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TWENTY-SECOND YEAR OF PUBLICATION

H. Bell

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Established 1882

Vol. XXIII—No. 8.

MONTREAL, AUGUST 31st, 1904.

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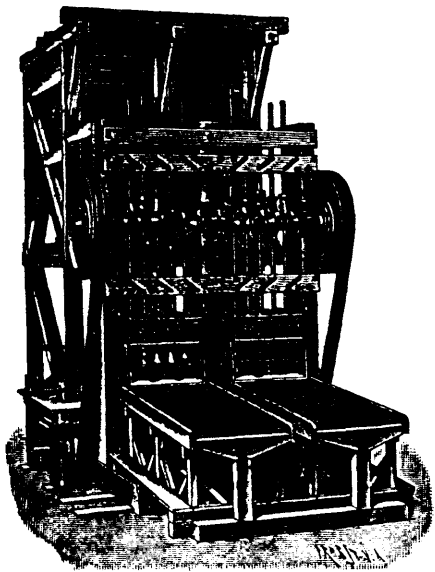
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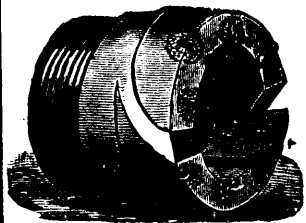
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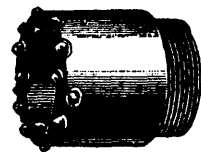
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3rd December, 1901.

Dear Sirs,—I have much pleasure in stating that the air compressing machinery, supplied by you in 1891 and 1897, to Pease and Partners, Ltd., Loftus Ironstone Mines, has given every satisfaction.

The valves of the air cylinders are remarkably good, and have never given any trouble or needed repairs. The compressor is a double horizontal compound engine, steam cylinders, 28 in. and 43 in. diameters, air cylinders, 40 inch diameters by 72 in. stroke.

The compressed air is used for rock drilling, hauling, and pumping underground.—Yours faithfully,
For Pease and Partners, Ltd.,
W. MOORE, Manager.

[NOTE.—These engines have four steam cylinders and two air cylinders.—WALKER BROS.]

The United Alkali Co., Ltd., Chief Engineer's Office,
Widnes, 23rd December, 1901.

Messrs. WALKER BROS., Pagefield Ironworks, Wigan.

Dear Sirs,—In reply to your enquiry of the 29th November, we have pleasure in being able to state that your blowing engines have given us great service and satisfaction.

We have had for several years quite a number of your large blowing engines in operation, driven direct by both single and cross compound arrangement of steam cylinders.

We consider that the arrangement of the "Walker" valves on the compressor cylinders is a valuable one, possessing the merit of simplicity and efficiency, while giving a large throughway with a small clearance space.—Yours faithfully,
For the United Alkali Co.,
EDWARD J. DUFF, Chief Engineer.

[NOTE.—See the number and dimensions of the compressors referred to in the list of users in our catalogue. The steam and air cylinders are nearly 70 in number, from 20 in. to 50 in. diameter.—WALKER BROS.]

Barrow Hæmatite Steel Company, Limited,
Barrow-in-Furness, 7th Oct. 1901.

Messrs. WALKER BROS., Pagefield Ironworks, Wigan.

Dear Sirs,—I have much pleasure in stating that after a long experience of your Bessemer blowing cylinders, extending over 15 years, we find the valves perform their work most satisfactorily, and they are most enduring; indeed, we cannot speak too highly of their performance or life.—Yours faithfully,
For Barrow Hæmatite Steel Company, Limited,
J. M. WHITE, General Manager.

[NOTE.—The various blowing engines (air compressing engines) referred to above include several air cylinders 48 in. diameter.—WALKER BROS.]

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S. PEARSON AND SON, Contractors,
Blackwall Tunnel Works, East Greenwich, S.E.,
May 10th, 1897.

Messrs. WALKER BROS., Pagefield Ironworks, Wigan.

Dear Sirs,—We are pleased to confirm what we told you verbally the other day, viz., that we consider the Air Cylinders and Valves of your compressors to be the best for such work as we have been carrying out on the above contract.

