in South Wales.

As coast and island ores can be very cheaply shipped by water to Vancouver, and many mines in an early stage need such tests as those offered by the Vivians, there is good reason to believe that several hundred tons of ore, together doubtless with some matte from the concentrators of mines in the upper country, will be duly consigned to Swansea by the "Tekoa." Argentinian auriferous mines in Texada island, and others on Vancouver island, are in particular expected thus to contribute. Other consignments will also be made from coast mines in the Phillips Arm district, where development work is busily proceeding, with the aid of, as a rule at present, but no less capital.

It is possible that the Vancouver City Council may decide shortly to submit a smelter bonus by-law to the local money by-law electorate. Although the bonus asked is larger than originally expected, viz. \$100,000. The offer is, however, made by a substantial man, Mr. W. H. Remington, of Salt Lake, and as at present conditioned is upon the only payment terms at all likely to be accepted by the Council and electorate, viz., a bonus on actual smelter output—in this case suggested as \$1 a ton. The smelter is to possess a 100 tons daily capacity. Such is the offer now under consideration. It may yet be modified somewhat, but probably not very greatly in its leading terms. The City Council is to be indemnified against all vote recording expenditure in the event of the citizens refusal to ratify the bonus or Mr. Remington's offer, to deposit sufficient cash to pay all such charges in the case of an adverse vote.

The Remington offer may perhaps bring to the point the promotion of a rival smelter project, at the head of which is Mr. J. H. Rothschild, of London, England, who states that he has organized a syndicate, with a capital of £250,000, in order to erect and work a smelter at Vancouver, and in respect thereof means to ask for a cheap water supply and other modest civic aid. This scheme has, however, been so long in incubation, its projector not being one of the financially omnipotent family of Rothschild, that Vancouver opinion is somewhat doubtful of its successful consummation. The coast and island mines increasingly need a smelter in or near Vancouver, but the City has until quite recently been the recipient only of a series of abortive proposals, mainly of a purely bonus-peddling nature. It is unlikely that the smelter will be built on one of the few sites available within the comparatively narrow limits of the City itself, but rather in some thinly populated suburban district on the harbor front. Vancouver can, as a city, bonus an industry located within five miles of the municipal boundary.

There has been very little booming and much adverse criticism of Yukon possibilities in Vancouver, the contrary being the case of Victoria. Consequently little mining outfitting has been done in Vancouver, but on the other hand singularly few Vancouver men—as compared with many from Victoria—are now suffering from great privation and discomfort at Skagway and elsewhere *en route* to the now freezing far north country. The press of Vancouver has generally dissuaded fall travel to the Yukon, and urged delay till spring. Many intending venturers from other parts are accordingly accepting the advice and now wintering in Vancouver. British Columbian mine veterans aver and quote figures to prove their assertion that the placer wealth of the Klondyke, as at present disclosed, is by no means so extensive as, and of course far less favorably distributed, than that of old time Cariboo.

In West Kootenay and Cariboo many claim-holders are astutely evading the provisions of the Mineral Act, requiring the doing of assessment work during the year following location, in order to hold a claim. These men simply stake and record their claim, doing no work, and ere the year elapses, relocating and then reviving their rights. In Cariboo this is accomplished yet more ingeniously by a kind of exchange system among groups of speculative claim-holders, the nominal ownership and the properties being changed on relocation, a mutual understanding being previously arranged. Large areas of mineral land are thus held unused and unworked for the purpose of speculation. Professor Carlyle, the principal mineralogist, suggests that to prevent this state of things, the locator of a claim should be compelled ere filing and getting a title to his claim, to do \$100 worth of work thereon. Something of the kind is required, and it is possible that the Mineral Act may be so amended as to meet the case next session, though it is by no means certain, as certain groups of claim-speculators who thus evade the Mineral Act, have much influence at Victoria which they may use to prevent or obstruct the suggested legislation. Such legislation may on the other hand be facilitated by the fact that a provincial general election follows the close of next session, whilst a previous redistribution of seats will give to the mine districts much greater representation in the Legislature. The voters of such districts naturally oppose the speculative "holding up" of large areas of undeveloped mineral land.

The most striking of recent Vancouver mining transactions has been the sale of 100,000 shares in the Golden Cache mines, Lillovet, by the Dominion Developing Co., Limited, for \$180,000, the buyer being Mr. Mark Oldroyd, M.P. for Dewsbury, England, a wealthy cloth manufacturer. He previously bought 100,000 other shares in the Golden Cache and now holds a controlling interest in the mining company, having acquired this at a cost of £70,000 sterling. This purchase from the Dominion Developing Company, Limited, has enabled that company to pay a dividend of \$1.75, or 700 per cent, on stock having 25 cents paid up. The transaction is the more significant, as no gold has yet been crushed at the Gold Cache, the stamp mill being only about to commence work. The purchase is accordingly based entirely on assay tests and expert investigation. The Golden Cache mine will practically be the pioneer free milling gold mine of a large district of

Lillovet in which are other similarly located claims and mines, whose fortunes largely depend on the success or failure of the Golden Cache Co., the shares of which stand at a big premium. News of the results of early crushings at the Golden Cache mill is accordingly eagerly awaited in Vancouver.

S. C. SCHOX.

NELSON DISTRICT.

There is not very much to report from this locality in the way of mines and mining matters, everything has been going on steadily, assessment work is being done on the numerous claims around us and development work on the more advanced properties. As an indication that the property holders here think well of their claims, it may be stated that no less than 257 notices of assessment work were recorded in Nelson for August, and 1107 notices altogether for the year so far, which represents a very considerable amount of money expended in the district.

The Trail Creek smelter has been successful in refining its own gold, and the first refined gold brick produced in British Columbia (as a result of smelting operations) was turned out from those works at the end of last month—it weighed about 250 ounces and will, it is hoped, be only the first of many more to follow. The owners of the works expect to be able to turn out refined copper, silver and gold from the Trail Creek ores in about a week from the time the ore is charged into the furnace, which is an entirely new departure in B.C. and cannot but be regarded as a most satisfactory indication of progress in the right direction.

Speaking of smelting and refining, it appears that the old established firm of Vivian & Sons, Swansea, are anxious to obtain the British Columbia ores for their works. The freight from Vancouver, B.C. to Swansea is now quoted at only \$8.50 per ton, and as everything of value that is in the ore is paid for by old country smelters, it may easily be more profitable to send the ore all the distance than treat it at home. It is not that the smelters here do not know the value of the "accessories" or bye products, but they have no market for them, and consequently are compelled to let them go to waste. Your correspondent knowing of a case in point where literally tons of arsenic and antimony are discharged into the atmosphere weekly, to the great comfort of the population, and to the marked alteration of the surrounding trees and shrubs. No doubt the accompanying sulphuric acid materially assists in the operation. However, the presence of a large works, employing hundreds of hands, is good for any town, especially young towns in British Columbia, and the inhabitants will put up with some inconvenience for the sake of the improved business resulting from the wages earned and expended in the place.

The long promised Crow's Nest Pass R.R. is being proceeded with rapidly, there being some 3,000 men employed on the first hundred miles, and it is now fully expected that the road will be in full working order as far as Crow's Nest Lake (practically on the summit) by the first of December. The road will be of immense help to this district, and will also be the means of opening up to a very great extent the mining district of South-east Kootenay, which up to now is almost inaccessible. Not the least of the advantages this line will confer, is the probability of cheap and good fuel for smelting and domestic purposes.

Among the more local happenings, reference may be made to the old well known 49 creek near here, where placer diggings have been worked for years with much success. Mr. D. W. McVicar has washed more ground than usual this season, and is confident of a greatly increased yield from his clean-up. Anyone who has stuck to his claim and worked them as faithfully as he has deserves the best possible luck, and he seems to be in a fair way to get it.

At the Fern mine the new 20-stamp mill is in progress, and will shortly be in full working order, probably early next month. This property is looking very well, and the tunnel is being extended with all speed; all indications point to its proving a most valuable mine. But little else has been found of note on Toad mountain. A report was prevalent lately that a 4-foot vein of free milling quartz had been discovered, but so far the necessary confirmation is lacking, though undoubtedly it is quite possibly correct.

The Messrs. Wilson, to whom I referred last month, are still working on their "Last Chance" group of claims, and the veins, of which there are several, are all looking exceedingly well. I had the pleasure of seeing one of the open cuttings the other day, and the copper pyrites could easily be shovelled up; it seemed in places quite separate from the quartz which accompanies it, and most easily handled. This also seems a most promising ground.

The Silver King is much as usual, shipping 200 to 250 tons of smelting ore to the smelter daily, and the smelter itself, now under the management of Mr. R. R. Hedley is working full time, and quite satisfactorily. Metallic copper is still being made and shipped, and a dividend is expected shortly. Towards the end of August a very serious forest fire was raging in too close proximity to the Silver King, but fortunately a change of wind and heavy rain prevented any damage being done, though all preparations had been made to send the women and children down to town for safety.

Two other claims on Toad mountain, the Investor and the Ethel H., are said to be looking very well, but too little work has been done on them yet to enable one to predict their future with confidence; it is, however, scarcely likely that the Silver King is the only body of good ore on that vast extent of country called Toad mountain.

Ainsworth, the oldest mining camp probably on Kootenay Lake, is still doing well, one of the latest discoveries being the presence of a considerable amount of gold in some of the ore (not hitherto supposed to contain any) from the Highlander, and if the indications are borne out by results, it will be no wonder to see the gold output equal or surpass the silver and lead in value. All things considered, Ainsworth is holding her own very well, and will apparently be a very lively place for the next year or two, and prove a good permanent camp in the future.

The Pilot Bay smelter has not as yet been blown in, but it is confidently expected that it will be in less than a month, and it will be of immense benefit to the district generally. More smelters are wanted than now exist, but so far the almost prohibitive cost of fuel has deterred capitalists from investing in them. Ore enough is now known to exist, and can be extracted without undue expense, while the other necessary adjuncts, such as limestone or iron ore, can be obtained without difficulty; all that is needed is the capital to erect the smelter, and the brains to run it, and then success is assured. There is some talk of re-opening the long disused Revelstoke smelter, and if that happens it can be readily supplied with ore from the Lardeau and Illecillewaet districts.

NELSON, 15th Sept., 1897.

A. H. HOLDICH.

MISCELLANEOUS.

The quantity of silver lead ore shipped from the Slocan during August, 1897, was 7,784,995 lbs. The following nineteen mines contributed to this shipment: Payne, Ruth, Whitewater, Slocan Star, Noble Five, Washington Rambler, Ibox, Great Western, Surprise, American Boy, Slocan Boy, Ap-torne, Red Fox, Wonderful, Wellington, Two Friends, Lincoln and Sapphire. The destinations of these shipments, with the quantities, are: Pueblo Company, 5,124,595; Everett, 1,396,000; Omaha, 830,000; Kootenay Ore Company, 281,400; Tacoma, 120,000; Aurora, Ill., 33,000 lbs. The August, 1896, shipments were from fourteen mines only. The Payne shipped only 70,740 lbs., as against 3,100,000 lbs. for August of last year. The entire shipments for that month in 1896 were 2,287,085 lbs., or less than one-third that of the same month for the present year. Of the shipments for August, 1897, as given above, 777,426 lbs. must be credited to Ainsworth mining division. The valuation of the August, 1897, shipments, according to the customs returns, was \$276,812. The quantity of lead in August shipments of the year was 3,834,280 lbs., and silver, 357,558 oz.

A three-drill air compressor plant has been ordered from the Jas. Cooper Man'g Co., Montreal, for the Silver King mine of the Hall Mines, Ltd. This will give the mine 25 drills. For the four weeks ending August 27th, the out-turn of this company was: Ore smelted, 5,766 tons; matte produced, 522 tons. Of this quantity there 232 tons of copper, 215 oz. of gold, and 157,360 oz. of silver. This company recently shipped 50 tons of blister copper to Messrs. Vivians' refining works, Swansea, Wales. Mr. W. C. Nichols, who succeeded Mr. Paul Johnson in the management of this smeltery, has resigned, and Mr. Robert R. Hedley has taken his position. The smeltery is now running satisfactorily.

At the War Eagle, Rossland Camp, some 85 or 90 men are engaged in developing the property. When shipping is resumed this force will be increased to 150, the number employed a few weeks ago. In the upper tunnel and crosscuts at the 110-ft. level, 1,000 feet of work has been done; on the second, or 250-ft. level, 2,000 feet; on the third, or 375-ft. level, 350 feet, and 900 feet on the lower, or 500-ft. level. The main winze is down 250 feet below the second level. All told, 4,500 feet of tunnelling, 250 feet of shafting and 800 feet of upraising has been accomplished since the property was first worked, and 30,000 tons of ore have been shipped, returning \$900,000. Since the 20th January, the time the new company took hold, 1,900 feet of tunnelling and crosscutting, 200 feet of shafting, and about 400 feet of up-raising, in all 2,500 feet of work, has been done, representing \$70,000 worth of development. A conservative estimate of "ore in sight" at the present time is said to be 75,000 tons. Last month the original War Eagle Company held their closing meeting, when a last final dividend was declared, making the total dividends paid about \$250,000. John Beasley Hastings, the manager, is a Liverpool man. He has been engaged in western mining since 1876, and in British Columbia 18 months.