One of your engines ran for almost a year without stopping, and it gives us great pleasure to thus testify to the good qualities of the plant which we purchased from you.—We are, Dear Sirs, yours faithfully,
(Signed) pro S. Pearson and Son, E. W. MOIR.

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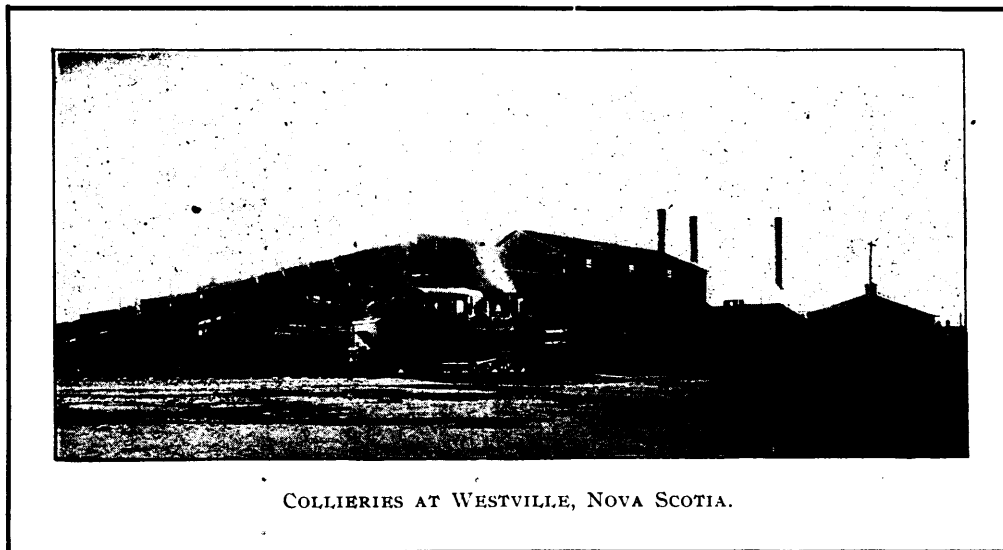