Although the Cariboo Mining, Milling and Smelting Company suffered a loss of \$12,000 in stolen bullion and legal expenses incurred in connection with the theft, and expended \$6,000 in new machinery, it has paid during the past year \$78,836.84 in dividends, and has \$21,297 in the treasury. To date the company has paid \$156,964.76 in dividends.

At Ainsworth, the Petersons, of Philadelphia, are building a 20-ton concentrating plant, and a tram in conjunction, in connection with their mine, the Highlander. It is claimed that the concentrator will treat ores for \$2.75 a ton, and the tram save \$1 a ton in the cost of handling most of the ores on Munn creek. It is claimed that though the Ainsworth silver-lead ores are low grade, they can in many cases be worked for 1.50 a ton, and being thus cheaply operated yield substantial profits. The Pilot Bay smelter will, moreover, under its new management, reduce rates considerably below the present usual one of \$21 a ton for freight and treatment. Ainsworth mine and claim owners are therefore in much better spirits.

Nova Scotia.

CAPE BRETON.

The output and shipments from the collieries of the Dominion Coal Co. for August were:—

	Output.	Shipped.
Gowrie	6,546 tons	3,964 tons
Caledonia	37,398 "	26,067 "
International	20,531 "	18,536 "
Dominion:	34,208 "	30,853 "
Old Bridgeport	21,047 "	20,252 "
Reserve	39,450 "	32,429 "
Victoria	9,892 "	10,832 "
Hub	16,870 "	15,844 "
Total	185,942	158,777

Largest day's output for August, 8,031 tons.

Largest day's shipments for August, 7,351 tons.

The shipments via River St. Lawrence were:—

Screened	31,696 tons.
Run of Mine	84,180 "
Slack	7,664 "

Total

The total shipments up till August 31st, 1897, were:

Gowrie Colliery	13,599 tons.
Caledonia	119,053 "
International	67,053 "
Dominion	126,084 "
O. Bridgeport	79,964 "
Reserve	123,666 "
Victoria	45,465 "
Hub	59,331 "

Total

The shipments for a like period in 1896 were 622,822, leaving some 12,000 tons in favor of 1897. By the end of October there is expected to be an increase over the nine months of 1896 of 40,000 tons, as it is expected the shipments for September will reach 160,000 tons—as up to the 15th inst. 80,000 tons had been shipped—and the shipments for October will be as great as for September. There will be good shipments likely till end of November. After that it is hoped a market may be obtained for the large quantities of slack coal on hand. Present indications point to much larger shipments in 1897 than in 1896.

QUEEN'S COUNTY.

The Brookfield mine cleaned up 292 ounces for the month, exclusive of concentrates, which have not yet been treated.

The Turnbull mine returned 60 ounces for the month, and the Parker Douglas 38 ounces.

GUYSBOROUGH COUNTY.

This County is to the front this month, and shows a splendid record, with the following returns: Modstock, 212 ounces, Blue Nose, 205 ounces, New Glasgow, 125 ounces, Stellarton, 67 ounces, Crow's Nest, 18 ounces, and several mines, including the Richardson, to be heard from.

The Beaver Dam mine has been bonded to an English syndicate.

R. G. Edwards Leckie has bonded the Mooseland mine.

Development work is being pushed forward at the Silver-lead mine at Chetichamp, with excellent results. The property has recently been examined and reported upon by Mr. F. H. Mason, F.C.S., of Halifax. The company intend sinking the main slope 50 feet, and if the quality of the ore continues a dressing plant will be erected.

A number of areas have been taken up near Whycomagh for alluvial gold, and prospecting work has been started. Alluvial gold in varying quantity is to be found in nearly all the rivers in this neighborhood, and we are glad to see some one with sufficient pluck to give the thing a trial.

A large number of areas have been taken up near Tatamagouche, Colchester County, for gold, but as yet we have heard no particulars of the supposed find.

Our old friend, Mr. Damas Touquoy, leaves shortly for France. Mr. Touquoy, although never working on an extensive scale, has been one of the most persistent gold miners in the province, and his efforts have been rewarded by no small measure of success.

A very curious incident has occurred in connection with the building of the new grand stand on the exhibition grounds in Halifax. In digging the foundations a 16-inch vein of quartz was cut, showing good gold. As a three-stamp mill by the Windsor Foundry Co. is to be put in operation during the exhibition, a very excellent suggestion has been made, that the vein should be sunk upon, and mining as well as milling operations shown. This is only one more instance of the hidden wealth of our province, and goes far to show how very little the country has been prospected.

The Oland Brothers are still mining very excellent ore from the old Symond-Kaye property. The vein, although small, is exceedingly rich,

eight tons yielding 182 ounces of gold. From accounts we have received from a most reliable source, there appears to be very good reason to believe that this strike is a well defined pay chute, and likely to continue.

Mr. R. McDonald is doing a lot of development work on the north dip of the Anticline, at Montague. Mr. McDonald has recently added a considerable number of areas to his already very extensive block, and his prospects appear to be exceedingly good.

PICOTON COUNTY.

We understand that the Mineral Products Company of New York has leased the furnace and plant of the Picoton Charcoal Iron Co. with a view to manufacturing ferro-manganese. The company owns a manganese property in Albert county, New Brunswick, and extensive works are, we are told, being now put up at Hillsboro in that province, for drying and making into briquettes the bog manganese occurring there. The plant is to be put into operation at once, and the briquettes and what "hard ore" they may require (and which they will obtain from their other deposits in Albert county), will be shipped to the furnace at Bridgeville and smelted with charcoal and coke. The charcoal kilns at Bridgeville are being repaired, a new hearth will be put in the furnace and the works started this fall. Mr. R. R. Hoyt is the general manager, and N. M. Langdon, superintendent of mines and furnace. The Picoton Charcoal Iron Company will continue to own and operate the iron deposits at Bridgeville, marketing its ores as formerly with the Nova Scotia Steel Co. at Ferrona.

Mr. E. A. Sjostedt, M.E., who has been since June 1st in Europe making a special study of the latest devices for utilizing waste fuel (forest, mill refuse and peat), for gaseous fuel, has returned to Nova Scotia, and will, we are informed, remove shortly to Montreal, where he will establish a chemical and metallurgical laboratory.

Quebec.

The Mica Manufacturing Company, Limited, is pushing forward the development of the Phosphate King mine in Templeton, and the Martha mine at Perth, Ont., formerly owned by the Lake Girard Mica System. Sir James Carnac, one of the directors of the company, is now in Ottawa looking after the affairs of the company.

A fine show of mica is reported to have been uncovered on the property of Mr. A. H. Murphy, in the Gore of Templeton.

The property of the Wallingford Mica Co., in Templeton, which has been successfully worked for a number of years, is reported to be on the London market, but at date of going to press particulars of the proposed sale are not available.

The Gilbert Beauce Gold Mining Co. Limited, is seeking incorporation to operate mining lands in the district of Beauce. The principals are: Dr. J. G. Joubert, St. Francis; G. C. DeLery, Quebec; P. Angers, B. Letellier, A. Fortier, L. Boiven, E. Soubier, all of St. Francis. The authorized capital is \$5,000.

Mr. C. M. Pielsticker, the well known London mining engineer, formerly associated with the Dominion Phosphate Co. of London, arrived at Buckingham last month.

Mr. R. H. Jones, F.S.A., of London, England, the author of that standard work, "Asbestos and its Uses," is at present at Black Lake on a visit to the asbestos mines of the Eastern Townships.

We are glad to be able to report a continued improvement in the market for Canadian asbestos. The Bell's, King, Asbestos and Asbestic, and other companies continue to be fairly busy, and the output will be about the same as last year.

Ontario.

Writing under date of 31st instant, Mr. Wm. Strong, M.E., General Superintendent of the Foley Mines Co. of Ontario, says: "The north shaft is now down 253 feet, showing at this depth 44 feet of clean quartz of good grade, and the vein five feet wide between walls which are clearly defined. Two drills are working day and night at this point, and it is expected that we will reach the 300 foot level by the 20th of September." Mr. William Brown, the representative of the Canadian Rand Drill Company (who are installing the twelve drill compressor plant) is on the ground, and the work is progressing satisfactorily. With the facilities at our command at present, we were only able to keep the mill running eleven days and eight hours from the 19th of June till the 31st of July, crushing 444 tons of ore, with an actual value at the U.S. mint of \$4,549.43, being a little better than four hundred dollars a day for the time the mill was actually running. Until our compressor plant is installed, we do not expect to be able to keep the mill running with present facilities to any great extent. The new plant should be installed and in operation by the beginning of October, and there at present appears no reason why, from the middle of November, or possibly earlier, the mill should not be kept running continuously for some years to come.

In their monthly report under date September 1st, Messrs. Amelius Jarvis & Co., report:

The paper read by Roberts-Austin before the British Association on the 27th inst., dealt with the mineral resources of this province. The pronouncement by such an authority as to their great commercial value must help to press on the investor the importance of this new opening for capital. The actual results of the month add to his facts and accentuate the correctness of his views. The Mikado's twenty-stamp mill started running on the 9th, and the results show an average 2 oz. to the ton, which is well above the estimate. 15 feet shaft on A.L. 138 shows the reef running over 5 oz. The Preston shows free gold all the way down to the 125 feet level. On the Yum Yum diamond drills have found No. 3 reef rapidly widening to 20 feet with a 5 feet pay streak on the hanging wall, whilst the Gold Coin shows an average of over 2 oz.

Fresh discoveries in Manitoba are reported, and a large area north of Dryden round Sandy Lake, Big Vermilion, and Minnetoskie, with reefs of good size, mostly free milling, and assays fairly high. One property opened on Sandy Lake shows \$27.50 stone to the 30 feet level. In the Township of Battie a rich silver lead vein has been opened, which, at a depth of 25 feet, yields from \$56 to \$300 to the ton. Near Schrieber a big sulphur deposit, running for over two miles, 7 feet wide on the surface, has been discovered. In the hillside, down which the outcrop runs, three tunnels are being driven in, at 50 feet levels, to prove. In the same region some very promising locations are being opened up, some of which are under option to London; whilst further east, near Lake Wawa, some remarkable reefs are reported, average samples of which run over 5 oz. Another point of interest is that the rumors of placer deposits, which have for some months been continually cropping up, appear to be not without foundation in fact. On Big Stone Bay a deposit of decomposed rock and glacial detritus of some extent has assayed high values, and from Lac Seul and the Albany River important discoveries are reported. The characteristics of this northern area make it very possible that these reports are true. Samples of dust have been brought down purporting to come from this source, and a party has been sent up to examine and verify.

Prices for the leading companies closed for the month:—

Saw-Bill, \$2.55-\$2.65; Hawk Bay, 90-95c.; Empress, 3-5c.; Foley, \$2-\$2.20; Princess, 25-30c.; Hammond Reef, 30-35c.; Bannockburn, 5-10c.; Hiawatha, 10-15c.

Locations in prospectors' hands have been in good demand, more especially those situated in the Saw-Bill and Seine River districts, and have sold freely at prices varying from \$200 and Government charges, to \$1,200.

Locations with demonstration work changed hands at figures ranging from \$5,000 to \$15,000, while options have been arranged at considerably higher figures. Amongst others a Steep Rock location was taken at \$10,000 by English capital. Cameron Island was sold for \$15,000. H. B. S3 \$12,000. T. 167 and A. L. 181 optioned at \$35,000, and K. 22 at \$12,000.

Work on A. D. 2 is progressing, and a Tremaine steam stamp mill is being erected. Gold Horn has a reef proved 10 feet in width running at out 3 oz. On the Gold Coin they are now down 50 feet, with a 5 feet reef; it is reported as averaging 2 oz. About 40 tons has been sent to the Rat Portage Customs Mill for test crushing. Here the country-rock on either side for some 50 feet assays gold, a feature that repeats itself on the Saw-Bill, where, it is reported, not a little of the protogene will pay to mill. 455 X, like all the Saw-Bill district properties upon which developments have proceeded, is opening up extremely well. The rapid improvement at slight depth of reefs assaying extremely low on the surface, which is a characteristic of the Rainy River District, is well exemplified by this property. Average samples taken and assayed by Prof. Hille, run, surface, \$3.8 feet \$5, 12 feet \$10, 19 feet visible gold. The Ferguson will shortly recommence operations, a new Superintendent having been appointed. The Bannockburn has resumed work after a thorough refitting, and is putting through from 15 to 18 tons a day; percentage of extraction is reported as being very high. Canadian Goldfields Company are putting out gold, but are very reticent about their mine and process. The latter seems rather unnecessary, as it will probably be very difficult to distinguish it from the methods of Cassel's Gold Extracting Company's patents. A little more candor would give the public greater confidence. On the Hammond Reef everything is now ready to start crushing, whilst the 10 stamp mill of the Saw-Bill started on the 25th, and the latest reports from both are satisfactory. As noticed above, the Mikado Mill is now in operation. This is an English company with an authorized capital of £45,000, for which a special settling day in January, 1896, was appointed by the Stock Exchange Committee. The locations consist of D 147-S 9. The reef is about 5 feet wide striking N.E. and S.W. with a steep dip to the E. The shaft is down 125 feet with levels at 60 and 120 feet. The ore is almost free milling and 90 per cent. extraction is estimated. There is no concentrating plant, as the pulp is conveyed to settling and leaching vats for cyaniding. The Regina, which is another English Company has an authorized capital of £150,000. The Stock Exchange Committee granted a special settlement in 127, 118 shares, 19s.-paid, in February of this year. The Company also carries debenture bonds for £16,000, 10 per cent. redeemable in 1900. The shaft is now down 325 feet where the reef, which was 3 to 5 feet on the surface, has widened to between 5 and 6 feet. There are five levels run about every 10 fathoms amounting in all to about 1,300 feet. The estimate of the ore all through is \$13 to \$14, and as the permanency of the reef is practically assured there is no doubt that the Company have a very valuable property. The present mill is not giving satisfaction, but arrangements for an enlarged plant are under consideration.

The shareholders of the Foley have taken up 36,000 new shares at \$2.00 per share, leaving 14,000 shares in the treasury. This has enabled the Company to clear off all its indebtedness, leaving enough to pay for and erect the

new compressor plant and to push on work steadily. The mill will not be running regularly until the new compressor plant is in working order, the present small one being inadequate to keep the mill fully supplied. Between 19th June and end of July the mill ran for 11 days, 8 hours, putting through 444 tons, yielding \$4,549.43 over the plates. The main shaft is now down 253 feet and the reef had widened 5 feet, 44 inches of which is clean quartz. There has been a complete change in the management, all unnecessary expenses have been cut down, and the conduct of affairs appears to have been placed on a thoroughly business basis.

During the month letters patent have been issued incorporating the following companies :—

The John Dwyer Gold Mining Company, of Toronto, Limited, capital \$450,000, in \$1 shares.

The Hastings Silver Lead-Mining Company, Limited, capital \$50,000, in \$10 shares.

The Hiawatha Gold Mining and Milling Company of Ontario, Limited, capital \$500,000 in \$1 shares.

The Great Granite Gold Mining and Developing Company of Ontario, Limited, capital \$5,000,000, in \$1 shares.

Supplementary letters patent have been issued by which the \$100 shares of the Eagle Nest Gold Mining Company of Ontario, have been redivided into \$1 shares.

Ferric Sulphate in Mine Waters and its Action on Metals.

The following paper read before the Colorado Scientific Society will prove of great interest to many of the readers of the REVIEW :—

"About three years ago Mr. C. A. Gehrman, general manager of the Stanley mine at Idaho Springs, requested me to make an analysis of the water he was pumping from the shaft. He stated that its corrosive action was so great that ordinary iron pipe could not long resist it. At that time he was pumping by steam, allowing the exhaust to pass into the water of the sump, under which conditions wrought iron pipe lasted only about a week. While the life of the iron pipe was somewhat lengthened by substituting air for steam, it was much too short to be satisfactory. Mr. Gehrman himself made a number of experiments with a view to avoiding the expense and trouble of frequent renewals of the pipe line, the maintenance of which 600 feet in length had become a serious item of expense. Without having investigated the subject, but from general impressions, and from the remarks of mining men who had experienced the same trouble, I attributed the action to sulphuric acid in the free state, and at once suggested the use of a pipe line of pure metallic copper. This would resist the action of the sulphuric acid, and at the same time would be unaffected by the copper sulphate, which existed in quite large proportion in the water, and against which no other metal would stand. Mr. Gehrman replied that the water had puzzled him, for the very reason that copper dissolved in it readily, and not only copper, but all the alloys which he had tried. His experiments were made by boiling the metals or alloys in a finely divided condition in the water itself, using a glass flask, and timing the operation so as to obtain comparative results. This matter was submitted to me about the time that I was engaged in investigating the method of determining iron by reduction with lead, on which a paper has already been read before the society. The experiments made in connection therewith suggested the cause of the extremely corrosive action of the mine water in question, and without going into details it will be sufficient to state in general terms the nature and results of the experiments.

"Before going further it might be advisable to call to mind the solubility of the ordinary metals in hydrochloric and sulphuric acids, the only acids likely to occur in such waters. Gold is quite insoluble in either sulphuric or hydrochloric acid, but dissolves readily in free chlorine. Silver is readily soluble in nitric acid, but it is insoluble in either dilute hydrochloric or sulphuric acids. Mercury, copper and lead are affected in the same way as silver by dilute acids; lead, however, is less liable to attack by sulphuric acid, owing to its sulphate being insoluble in that acid when dilute. Tin is readily soluble in either hydrochloric or sulphuric acids, strong or dilute. Iron and zinc are readily soluble in all three acids, the iron forming with hydrochloric acid ferrous sulphate. Aluminum dissolves only slightly in dilute sulphuric acid when cold; more readily on boiling. Hydrochloric acid dissolves it readily, hot or cold.

"It will thus be seen that gold is the only metal which completely resists the action of all the acids. Of the common metals, copper and lead come next in order, while tin, iron and zinc are the most readily dissolved. Hence it would be inadvisable to use alloys containing either of the three latter metals, as they would dissolve out, leaving the more resistant metal in a spongy condition. The first step in the investigation was a complete analysis of the water, and accordingly a large glass bottle was filled at the sump. The sample of water on its arrival in Denver contained a considerable amount of a muddy brown precipitate, which was filtered out and analyzed, with the following results :

	Per cent.
Ferric oxide	53.57
Aluminum oxide.....	2.87
Silica.....	10.85
Sulphuric anhydride	11.46
Water	21.14
	99.89

"The precipitated material was dried on a water bath before analysis, and is evidently a hydrated basic sulphate of iron. The analysis of the water filtered off from the precipitate gave the following results :

	Parts in one thousand.
Silica.....	0438000
Sodic chloride.....	0134500
Sodic sulphate.....	3117200
Potassic sulphate.....	1554800
Aluminic sulphate.....	0197870
Zinc sulphate.....	1224400
Manganous sulphate.....	4271400
Magnesian sulphate.....	4674600
Calcic sulphate.....	6362900
Ferric sulphate.....	6033600
Ferrous sulphate.....	0093370
Cupric sulphate.....	1918010

3.0020650

"The last analysis is somewhat remarkable, showing as it does the presence of an extremely small amount of chlorides, the large number of bases in solution, and a large amount of ferric sulphate. The corrosive action of the water is undoubtedly due, in part, to the presence of copper sulphate, but its solvent power for copper was found to be entirely due to the action of the ferric sulphate. Free sulphuric acid was not present. This was proved by the presence of basic sulphate, by the precipitation during evaporation of an additional amount of this substance due to oxidation of the remaining ferrous sulphate, (if free acid were present the precipitate would not be formed,) and by the amount of the acid found, which when calculated to form salts with the respective bases, showed no excess. The water had a strongly acid reaction on litmus paper, but for that matter all ferric salts have an acid reaction.

"Experiments were then tried on finely divided metals with solutions of ferric sulphate, and it was found that silver, copper, antimony and bismuth readily dissolved, (it must be remembered that neither of these metals is practically insoluble, owing to the formation of the insoluble sulphate. Gold, precipitated from a solution of the chloride by aluminum, was boiled for about 10 minutes with a strong solution; but no action could be detected. The addition of salt, and boiling for some time longer showed a faint trace. When it is remembered that ferrous sulphate is a good precipitant for gold, it is seen that it can not pass into solution by this reaction. Experiments were then tried substituting ferric chloride for the sulphate. In this case the lead dissolved readily, since the lead chloride formed is soluble in boiling solutions. Copper, bismuth and antimony dissolved readily. Silver was converted into the chloride, but only partially. Mercury bumped violently, becoming dirty gray, as if mercurous chloride were formed, which is probable. Gold did not dissolve, and after boiling for about 10 minutes only a trace of ferrous iron could be detected. The addition of MnO₂, however, producing free chlorine with the free acid, caused rapid solution. The method employed was to precipitate, in the metallic form, from a suitable solution by means of aluminum foil, dissolve the precipitated metal in either ferric sulphate or chloride, and titrate the ferrous salt produced. The results are, however, liable to be too low, owing to the oxidation of the iron by the air. If the reaction were performed in a flask, in an atmosphere of steam or carbonic acid, I have no doubt that this trouble would be avoided. The results of the practical experiments on a large scale may now be stated. After the iron pipe was found worthless, lead-lined pipe was tried. This, while a little better than the iron, did not prove satisfactory, for the lead being too soft to withstand the friction was cut out too rapidly. Wooden pipe was then tried, built on the Allen principle. The staves were two inches thick, of Chicago pine, banded with half-inch No. 0 iron, asphalted heavily. The inside diameter of the pipe was four inches. This pipe lasted over a year, but proved unsatisfactory, for the wood fibers were loosened, and catching the pump packing the pipe soon became clogged with the precipitated ferric hydroxide.

"A pipe of copper with a very small amount of zinc was next tried. This soon became spongy, the zinc being dissolved out, and after a short time it gave way at the joints. A gutta percha pipe which was tried was found to be too soft to stand both pressure and friction, giving way at the joints. The weak spots in all the pipes were where the threads for making the screw connections occurred. Finally, as a result of the above investigations, it was decided to try bronze, with the smallest practical amount of tin, or better, aluminum. The bronze pipe has now been in place for two years, and is good for at least another year, when it will be replaced, if necessary, by one of aluminum bronze, which I think will prove entirely satisfactory. Pumping during the last two years has been done entirely by compressed air, the air compressor being worked by water power."

Mr. Jones' views were then discussed by members of the society, as follows :

E. B. Kirby.—The practical question upon which this investigation bears is that of the best material for pump parts and columns. There does not seem so much difficulty with the former as the latter, and it is one of the features in mine drainage which does not seem to have been fully developed. A very satisfactory column pipe for corrosive waters was in use a few years ago at the Buell mine at Central City. This was common wrought iron pipe with a wooden lining, which was inserted in the pipe lengths at the mine. It was made of pine staves, about three-fourths of an inch thick, and one and one-half inches wide, carefully fitted by a good carpenter, and the last, or key stave, was made like a wedge, with one end smaller than the other. Its two neighbors had a corresponding taper, so that when the key was driven in from one end of the pipe the entire lining was wedged. This seemed entirely satisfactory. The cost of the lining was not great, and while the waters were remarkably corrosive the wood appeared to be sound and the iron uninjured. The old lengths I examined had been in use over a year.

Philip Argall—I cannot quite agree with Prof. Kirby's statement that the protection of pump columns from the action of corrosive mine waters is not fully solved. It has been satisfactorily solved in Europe for over 50 years, and very much in the way Prof. Kirby describes it, viz: lining the pipes with wood. My personal recollection of this matter goes back 35 years, when as a boy I saw the cast iron pipes being lined with wood for use

in the Irish copper mines of Wicklow. Later it was my privilege to be engaged in the various gradations of mining, extending from the precipitation of the copper out of the mine waters at the surface, through the manifold conditions incident to underground work, finally reaching the position of assistant manager. Seven years so spent gave ample opportunity to observe the utility of wood lining, and I have simply to say I never knew or even heard of its failure to protect pipes from internal corrosion. The standard practice in the Wicklow mines consisted in lining the cast iron pipes with half inch soft pine strips, making the suction pipes of hard wood (usually beech) and the plungers and valves of bronze. The portion of the valve which had a bearing on the valve seat was made of leather, attached by copper rivets to the bronze valve. These rivets very often corroded. In the wood lined pump column, accretions of ochre occurred, so that it became necessary to pass scrapers through them about once a year. A large revenue was derived from the copper precipitated from the waters of these mines. In one case I remember the mine waters were pumped out of the workings for several years after active mining had ceased, the presumption being that the copper collected as precipitate gave a profit on the work.

Ernest Le Neve Foster.—The action of corrosive mine waters has been a source of much trouble and expense at many of the mines in Gilpin county, and their presence has always presented serious difficulties to the miners of that section. The Saratoga mine, in Russell gulch, has had the reputation of having about the worst water to contend with. Pumps and column pipe were eaten out in a short time, and constant renewals not only caused great expense, but interfered very much with the mining operations. Bronze pumps and other expedients were tried but with little improvement in conditions. About four years ago, the property having been placed under my supervision, my attention was directed to the subject. At that time the pumping was done by a compound condensing Knowles pump, and the column was made of wrought iron with cast iron flanges screwed on. It was observed that the action of the water was more severe on the wrought iron, and that cast iron was attacked in a less degree. Another point noticed was that the action was increased as the pressure increased, that is to say, that the lower pipes were eaten away more rapidly than those above, especially in the case where small leaks occurred, which enlarged rapidly, so that a pin hole would in the course of a few hours become a large leak. One of the chief causes of trouble was the liability to leakage around the threads of the flanges, as the slightest imperfection in these gave an opportunity for a small leak, which, as before stated, was rapidly enlarged. The bolts holding the flanges together would sometimes be eaten out, if there happened to be an imperfect gasket that permitted a leak, and in one instance called to my attention a five-eighths inch bolt was in less than 48 hours reduced to only one-eighth in size. The corrosive action of this water has usually been attributed to free sulphuric acid, but no very accurate analysis of the water has been made, the only one known to exist was made by the Keystone Chemical company for the purpose of determining its qualities, so as to purify it for boiler use, and, therefore is not as complete as is desirable. This analysis showed that a U.S. gallon contained:

	Grains.
Sulphate of lime.....	17.63
Sulphate of magnesia.....	3.54
Chloride of sodium.....	0.59
Sulphate of iron.....	13.79
Free sulphuric acid.....	3.20
Sand.....	6.96
Volatile and organic matter.....	5.49
Total.....	51.20

Whether the iron was present as ferric or ferrous salts was not determined. No copper is given in this analysis, but it is almost certain that at least a small amount of it would be found by a more complete analysis, although the ores of the mine do not contain many copper minerals, and those occur only in small quantity. It having become necessary on account of the destruction of the pumps and column to install an entirely new plant, it was decided to replace the steam pumps by a Cornish pump with clack seats and clacks made of bronze, and all other parts of cast iron. Cast iron was also selected as the material for the stand pipe, and the pipe and flanges were cast in one piece. This plant was installed 20 months ago, and since its installation there has never been any trouble from the corrosive action of the water, and the plungers, which are also made of cast iron, are as smooth to-day as the day they were put in. It might here be mentioned that the action of the mine water dripping on iron is much more severe than when the iron is simply immersed in it. A drop of the water falling from the back of a level on to a 12 pound tee rail will cut it in two in the course of a few weeks. An interesting instance of immersion was presented in the case of a steam pump which was submerged two years. The steam pipe was of ordinary wrought iron two inches in diameter, whilst the column was five inch cast iron. These were side by side. On being taken out it was found that the wrought iron pipe was scarcely thicker than paper and worthless, while the cast iron one was apparently as good as the day it was put in. The same action was noticeable on the wrought and cast iron portions of the pump itself. Whatever the cause of the corrosive action, whether from free sulphuric acid, as shown by the analysis, or from the presence of ferric salts as suggested by Prof. Jones in his valuable paper, it has in this case been practically overcome by the use of cast iron, and keeping the temperature of the mine water as low as possible. It is to the latter cause, probably more than any other, that is to be attributed the marked success made in this instance. For the protection on the outside of the pipes painting thickly with asphaltum varnish has been found a very excellent plant in this mine.