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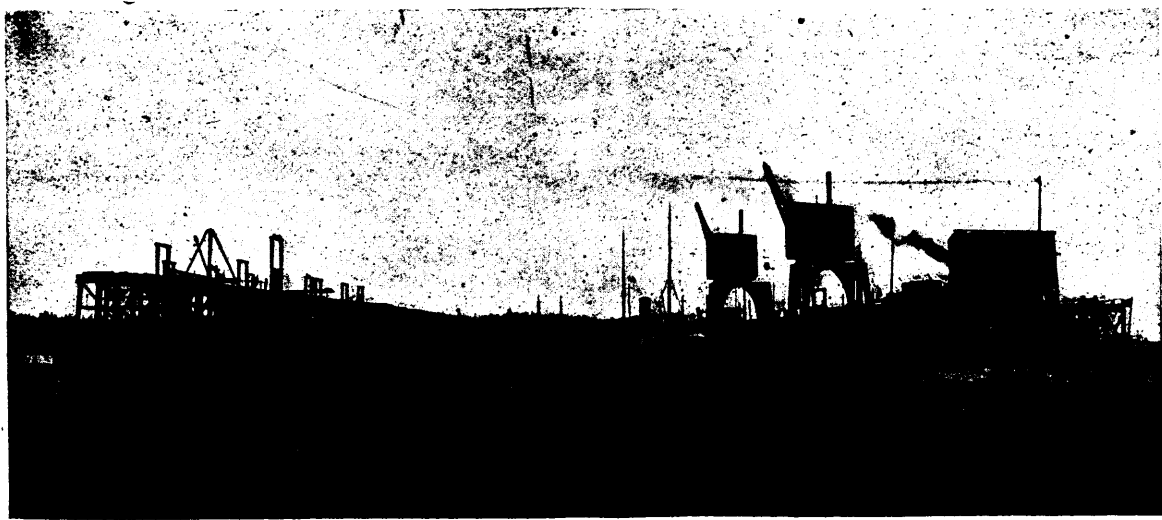
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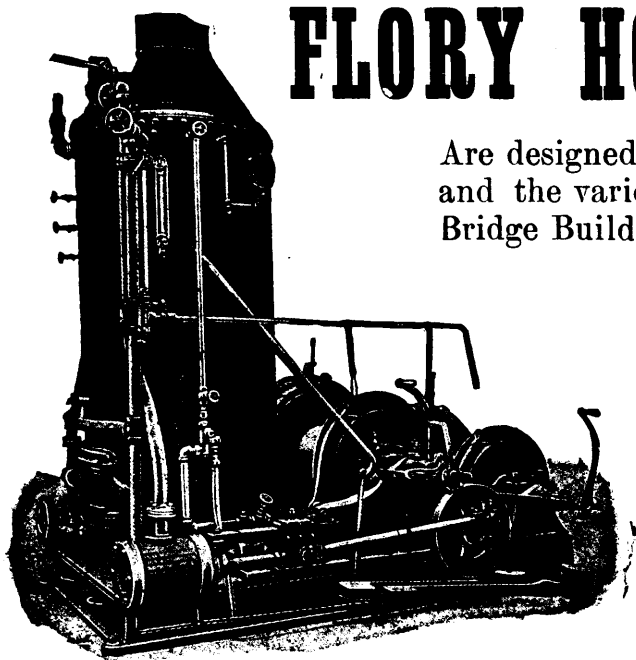
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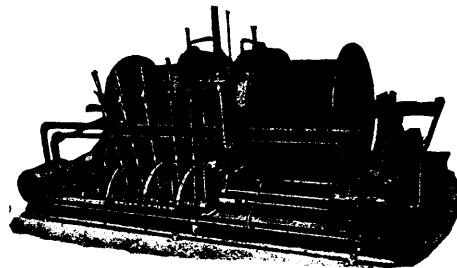
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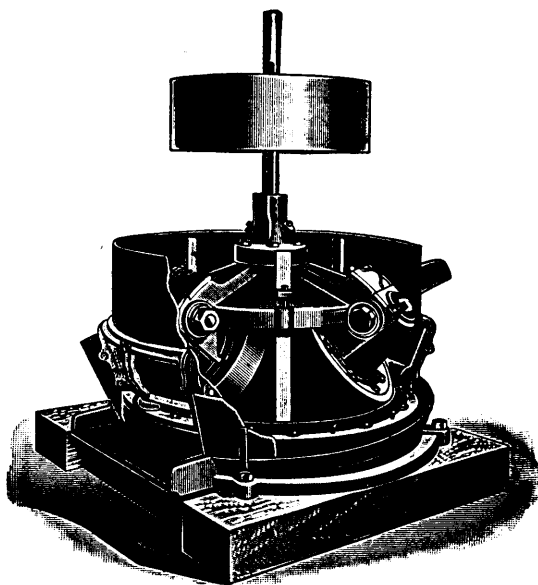
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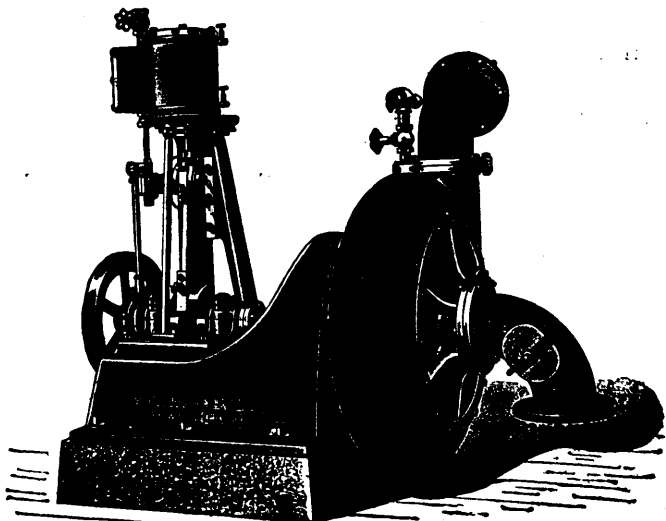