The Metallurgical Industries in Canada.

In connection with the meeting of the British Association, held last month at Toronto, Professor Roberts-Austen, C.B., F.R.S., delivered an evening discourse on "Canada's Metals." The subject, Professor Roberts-Austen said, was chosen because the strength of a nation depends in no small measure on

its metals, and in the near future he considered that the mother country would turn to her eldest daughter, the one who is nearest home, for the supply of those metals upon which the material welfare and industrial progress of the Empire depend. The vast area of the Dominion and Newfoundland, with its 3,617,000 square miles, rendered the lecturer's task no easy one, and at the outset due acknowledgment was made to those who had done so much to reveal stratigraphically the mineral wealth of the Dominion, for, as was pointed out, Canada had been splendidly served by the officers of the Geological Survey. A large geological map, some 30 feet long, specially prepared for the purposes of the lecture, embodied the results of the labours of Logan, of Selwyn, of Dawson, and of many others whose names are as well known in England as in the Dominion. As a tribute to the admirable services of the officers of the Survey it was stated that their reports often appeal to the reader by expressing in a few words, as dignified as they are picturesque, results of arduous work in wild and almost inaccessible regions. The main, geological distribution of strata from the Atlantic to the Pacific was then considered at some length, following Dr. Dawson's arrangement, which divides Canada into three divisions—the eastern, central and western. The eastern extends from the Atlantic to Lake Superior and northward by the chain of lakes to the Arctic Ocean near the mouth of the Mackenzie River; the central division extends from the western boundary of the eastern to the base of the Rocky Mountains, and runs northward with narrowing dimensions to beyond the Arctic Circle; while the western division comprises all the territory, including the Rocky Mountains, to the Pacific. Reference to the geological map showed the way in which the formations are distributed, but without the aid of a map it would be difficult to briefly describe this portion of the lecture. Canada's principal metals are gold, silver, nickel, copper, lead and iron. There is also manganese, chromium, antimony, mercury and zinc, besides platinum, and rarer metals such as molybdenum, which, though sparsely distributed in nature, seem to exert, when alloyed with other metals, an influence on their physical properties out of all proportion to the amount actually present.

The gold is at present obtained mainly from the provinces of British Columbia, Ontario and Nova Scotia. In the latter province the first discovery was made in 1860, and in the year 1867 alone no less than £108,000 worth of gold was produced. Professor Austen pointed out, however, that in speaking of the Dominion generally the richness of the deposits and the hopefulness of prospects must be kept in view rather than the immediate output, but the significant fact should be remembered that since the visit of the British Association to Montreal in 1884 the mineral production of the Dominion had more than doubled. It is well known that Canada possesses great riches, but it was easy to lose sight of the fact that the recognition of the extent and variety of her mineral wealth is comparatively recent, and that the development of the mining and metallurgical industries had been slow. This is due to many causes, one of which is that the early history of the western portion of Canada is closely woven with that of the company of "Adventurers of England trading into Hudson's Bay," to give them the picturesque title in the charter granted by King Charles II. in 1670 to a body of men who achieved results of which our nation has reason to be proud, though their efforts were not directed to the development of the mineral industries. Formerly the policy of this great company was to preserve their territory in its primeval state as the home of animals useful for their fur. Hence, to name only the smaller animals, the silver fox was more carefully sought for than silver ore, and miniver and minx than minerals. Some thirty years ago this policy showed signs of change, and Professor Roberts-Austen stated that his first metallurgical work had been done for Canada, for Sir Donald Smith, now chairman of the Hudson's Bay Company and Canada's High Commissioner to the mother country, had sent him some samples of silver and copper ore to examine. There were other reasons why the mineral resources of Canada had been slowly developed. We in England are not as familiar as we should be with the real merits of Canada's beautiful climate, which is "hot in summer, cold in winter, but always dry," as Sir Wilfrid Laurier had recently described it to be. Another reason was that, favourably situated for water transit as Canada is by her magnificent network of lakes and rivers, it was not until the continent was traversed from ocean to ocean by the railway system that mining districts could be freely opened. Professor Austen, without naming any individual mines or companies, passed in review the present state and prospects of the supply of precious metal in the provinces of Quebec and Ontario, quoting in all cases the authorities, which usually consisted of official reports. As regards Ontario it was stated that discoveries of gold had been made over an area of some 2,000 miles, throughout a tract 100 miles wide and 200 miles long. At the present time, however, interest is mainly centred in British Columbia and in Ontario, as the gold-producing districts of the West, the literature of this portion of the subject being, it was stated, very voluminous and of general interest. From the sluice boxes of the Cariboo district alone some £12,000,000 worth of gold dust and nuggets had issued, and this in a district situated in a densely forested, mountainous region, which, on account of its inaccessible character, had remained unknown even to the wandering native hunters. The future of that wonderful district in the far north-western territory, the Yukon River and its tributaries, was then considered. The great silver and argentiferous lead districts of Canada were briefly described, and it was stated that the Slocan silver-lead mines and those of Tail Creek and East and West Kootenay appeared to be of extraordinary richness.

The great part Canada might be expected to play, as regards the production of iron and steel, when means of transit were improved, was then dealt with. The audience were reminded that it was in the essay entitled "Of the True Greatness of Kingdoms and Estates" that Bacon quoted Solon's warning to Cræsus, which was to the effect that he who had iron would possess the gold. This transfer would not be brought about by the operation of the law framed by Bacon's youthful contemporary, Gresham, which states that a cheaper metal will replace the noble one. Solon pointed to the possession of superior armaments, and his lesson has not been forgotten. We at the present day are not unmindful either of the amount or quality of our iron and steel, and it would never be forgotten that the chief incidents in the first official visit of her Majesty the Queen in connection with the commemoration of the sixtieth year of her reign occurred at Sheffield, where her Majesty saw a 56-ton armour plate rolled for the battleship "Ocean." Canadian visitors to the Naval Review on June 26th last must have realized the

importance of the part played by the metallurgist and engineer in enabling our Empire to maintain her great place in the world. Sir William White, the Chief Constructor of the Navy, enabled Professor Roberts-Austen to give the estimate that no less than 300,000 tons of iron and steel were aloft in the ships of the Royal Navy comprising that magnificent fleet assembled at Spithead. Bearing in mind the fact that only one-half of the steel produced in the United Kingdom is derived from British ores, it was unnecessary to say much more in pleading that the resources of the Dominion as regards iron and steel should be made available as quickly as possible for the service of the Empire. This portion of the subject concluded with a few words of warning. It had been perceptibly said that the old miners opened holes on a lull-side, while modern miners too often merely opened offices on leading thoroughfares. It was of great importance that the highest technical skill and professional knowledge should be brought to bear on the mining and metallurgical industries of Canada, and the services of Canadians of much experience were fortunately available, and graduates of the Royal School of Mines of England and of the Canadian Schools of Mines might well be consulted before great projects were set on foot, and there need then be but little fear of the reckless speculation which too often wrecked new mining districts. There was abundant justification for the opinion recently expressed by Dr. Dawson—that the position of mining in Canada is most hopeful in every respect. Professor Austen stated that this was only his second visit to Canada, and he had little direct experience of some districts, but he trusted that those in England who intended to aid in the development of Canada's metals would consult the reports of the Geological Survey, and would avail themselves of the information which could be readily obtained at the office of the High Commissioner for Canada, at the Imperial Institute and at the Colonial Institute.

Turning to the experimental portion of the subject, it was stated that it was impossible to appreciate the relative importance of the metals of any one country without possessing some insight into the distinctive physical behaviour of metals generally. Canada had in great abundance the metal nickel, which she showed to be of special interest in connection with the metallurgy of steel. What, then, are the distinctive properties of metals, and how is the investigation of these properties related to the advancement of science, which it is the object of the British Association to promote? The whole tendency of modern work had been to break down the barrier between metals and the so-called non-metallic elements. It had been proved, moreover, that the three states of matter, solid, liquid and gaseous, merge imperceptibly into each other, and that even in a solid some molecules were present which retain the freedom of motion characteristic of gaseous molecules. Much care was devoted to showing experimentally that the behaviour of a solid metal may closely resemble that of a fluid one, and that a fluid one in turn shares the properties of an ordinary non-metallic fluid. Water in flowing in a vertical stream through a narrow orifice breaks away into characteristic drops and droplets. Professor Boys had, by instantaneous photography, pictured such water-drops. Professor Austen had done the same with a fluid stream of pure molten gold, and he found that the drops and droplets of gold were identical with those of water. Again, a sphere falling from a height of a foot or two into water produced a remarkable "splash," which within the tenth of a second changed from a coronet-shaped splash into a columnar one some two inches high. Professor Worthington had taught us how to photograph such splashes. Professor Austen stated that there was an old tradition that much might be effected by shooting with a silver bullet. He had, for the purposes of the lecture, cast bullets of pure gold, and had photographed the splashes they made when they fell into a pool of molten gold, and found that the gold splash and the splash of water or milk were identical. Further, it was shown that when a solid projectile of steel was urged against a steel armour-plate with a velocity of some 1,600 ft. a second, the projectile produced in one three-thousandths of a second a splash of the solid steel plate, which in turn bore strange resemblance to the fluid gold splash. Hence it was evident that solid steel really behaved like viscous fluid, and knowing this, a valuable indication was gained as to the treatment the metal should receive to fit it for defence purposes. A steel armour-plate might, by the suitable addition of other elements, be either stiffened or made more viscous in order to meet definite conditions. Metallurgists had recognized this, for the addition of one of Canada's metals, nickel, produced some remarkable effects on steel and enabled it to resist the attack of projectiles. Hence the importance to the Empire of Canada's great and almost unique deposits of nickel ore. The investigations of Guillaume on nickel steels were then referred to. It was shown experimentally that steel containing 22 per cent. of nickel expands more when heated than ordinary steel does, while steel with 37 per cent. of nickel hardly expands at all, so that a variation of 15 per cent. of nickel in steel entirely changed the nature of the material. As an example of the extreme mobility of solid metals it was shown that metals will diffuse into each other even when solid, just as gases diffuse into each other, though, of course, with much less rapidity. A very difficult experiment was then shown by the aid of a thermo-junction. A curve representing the solidification of nickel was traced upon a piece of smoked glass, which was placed in a lantern and slowly raised by clockwork. The curve of solidification thus appeared in a few seconds on a screen some 20 ft. across. Some very beautiful effects were then produced by reflecting on the screen a bath of chromium kept melted in an electric furnace at a temperature of some 5,000 degs. Fahr. The experiments shown taught that metals even when solid were not the inert things they were supposed to be, they were really vibrating masses of great complexity. At the same time the behaviour of metals and alloys at high temperatures in the electric furnace led us to the consideration of what happened to metals in the atmosphere of the sun. Metals are, in fact, sensitive things, almost sentient in their organisation, strangely lifelike in their behaviour. Of their genesis much might be written, and most physicists and chemists are now ready to accept, at least in principle, as the result of the lifelong work of Sir Norman Lockyer, the hypothesis that the phenomena of the inorganic world are dominated by an evolution not less majestic, although much more simple, than that now universally accepted in the case of organic nature. For the main evidence on which this hypothesis rests we have hitherto turned to the spectral analyses of the glowing atmosphere of the sun. There may be some who dread the extension of the great principle of evolution which these words imply, and shrink from recognizing that the elements, as we know them, have, like our own

species, been derived from simpler forms. If there were any such present, Professor Roberts-Austen said he would remind them that Sir Thomas Browne, in 1642, had anticipated their fears by stating in his *Pseudodoxia* that "there is surely a piece of Divinity in us, something that was before the elements and owes no homage unto the sun." It is the province of the British Association to consider such questions as the origin of the metals. The metallurgist is beginning to study the molecular motion in solid metal, which makes them so like living organisms. The miner, on the other hand, accepts metals as he finds them, and may be content to enter upon the splendid heritage which Canada's metals present.

The Cyanide-Process in the United States.*

By GEORGE A. PACKARD, Boston, Mass.

When, in April, 1892, the writer began experimenting with the cyanide process, it had already proved a success in the treatment of tailings, but had not become an important factor as a primary method of ore-treatment. The Livingston, Colorado, mill was running a few small agitators; the Mercur mill, in Utah, was said to be a success, but was "closed down to increase capacity," and Mr. R. B. Paul, in Shasta county, California, was running ore through a stamp-mill into leaching-vats, using a weak cyanide solution in the battery. Mills had been, or were being, erected in Arizona, on the Comstock lode, and in South Dakota. Some of these never started, and several were shut down or remodelled for other processes. Altogether, the outlook was anything but favourable.

Many of these mills were planned to make use of agitation, and a cyanide solution containing at least 1 per cent. of potassium cyanide was employed. Since then the improvement of the process, both chemically and mechanically, has placed it among the recognized successful methods of ore-treatment.

Within the past year I have visited a large number of cyanide mills, and have collected considerable data, of which I publish enough herewith to give an idea of the development of the process, and of the methods followed in the principal mills. I would say, however, that nearly all of these plants are experimenting, most of them employing experienced chemists, and are so constantly making improvements, increasing extraction and decreasing cost of treatment, that the figures here given are only approximate.

Table I shows the character and approximate composition of the ore treated by cyanide at a number of mills, and Table II gives the details of treatment.

The process has been applied on a large scale only to rather low-grade, highly siliceous ores, containing but a small percentage of base metals, and having their value principally in gold. In fact, the cyanide process has a field of its own. I have been told of one instance in which cyanide competed successfully with the smelters on ore, carrying as high as 4 ounces of gold, the ore being one in which the value was easily extracted to a high percentage. In the Cripple Creek district, where an extraction of 90 per cent. is obtained in from four to six days, and where the smelting charges were from \$5 to \$7 per ton, ore running as high as \$30 was in 1895 bought by the cyanide mills.

With silver-ores, while some very good results have been obtained, the length of time required for treatment has usually been too long, and the consumption of cyanide too high, for the process to give economical results. There are, however, several plants in the vicinity of Tombstone, Arizona, working on silver-ores. In the case of ores containing from 1 to 10 ounces of silver, in addition to a commercial gold value, the process has been advantageously employed. Thus the Golden Reward Company, in South Dakota, having certain ores containing from 1 to 5 ounces of silver which was lost in chlorination has built an addition to the plant, in which such ores are treated with cyanide.

Chlorination is the only process the field of which the cyanide method is seriously invading. For mines located at a considerable distance from a railroad, the cost of transportation of the chemicals used in chlorination has been hitherto an almost prohibitory factor; and here, at least until the use of liquid chlorine becomes a practical success, cyanide has the advantage. At the Golden Reward plant, early in 1895, they were using for chlorination about 35 pounds of chemicals per ton of ore, while only 2½ pounds were necessary for treating 1 ton with cyanide. As already observed, if there is silver present, the cyanide has the advantage that part of the silver is recovered; but, so far as my observation goes, the gold-extraction is usually higher by chlorination than by cyanide.

With amalgamation, cyanide enters into competition only in the case of very finely-divided gold, which is saved more or less successfully in pans. Generally speaking, ores suited to one process are not suited to the other. Thus at the mill at Cooke, Montana, there was a sudden change in the character of the ore. A quantity of very fine free gold appeared in a mine where a "color" had but rarely been seen before. This gold, although so fine as to pass through a 60-mesh screen, could not be extracted by the strength of the solution employed, and in the length of time usually allowed on the ore there being treated, while the value of this new ore was too low to permit the use of a stronger solution (entailing larger cyanide consumption) or a longer time. To save this gold, and a little pyrites, the tails were passed over a system of riffles and blankets. A similar arrangement has since been used at one of the Florence, Colorado, mills, to save the coarse gold resulting from roasting ores containing tellurides.

The treatment of low-grade concentrates has not generally proved a success, on account of the long time and high consumption of cyanide involved; and smelter rates are too favorable to make the process profitable on high-grade concentrates, save in exceptional cases.

There are at least two districts in this country where the cyanide process has proved a panacea: Camp Floyd (Mercur) Utah, and Gift Edge, Montana. To these Cripple Creek might be added; for the ability to sell low-grade ores has certainly aided largely in the development of that camp.

* American Institute of Mining Engineers: Colorado Meeting, September, 1896.

At Mercur, Mr. E. A. Schweider* says "the gold occurs as a fine coating on particles of magnetic iron in limestone." The ore is somewhat porous, and the value occurs largely along certain lines of cleavage which become the lines of fracture, enabling the ore to be treated with only a very coarse crushing. In fact, at one mill, the Marion, treating fifty tons a day, the only crushing machinery is a No. 2 Gates crusher, from which the ore goes to a 7/8-inch mesh trommel, the oversize being returned. In nearly all of the mines in this district some cinnabar and more or less arsenic occurs; much of it, however, is deposited on the hanging-wall in such a manner that very little is sent to the mills. At the Marion mill, I was told that they sometimes retorted the "slimes" on cleaning up, in order to save the quick-silver deposited on the zinc. At the Geyser mill I was told that they sometimes found arsenic as the oxide, though never enough to amount to 1/2 per cent. All of the arsenic which I saw in the district was a sulphide. It has been found that the presence of a very small quantity of arsenic in the ores soon fouls the solutions so that they cannot be titrated for standardizing; and at most of the mills the solution is thrown away if it becomes badly fouled.

The Gilt Edge ore contains porphyry and limestone, and is not unlike the ores of the Camp Floyd district. There are but two mills in operation here.

The ores of the Cripple Creek district are porphyry (or phonolite), containing a fraction of 1 per cent. of tellurium, some of which, as Prof. Anderson, of the American Reduction Co., informs me is combined with gold and some with iron. When the tellurium occurs in the oxidized condition, the ores are easily treated raw; but in the case of other ores a preliminary roast is required. Up to the present time the glut of ore at Cripple Creek has been so great that the cyanide plants have been able to discriminate closely in buying, and have avoided ores which offered either chemical or mechanical difficulties. I am told that the roasting of ores in this district is done largely for mechanical reasons, as the ore leaches much more freely after roasting.

In South Dakota the ores all contain a little sulphur, and in some the sulphur runs as high as 5 per cent. Both mills have found that a higher extraction is obtainable after roasting, but it is accompanied by a higher consumption of cyanide.

A plant at Plumas was operated for a time on concentrates, but was abandoned, being unable to compete with the smelter.

In general, ores containing much sulphur have given unsatisfactory results. I obtained some very good extractions in tests of small quantities of pyritic ores, at Cooke, Mont., using cyanogen bromide, and Mr. H. C. Cutter obtained similar results at the University of Minnesota. Mr. Wallace Macgregor, in charge of the Congress, Ariz., cyanide-mill, reports a 93 per cent. extraction from ore containing pyrites, which had received but a slight roast, and which he treated with potassium cyanide alone. Mr. Macgregor, in some recent experiments on ores containing a small percentage of pyrites, found that where the ore received a thorough roast, the consumption of cyanide is decreased; and a similar effect has been noticed after roasting at the Florence mill of the American Reduction Co.

The size of ore leached varies from through a 7/8-inch-mesh at the Marion to through a 50-mesh at the Metallic Reduction Co.'s mill at Florence; and the crushing and sizing-machinery ranges from the single Gates crusher and one trommel at the former, to three Gates crushers, three multiple-jaw crushers, six sets of rolls and numerous trommels at the latter.

The method of conveying ore from pulp-bin to leaching-vats is almost universally by cars on a track over the vats. The Commercial mill, at Bingham, Utah, has inclined spouts, through which the ore flows from a centrally located bin into the tanks, and a few mills have bins directly over the tanks.

The vats are usually round, and vary from 9 to 26 feet in diameter and from 2 to 5 feet in depth. A few mills have all-steel tanks. In Utah many of the vats have sides of iron and wooden bottoms—a very satisfactory arrangement. Other mills have vats of pine, cypress or redwood, sometimes unpainted, but usually painted with paraffine or asphaltum paint.

The false bottoms consist of a frame of strips, or of boards, in which 1-inch holes are made, covered with jute or matting. Over this a No. 8 duck is sometimes used, especially if the tank is to be emptied by sluicing. In a few mills a gravel filter is used.

The method of leaching I find to be quite variable. The preliminary treatment includes the use of lime, caustic soda and sodium dioxide. Lime, when used, is mixed directly with the ore. In some cases the pulp is then washed with water until the lime is all washed out. At other mills the solution is put on at once. Caustic soda is used in the same way, and also in solution as a preliminary wash. At the Commercial mill, Bingham, Utah, Mr. Stephens told me he had found that a preliminary treatment with a solution of sodium dioxide in water gave better results than either lime or caustic soda, and considerably decreased the time required for leaching.

Many mills begin the leach by admitting the solution at the bottom of the vat, until the ore is covered. The solution is then turned on top and allowed to run on at the top and drain off at the bottom simultaneously for a certain number of hours, the surface of the ore being kept covered. Very good results are obtained from this mode of treatment when the tanks are allowed to stand for a short time, after the pulp is covered, before the drainage-valve is opened and the solution turned on top. This allows the whole mass to become thoroughly saturated and the slow draining prevents the formation of channels. Any great depth of solution on top of the charge causes it to "pack," and an uneven extraction follows. In the Mercur district the ore is covered with solution, which is allowed to stand for thirty minutes to six hours and then drawn off. This operation is repeated from eight to thirty-five times. Here the material leached is so coarse that there is no danger of "packing." Each operation of covering takes two to six hours. A few mills cover the pulp with solution, allow it to stand forty-eight to ninety-six hours, draw it off and wash. Many of the mills follow the strong solution with a wash of weak solution (1/10 per cent. or less). This is in turn followed by a water-wash, which flows through the zinc-boxes into the weak-solution tank, and becomes the first wash for the next charge.

A few mills warm the solution, and at one mill found facilities for steaming the charge before putting on the solution.

The use of sodium dioxide in connection with cyanide, which is known as the Kendall process, has been adopted at a few mills. Prof. Kendall says that the better results are obtained by adding the freshly made solution of dioxide to the cyanide solution; but many chemists claim that much oxygen is lost in this way, which is made available when the dioxide is mixed, dry, with the ore. The object of the dioxide is to furnish "nascent oxygen," which "acts on the cyanide to liberate cyanogen," hastening the reaction. My own experience with the use of dioxide has been that, in general, a greater extraction is obtained in a short time (twenty-four to forty-eight hours); but that at the end of a long time (seventy-two to one hundred and twenty hours) the extraction with dioxide is about the same as with cyanide alone.

The only method of removing the gold from the solution known to the writer to be in practical use in this country is by precipitation on zinc shavings. An attempt in Arizona to precipitate electrically on lead sheets (not the Siemens-Halske method, no iron anodes being used) proved a failure. The same plant is now experimenting with precipitation by "zinc-fume."

The author shows the form of zinc-box in common use. The box shown is made of 2-inch plank, dressed and bolted together, and painted with paraffine-paint. It has six compartments, 13 x 20 inches in size and 20 inches deep.

The screen on which the fine shavings rest is 4 inches above the bottom. In the bottom of each compartment is a 1-inch pipe, closed by a stop-cock, through which the slimes are drawn off in cleaning up. The zinc-boxes at the Cripple Creek mill have these discharge-pipes at the bottom, through the side, and discharge into a trough leading to a tank. At the Mercur mill long sheet-iron boxes used, having wooden partitions wedged in place. These are easily removed for cleaning-up, and the slimes are all brushed together.

He also shows the form of the boxes at the South Dakota mills. No iron is used in their construction, and they are carefully painted with asphaltum. A series of these is used in lieu of a larger box, divided into compartments. They have the advantage that they are small, and easily handled in cleaning up.

About sixty pounds of zinc shavings are necessary to fill a box of the size shown, and this will precipitate the gold from about 1500 pounds of 0.2 per cent. solution per hour, the solution carrying from 0.1 ounce to 0.8 ounce of gold per ton on entering the zinc-box, and from 0.01 to 0.05 ounce on leaving it. The gold in wash-waters and weaker solutions is less easily precipitated, a much longer contact with the zinc being required.

On cleaning up, the zinc is washed, the slimes are screened through a sieve varying from 1/2-inch-mesh to 60-mesh at different mills, and the coarse stuff is returned to the zinc-box. In this country, where slimes are treated at the mills they are subjected to the action of acid (usually sulphuric), the zinc is thoroughly washed out and the residues are fluxed and melted. A few mills ship the slimes to smelters or refiners, but the difficulty of obtaining a satisfactory sample and the almost constant wide disagreement between buyer and seller have led many smelters to refuse to handle them.

At the Gilt Edge, Montana, mill, an attempt was made to chlorinate the slimes, with only partial success, it being found necessary to roast and melt the residues in order to obtain all the gold.

The consumption of cyanide varies with the character of the ore and depends very little on the amount of gold and silver extracted. It varies from 2 pound per ton, reached occasionally on Cripple Creek ores to 7/8-pound on the Gilt Edge ore. The latter ore is an ideal one for the process, showing no indications of decomposed pyrites and the resulting acid compounds. Acid ores, although a preliminary treatment be given to neutralize the acid, consume more cyanide than others.