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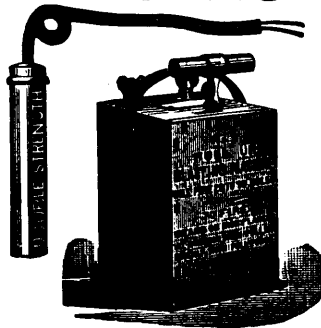
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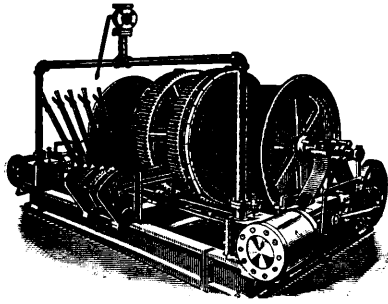
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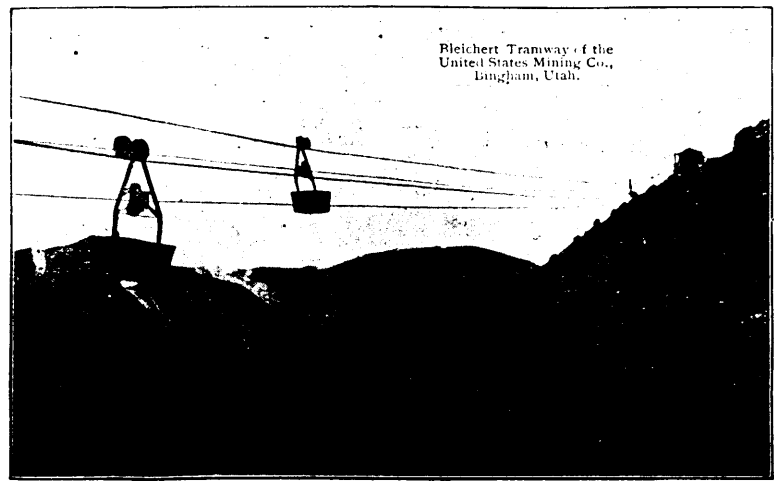
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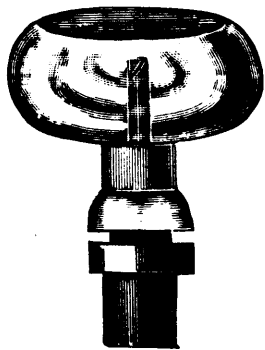