The consumption of cyanide in the zinc-boxes varies with the strength of the solution, the length of time it is in contact with the zinc, and the amount of other salts in solution. Using a 1 per cent. cyanide solution, and having mixed with the ore in the tanks an excess of impure lime containing alumina and magnesia, I have had as high as 3 pounds of cyanide per ton of solution consumed in the zinc-boxes. Ordinarily, with a solution of 0.2 per cent. KCy entering the boxes, the consumption is practically nothing. The strength rarely falls below 0.17 per cent. KCy on leaving, and often shows no perceptible loss.

A series of experiments made by the writer last winter indicated that the loss of cyanide in the zinc-box is less when lime is used than when the acid in the ore is neutralized with soda, the excess of lime or soda and resulting salts not being washed out before the cyanide solution is added. The consumption of zinc, however, was slightly less when soda was used. This latter result was confirmed by Mr. Macgregor at the Congress mill.

The cost of "cyaniding" varies largely with the character of the ore. There are a number of mills which crush and "cyanide" ore for less than \$2 a ton, exclusive of royalty paid to the company owning the patents. The lowest cost I have heard of is 85 cents a ton, at the Mercur. No company has yet been able to reduce the cost of treating tailings to the minimum reached in South Africa, 59 cents per ton; but one plant operating under exceptionally favourable conditions is working at a cost of 69 cents a ton. In general, the tailing-plants working in this country do not obtain a high extraction.

There are a large number of tailing-plants in the United States, especially in the south-west, where the hot, dry climate renders expensive buildings and drying machinery unnecessary. Including the output of these mills, I find that nearly 200,000 tons of ore and tailings were treated by cyanide in 1895, producing over 1,000,000 in bullion value.

The first clean-up of the Mikado mine, Lake of the Woods, gave \$16,000 from a ten day run.

Mr. J. Burley Smith, M.E., has started sinking his sub-marine shaft at Bald Indian Bay, Lake of the Woods, Ont. An Ingersoll-Sergeant plant from the Cooper Manufacturing Company, Montreal, is installed.

* Eng. and Min. Jour., May 18, 1895.

Colliery Sinking Extraordinary—Eleven Tons of Water a Minute to a Depth of 150 Yards.*

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

Readers of *The Science and Art of Mining*, closely identified as they are with the coal mining industry, will understand that putting down two pit shafts for coal winding from a depth of six hundred yards, even when no special difficulties are met with, is not an undertaking of a light character; necessitating, as it does, heavy expenditure, and requiring the exercise of much skill and care. But when the pit shafts have to be sunk through virtually inexhaustible water feeders, extending to a substantial depth, the work takes rank amongst the most important with which our modern mining engineer has to contend; and whilst on the one hand only the best of skill and appliances and unflinching determination will accomplish it, on the other hand only the fact that valuable and extensive seams of coal are to be reached will justify the outlay. My close association for many years with mining instruction sufficiently accounts for a lively interest in mining development; and I have closely followed, during the last two years, the best example of difficult sinking that has occurred within my experience; the obstacles which many thought insurmountable have been overcome, and the really difficult part of the work successfully accomplished. The Moss Hall Coal Company is one of the oldest of our Lancashire colliery firms; and as the constant drain upon coal resources exhaust an area, new fields have to be attacked. In and about the mining district of Wigan we probably know all that can be known of the coal area, and of the difficulties or ease of reaching the coal seams. In the Township of Abram—which a couple of generations ago was practically an agricultural community, and which, by colliery development, has become an urban district—an area was secured, some fourteen hundred statute acres in extent, known to contain ten different workable and marketable seams of coal, besides some two million tons of Abram cannel, the price of which at the pit during the last fifteen years has never been below twenty-five shillings, and has reached forty shillings per ton. It gives, per ton, 14,000 cubic feet of 38 candle gas, with good coke and a large quantity of tar and liquor. The value of such a seam of such an extent commands its own appreciation. The difficulty was to reach the coal seams; not that there is any supreme difficulty in sinking to a depth of a thousand yards, if necessary, but it is very different to contend successfully in sinking with feeders of water, amounting in the aggregate to thirteen thousand, and even sixteen thousand tons in twenty-four hours, and this heavily watered strata extending to a depth of a hundred and fifty yards. Two previous attempts were made, a generation ago, to capture this veritable gold mine, which, not in the frozen wilds of Klondyke, but in the County of Lancashire, is destined to bring fame and fortune to its owners, and profitable employment to hundreds of families. These first attempts were not successful, but the highway to success is macadamized with non-success; defeat is often the pioneer to victory. Two years ago the present venture was commenced, with vigor at the prow and skill at the helm. I noted its inception, watched its progress, and now chronicle its success; it has been an excellent object lesson for mining students and mining workers. The watery strata has been passed, and what remains of the work is prosaic sinking through ordinary metal to the black diamonds below, and to commence actual commercial work of sending to the surface large quantities of the highest quality of cannel coal to be found in the United Kingdom. It may be remarked, will the coal find a profitable outlet in an overstocked coal market? Good coal need never be a drug, and can always sell; it is not the higher qualities that glut the market, especially the superior class of cannel coal, which holds the field for purposes of illumination. In this brief article I am attempting no disquisition geological, but to give the best practical and unvarnished description that I am able of the difficulties, and how these difficulties have been overcome, in the finest piece of plodding skilful coal sinking that I have ever known. The sinking, which comprises two shafts 50 yards apart, and measuring respectively 16 feet and 18 feet diameter clear inside the brickwork, was commenced at the No. 1 shaft on 31st May, 1895; and the first water was encountered at a depth of 40 yards, on 2nd July. This stopped the sinking until 18th September to enable a direct-acting sinking pump, with ram 7 inches diameter to be put in. At a depth of 80 yards the water had reached 12,000 gallons an hour. Sinking progressed till 8th January, 1896, and at a depth of 113 yards the water increased to 60,000 gallons per hour, and two other direct-acting sinking pumps were applied. All these pumps were placed at the bottom of the shaft as then reached, namely, 113 yards, and in addition a surface pumping engine with 24 inch ram, 10 feet stroke, was fixed, the pump itself being at the depth named. Another pair of direct-acting pumps, with rams 10 inches diameter, was also located. Whilst sinking was suspended to enable this powerful machinery to be got ready for work, storage room for water was made at the 113 yards depth. Sinking was resumed on 23rd June, 1896, but in a week, at a depth of 120 yards, the large pump worked from the surface temporarily failed, and delayed sinking till 27th July. During the stoppage the water rose nearly 100 yards up the shaft, namely, to within 25 yards of the surface. On August 4th, at a depth of 128 yards, the water was increased by 27,000 gallons an hour, and two days later the water was further increased to 150,000 gallons per hour, which was pumped at for a month, and the quantity fell to 120,000 gallons an hour. Sinking ceased at this No. 1 pit shaft, and was proceeded with at the sister shaft, namely, No. 2, where the first sinking had commenced on 27th August, 1895, being stopped by water at a depth of 40 yards; then resumed, and stopped again on 30th October at a depth of 115 yards. A connection was made by tunnel at this depth between the two pit shafts, and sinking was commenced in the No. 2 pit shaft on 7th Dec., 1896, but was stopped by flow of water a few days later at 120 yards. One of the largest sizes of pulsometer was put in at this depth to pump out of the pit bottom, through the tunnel, to the wells of the pumps in the other pit shaft. Sinking resumed on 14th January, 1897, and continued to 2nd March, when the large pump worked from the surface again temporarily failed, and for nearly three weeks, day and night, 50,000 gallons of water an hour was raised to the surface from a depth of 120 yards by winding alone. Sinking

was resumed on 2nd March, 1897, and as additional feeders of water were met with, three other equally large pulsometers were put in. The special reason for adopting pulsometers in sinking operations, was on account of the large quantity of sand mixed with the water, amounting to five tons a day, and they have fully justified their adoption. At the depth of 145 yards the quantity of water being pumped from the pit bottom through the tunnel into the wells of the main pumps was 130,000 gallons per hour, and their capacity was equal to double this quantity. This 130,000 gallons an hour was further conveyed to the surface by the pumps already described. On 15th April, 1897, a borehole was put down from the bottom of the sinking, and at 12 feet below, or a total of 150 yards, a further feeder of water was tapped, and rose to a height of 16 feet above the borehole. Two other boreholes were made and the volume of water increased to 150,000 gallons per hour, and after about a fortnight's pumping fell away to 130,000 gallons per hour. At this depth another pair of direct-acting pumps, with rams 13 inches diameter, was fixed. Another borehole was pushed forward, and the coal measures were touched immediately under this last feeder; a depth of 56 feet of metals was bored into producing no water, and the management recognized that the watery strata had been passed through, and that the further sinking would add nothing to the volume. Pumping until 8th August, 1897, diminished the flow to 125,000 gallons an hour; the new pumps were started, sinking was resumed on August 12th, and is now proceeding, and will continue in the measures which water does not trouble. The volume of water now being pumped is 120,000 gallons an hour, and the capacity of the pumping plant is equal to at least a quarter of a million gallons an hour. Such is a description, in brief, of the Maypole sinking through heavily-watered strata, extending to a depth of 150 yards, in the Township of Abram, Lancashire. Very few, indeed, predicted or anticipated success, but the work, as great as anything in my mining experience, has been successfully accomplished, and not a single accident to the person has marred its progress. We write and read much about mining in the Transvaal and at Klondyke; I confess to having even a greater interest in mining at home. I should be failing in my duty if I did not pay an earnest tribute of appreciation to the one man who originated, continuously directed, and fulfilled the operation. That man, always the same, in the midst of great difficulties and in the hour of success, never jubilant, but always calmly confident, is Mr. James Keen, the general manager of the concern.

Boundary Creek, B.C.

A new era is dawning for the Boundary Creek district, and that is one of railway transportation. Five survey parties are now at work between Trail and Penticton and it is understood that work of construction will start early in the Spring. If this be true, Boundary Creek will next summer be one of the most active districts in British Columbia.

Last week the Brandon and Golden Crown Mining Co. placed an order with the Ingersoll Rock Drill Co. for a 50-H.P. locomotive boiler, a Lidgerwood hoist and a Knowles pump.

This makes the third plant ordered for the district. The steam hoist and pump at the Jewel being the first, and the 60-H.P. boiler hoist pump and 4 drill compressor at the Ironsides the second. In regard to the Jewel and Denoro Grande a hitch has occurred.

The Prospecting Syndicate have obtained $\frac{3}{8}$ of the Jewel and $\frac{1}{2}$ of the Denoro Grande and ask the owners of the remaining interests to lower their bonding price. Everything in the matter is still unsettled and in a very unsatisfactory state for all parties concerned.

A. H. Harrison has taken over the bond that McEwen had on the "B.C." and has 13 men at work. He is putting up winter quarters and will develop continuously throughout the winter. If this ore body maintains its present width and values it will be one of the largest copper properties in the west.

On the Josie, in Summit Camp, a great deal of native copper is being found which is attracting considerable attention.

GREENWOOD, B.C., Sept. 18th, 1897.

G.

CAPE BRETON COPPER CO.—It is reported that the management of the Coxheath copper mine of Cape Breton, N.S., will shortly make application for the listing of its stock on the Boston stock exchange. Pres. Gragg has just returned from an inspection of the mine, where he found everything in excellent shape, the amount of ore underground "in sight" at present being greater than ever before. No. 1 shaft in the crosscut is being driven south to intersect vein "B," where a stringer of rich ore a foot wide was cut 147 feet from the shaft. The ground in the heading looks remarkably promising. In No. 2 shaft the stopes in both "B" and "C" veins have been put in order for immediate work. The heading of the west drift on the 320-foot level is coming into high-grade ore. No. 3 shaft is located on top of the Coxheath hills, on what is known as the "Mountain vein." This vein is a most promising prospect for large values, two shafts, Nos. 3 and 4, located 700 feet apart, showing 12 and 14 feet of vein near the surface. On the 100-foot level of No. 3 drifting was recently commenced, both east and west, with an air drill in each heading. Each drift is now in about 30 feet. At this depth the vein is fully 14 feet wide, with a small band of white quartz running through the centre of it. The vein is well mineralized, and the ore in both headings is rapidly improving in quality. The surface prospecting to the west of No. 2 shaft on the strike of the big "B" vein has been resumed. A few shots in the pit 2,000 feet west of No. 2 produced some fine

*From the "Science and Art of Mining."

ore, and proves vein "B" to be strong and promising for a length of over 3,500 feet. The great demand for copper, and the well-known cheapness for smelting facilities in Cape Breton, is drawing the attention of copper capitalists and investors to the Coxheath mine, on account of the extent of developments that the owners have accomplished, while waiting for a suitable condition of the copper market to erect concentration and smelting works. Recently inquiries about the property were made by Pres. R. T. Bayliss of the London Mercantile Association, and also by the Exploration Company, limited, through J. H. Lurach, the managing director. Both parties were informed that the property was not on the market.

ELECTRIC POWER IN MINES.—Owing to the fiery character of some coal pits, the transmission of power by electricity has, to a large extent, been retarded; for it is imperative in fiery mines that no sparking shall ever take place, such as might ignite a dangerous mixture of air and gas. With direct current motors it has therefore been necessary to completely box in the commutator and brushes, and this renders them rather inaccessible. The great advantage of a three-phase or a two-phase alternate current system for such work, says the "Electrical Engineer," cannot be too largely brought before the notice of the public. When motors of this type and of reasonable output are used, a simple throw-on switch is all that is required in the way of regulating gear, and the contacts of this switch are the only points at which sparking can occur. It is a comparatively easy task to box in this switch gear. The motors being without commutators or collecting rings, are absolutely free from sparking. The cables leading to the motors only need protection, and there is no lack on the market of well-protected concentrics which will give safety in this direction. The motors have a good starting torque, and can be relied on to drive coal-cutting machinery and hauling ropes. Our contemporary has to admit, however, that there is still the need for a satisfactory electric locomotive suitable for working in fiery pits.

CONDENSATION OF VAPOURS FROM SMELTING WORKS—Roasting processes poison the air with vapours of sulphurous acid, lead, zinc, arsenic, antimony, etc., which create a nuisance and constitute a waste. The reutilization is unfortunately a difficult problem. The Mansfield copper works first tackled the difficulty by means of wooden and iron conduits, which did not long resist the attacks of steam, oxygen and acid. In 1888, Freudenberg, of Harzgerode, introduced beton conduits of the Monier system

(strengthened by layers of wire), in which he fixed pieces of sheet iron parallel to the longitudinal axis. A great deal of lead dust has been caught in this way, and compensations and litigations have diminished. Although the sulphurous acid is not intercepted, and has to be diluted as much as possible, a large conduit, 600 yards long, 86 square feet in section, has been built at Harzgerode. Similar plants have been erected at Stolberg, in Nassau, and at Braubach on the Rhine. At the latter place a branched canal had been built, whose U portion suffered considerable corrosion, until a plaster lining was resorted to.

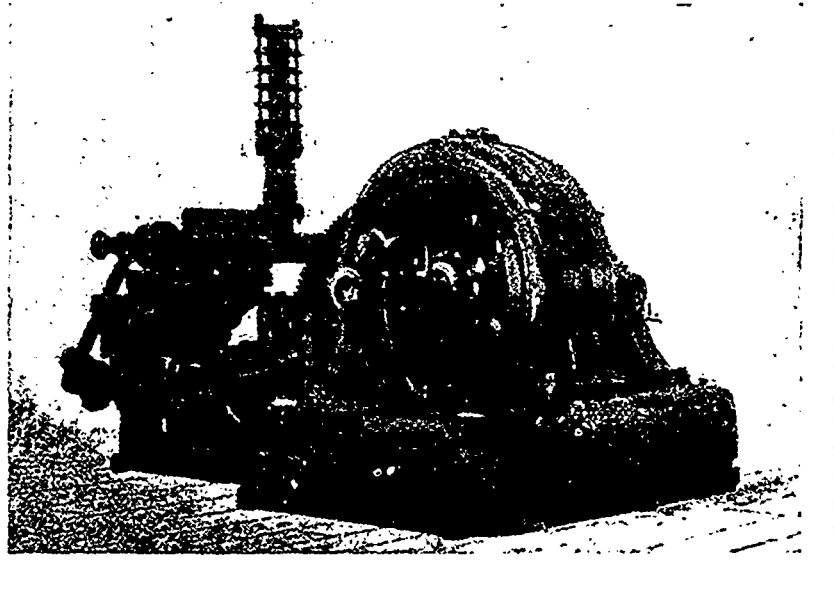
THE AMBITIOUS BOOMER—The old saying that fools rush in where angels fear to tread, finds an illustration in the manner in which some men of moderate means attempt to secure all the available ground in a new mining camp. With ear-drums sensitive to the first faint rumbles of a coming boom they rush into a new mineral Mecca and plant their stakes upon a thousand hillsides, until they can sit upon a towering throne of gilded hopes and proclaim themselves monarchs of all they survey—or, rather, of all they expect to have surveyed when the periodical sucker gets ready to swarm. When the development of a mine here and there in the new district arouses the ambitions of more conservative capital, the man who has staked off three or four townships into bonanza mining claims begins to feel that the gyrations of the humble flapjack will soon cease to struggle with his appetite, and that his journey of life will henceforth be pursued on velvet. He immediately places a fancy price on each of his properties, and assures the would-be investor that the known pay vein, three miles or more away, ties a double bow-knot around the intervening mountains, double-switches the turn at the head of the gulch, and crops out on the claim he is exhibiting to the tenderfoot in such unparalleled wealth that at some seasons of the year nuggets can be shaken from the tree tops. All the arts of diplomacy and tact are resorted to by the man with a township on each hand, to unload his holdings at a price that bears no relation to their actual value in a crude and undeveloped state. He usually fails to unload, and after the boom has subsided and the several mines in the new district have become regular shippers of good ore, he walks out of the country in the belief that fate has treated him unkindly. As a matter of fact, he suffers the legitimate rewards of iniquity, the penalty of cultivating a greed too great for his financial digestion. He has gone to pieces in an attempt to overturn a mountain with a crow-bar—*Western Mining World*.

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DANGEROUS OCCUPATIONS COMPARED—If statistics are of any value in estimating the comparative dangers of various occupations, it is clear enough that coal mining is by no means the most perilous of our great industries. The *Laborer* gives a table which shows that the total number of lives lost in July in connection with mining was 68, as against 130 fatalities to seamen and 16 among railway servants. On the other hand, 391 miners were injured during the same month, against 261 seamen and 1,230 railway servants. The obvious inference is that neither in respect of fatal accidents nor injuries can mining be reckoned as the most dangerous of employments.

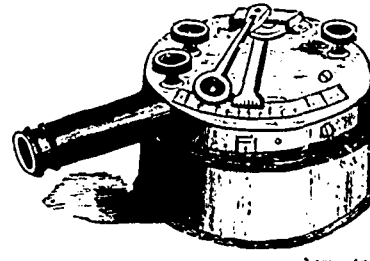
NEW MIXING EXPLOSIVE.—Inventors have been busy lately in the endeavor to discover a safer and cheaper explosive than gunpowder for the blasting of coal. Some interesting experiments were recently carried out at Southport, to determine the relative strength and efficacy of a remarkable new explosive invented by Mr. George Bencke, of Southport. The conditions of test in each case were the same, 10 grammes of the explosive being used. This was placed in a steel mortar loaded with a projectile weighing 35 lbs. All shots were fired at an angle of 55 degrees, with the following results: Gunpowder threw the projectile 51 yards, kynite 88½ yards, benedite, as the new powder is called, 155 yards, and dynamite 161½ yards. Benedite contains no nitro glycerine, and it was also subjected to severe tests as regards handling. Unlike dynamite and explosives generally, says the *Iron and Coal Trades Review*, benedite could not be exploded by either a

blow from a hammer or direct application of flame, an advantage which ensures perfect safety in the use and handling of the explosive. It can only be exploded by means of a detonator. For safety blasting in coal mines, a series of trials have shown that when it is exploded in the presence of highly inflammable mixtures of pit gas and coal dust it will not ignite them. It is further claimed for the new safety explosive that its cost of production is much below that of powerful explosives generally, and it is to be put on the market at a considerably lower price. If this new blasting agent should prove to possess all the advantages set forth, it comes at a most opportune time, when the new regulations as to explosives in mines are causing anything but general satisfaction.

The Ontario Limited Mining Co. has sent two 50 ton lots of quartz for treatment at the Mikado mill.

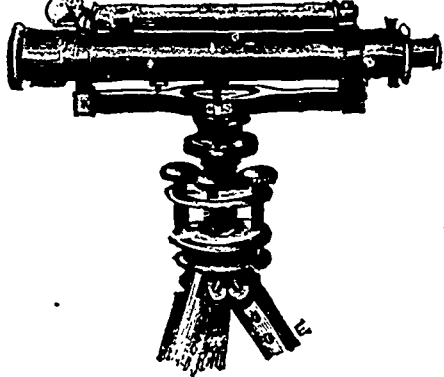
There are fourteen veins on the company's location, twelve of which have been prospected to some extent, as much as 900 feet of stripping having been done on some of the veins. Several pits have also been sunk on the more promising veins, with the result that all show up almost equally as well as each other.

The construction of the 20 stamp mill of Ottawa Mining and Milling Co. at Keewatin is being rapidly pushed forward. It is expected to be running by the end of next month.