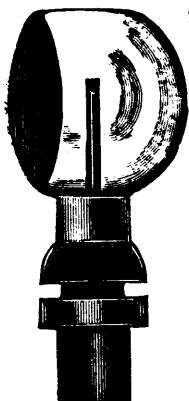
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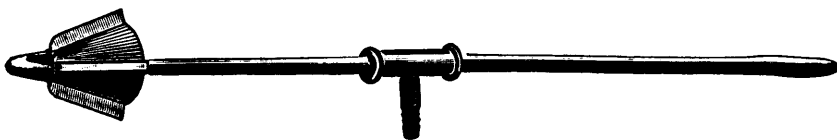
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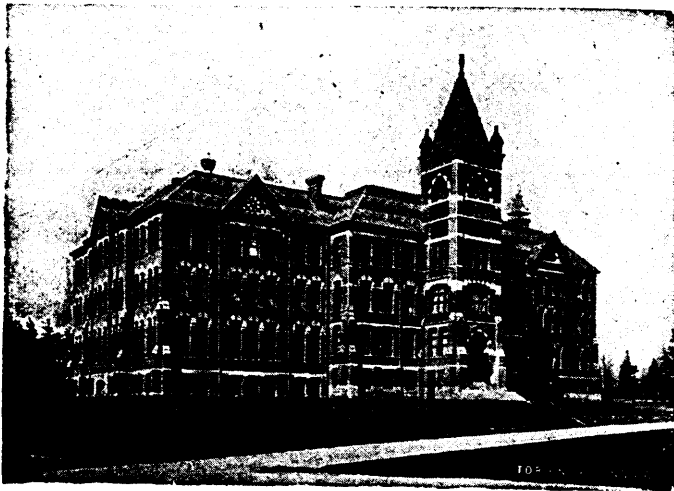
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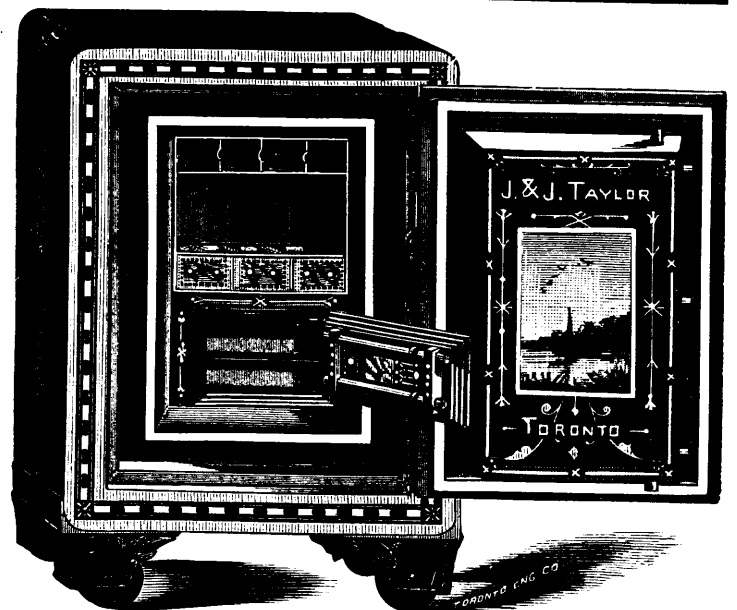