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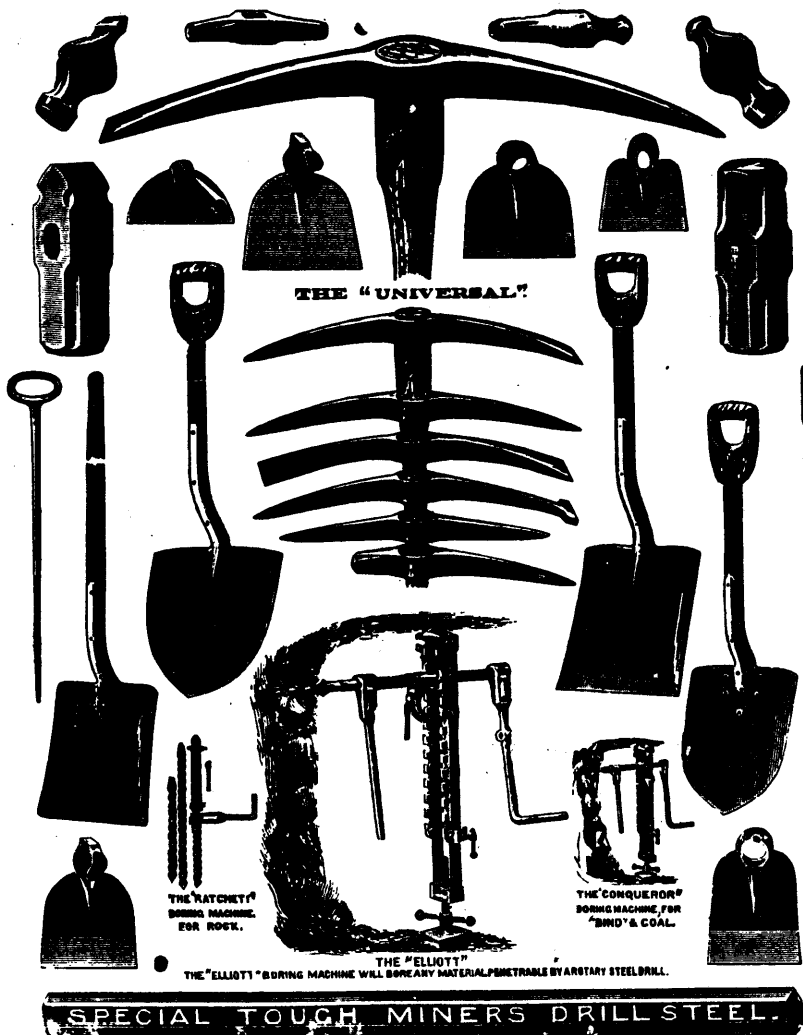
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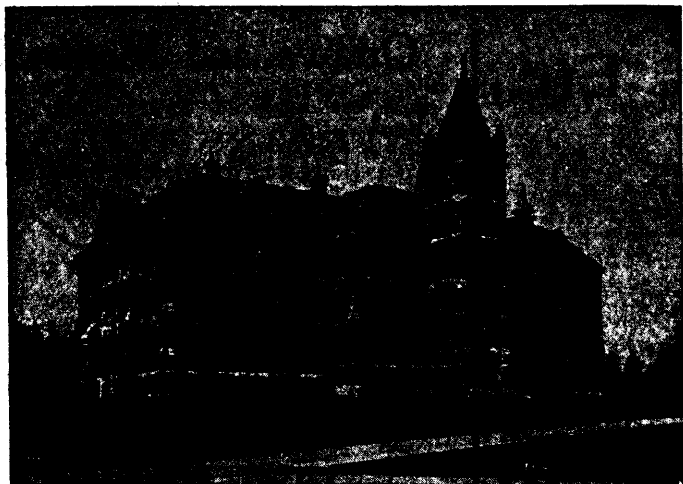
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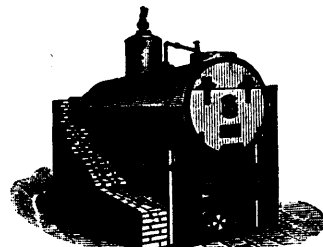
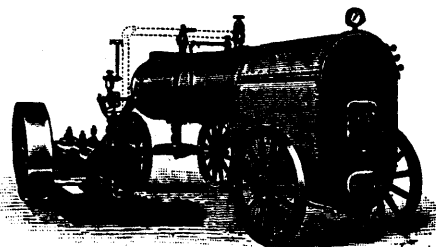
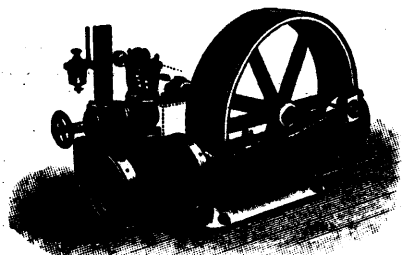
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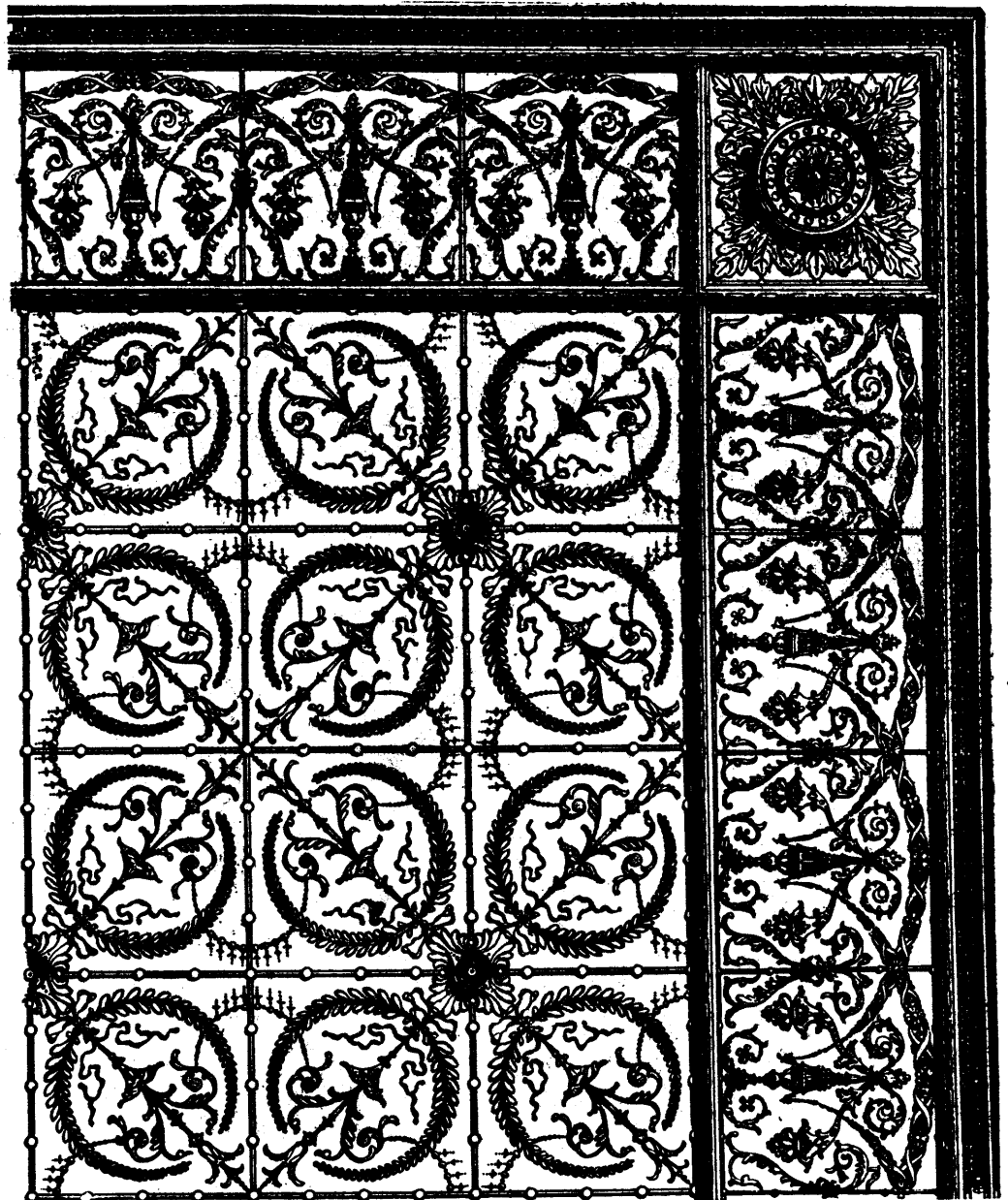
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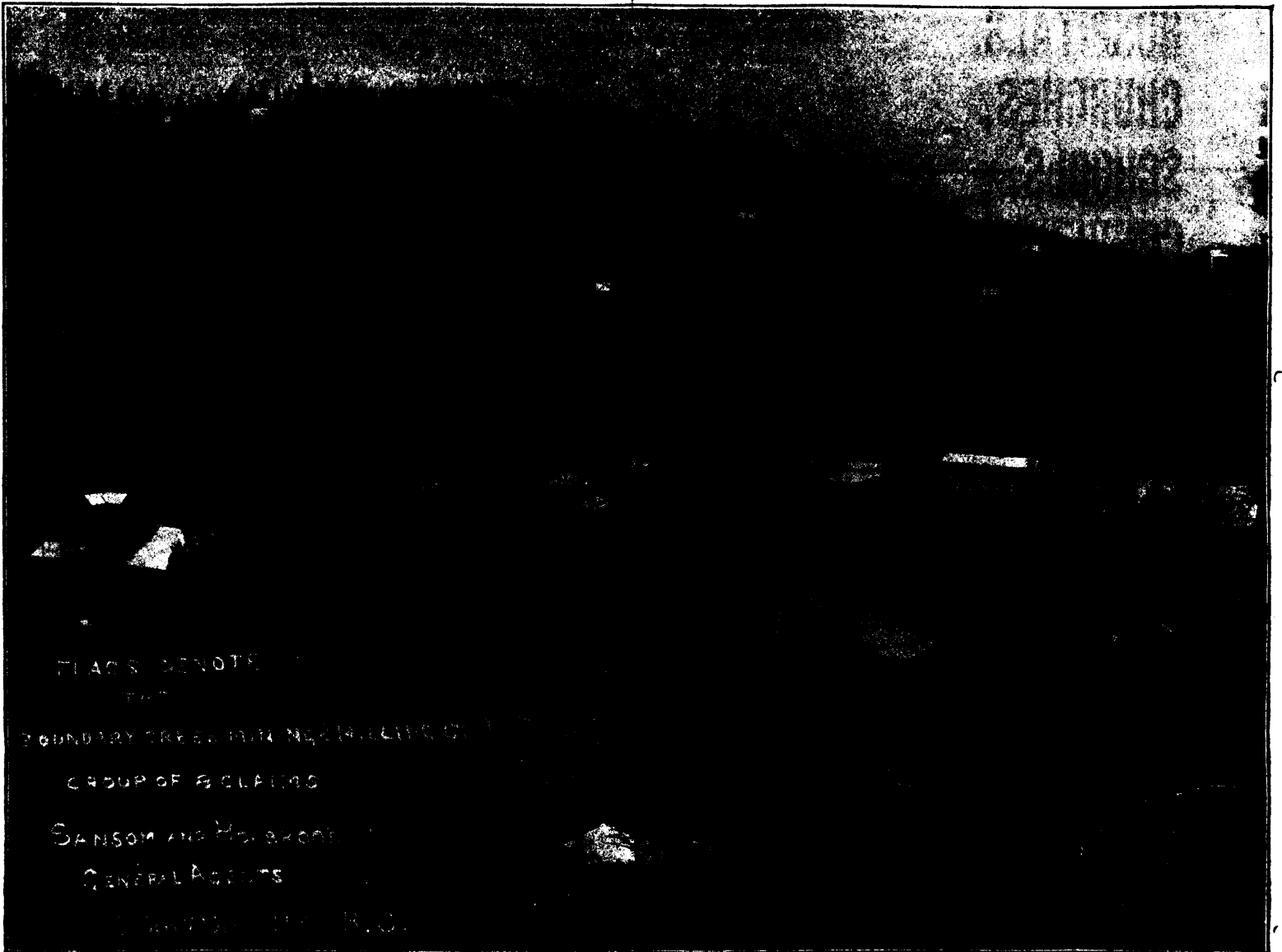
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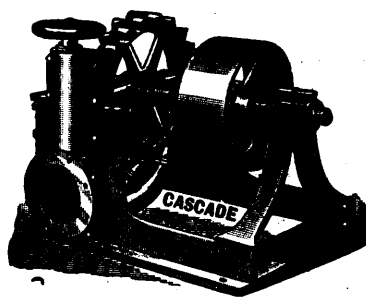
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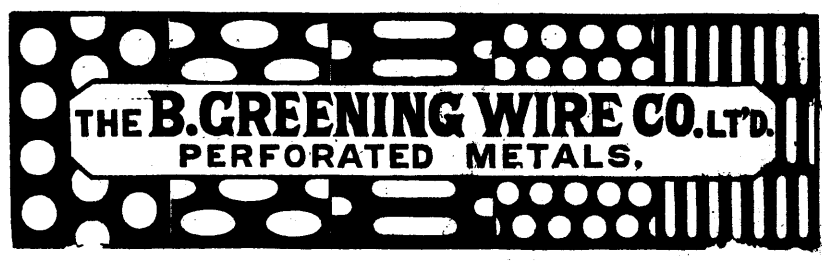


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the Asbestos Mining Property and Plant of the
said Company, at Black Lake, in the
Province of Quebec,

situate upon the parcel of land known and distinguished as the southerly ends or halves of lots number twenty-seven and twenty-eight, in range B of the Township of Coleraine, in the County of Megantic, containing about one hundred and four acres of land.

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Tenders for the property will be received up to the date of sale, the Joint-Liquidator reserving the right to accept any such tender and withdraw the property from sale, and further reserving the right to place an upset price upon the property at such sale, and make such other conditions as they may see fit. The property is open to inspection at any time. Inventory can be seen, and any further information will be furnished on application to the undersigned.

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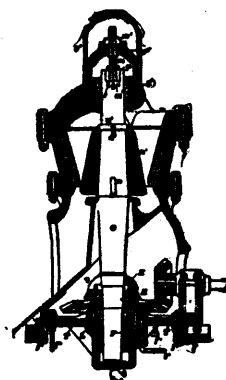
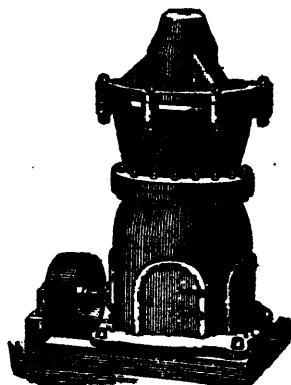
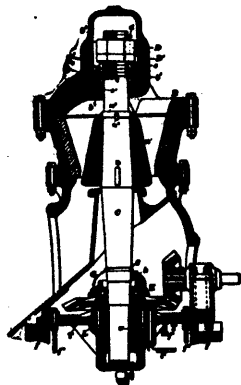
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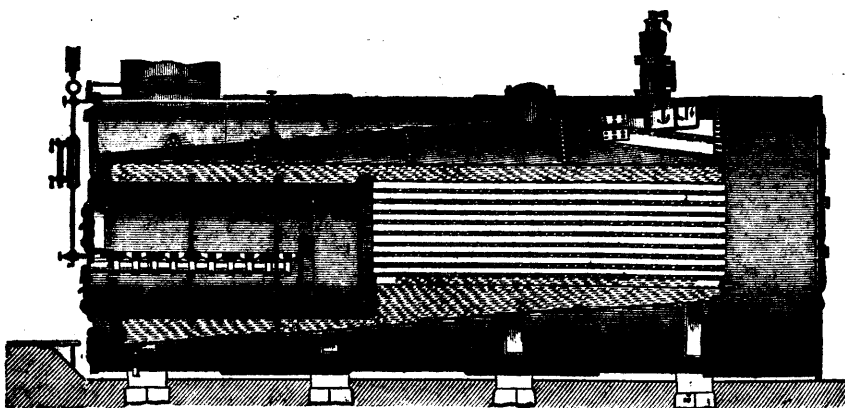
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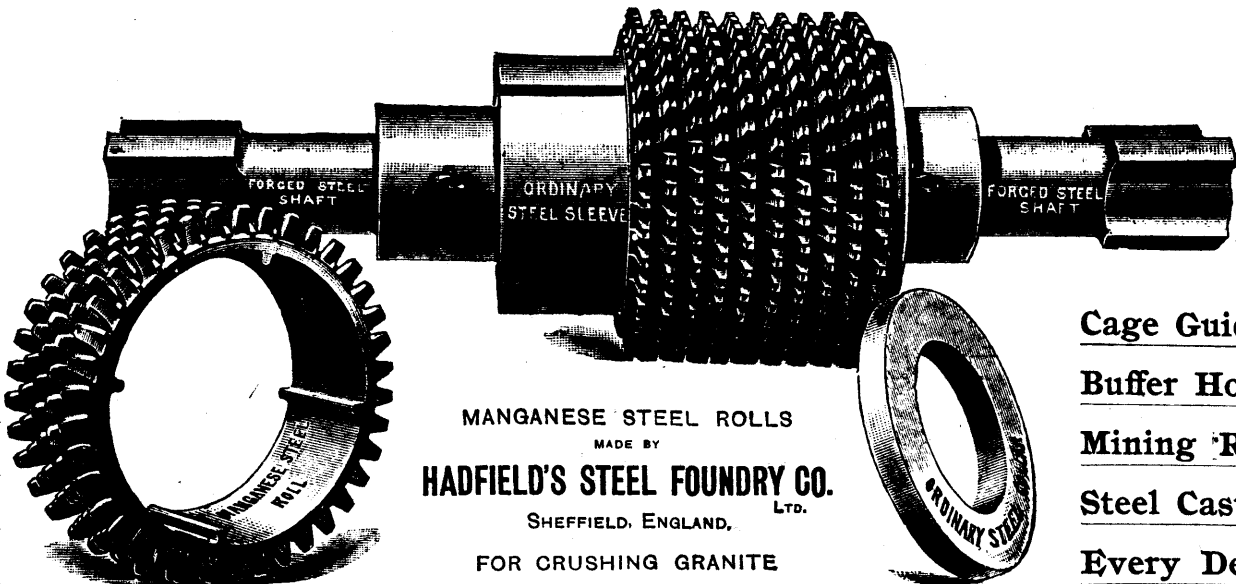
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