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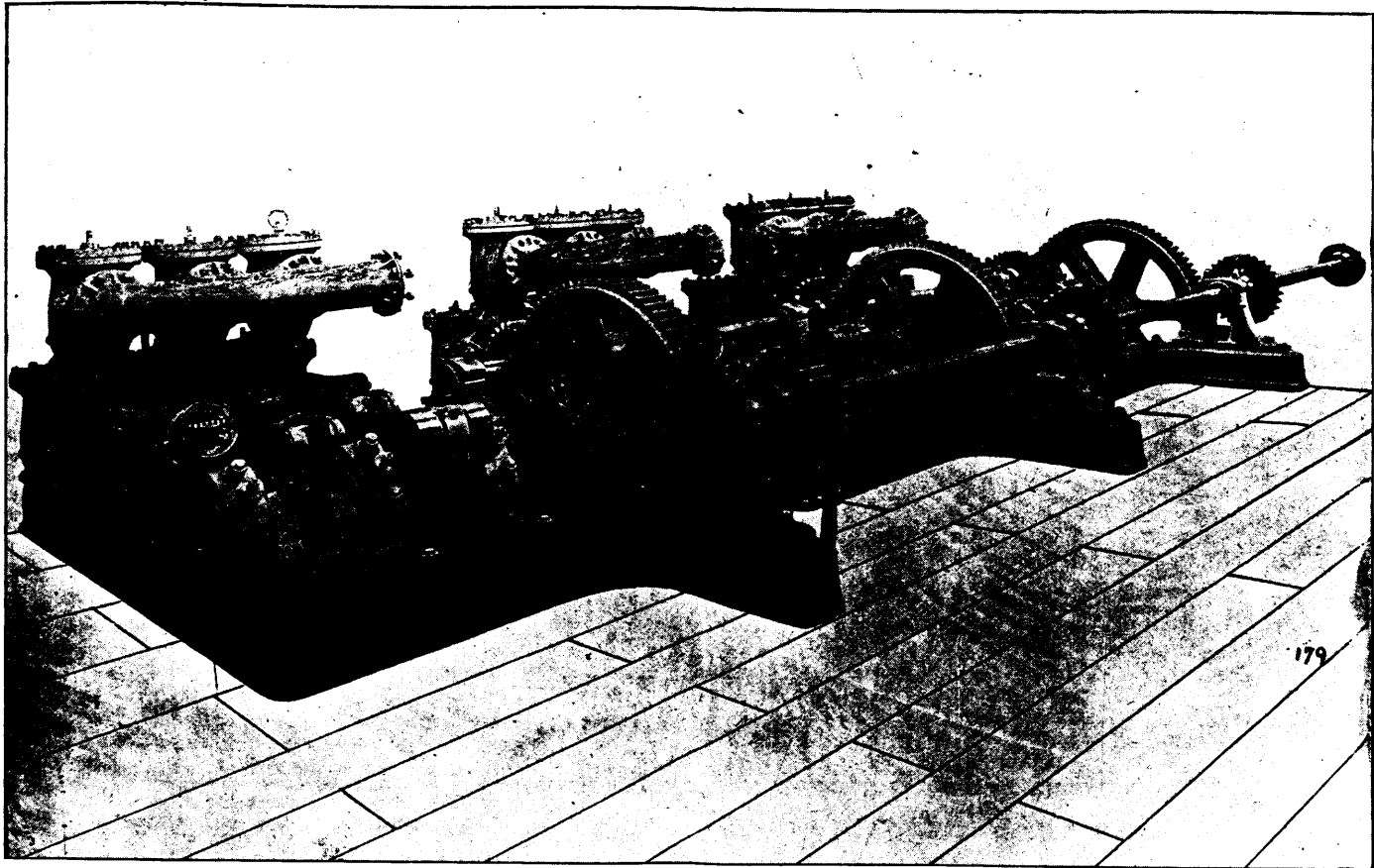
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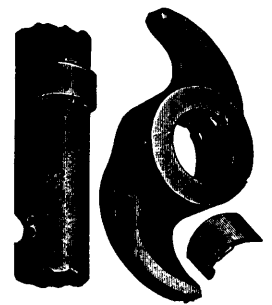
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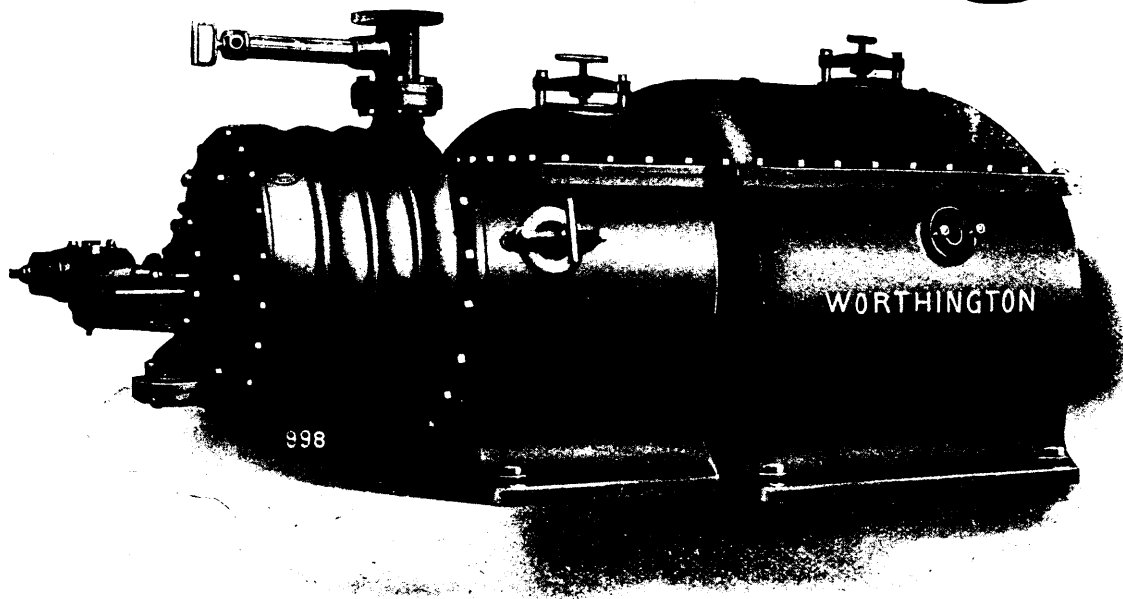
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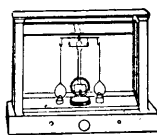
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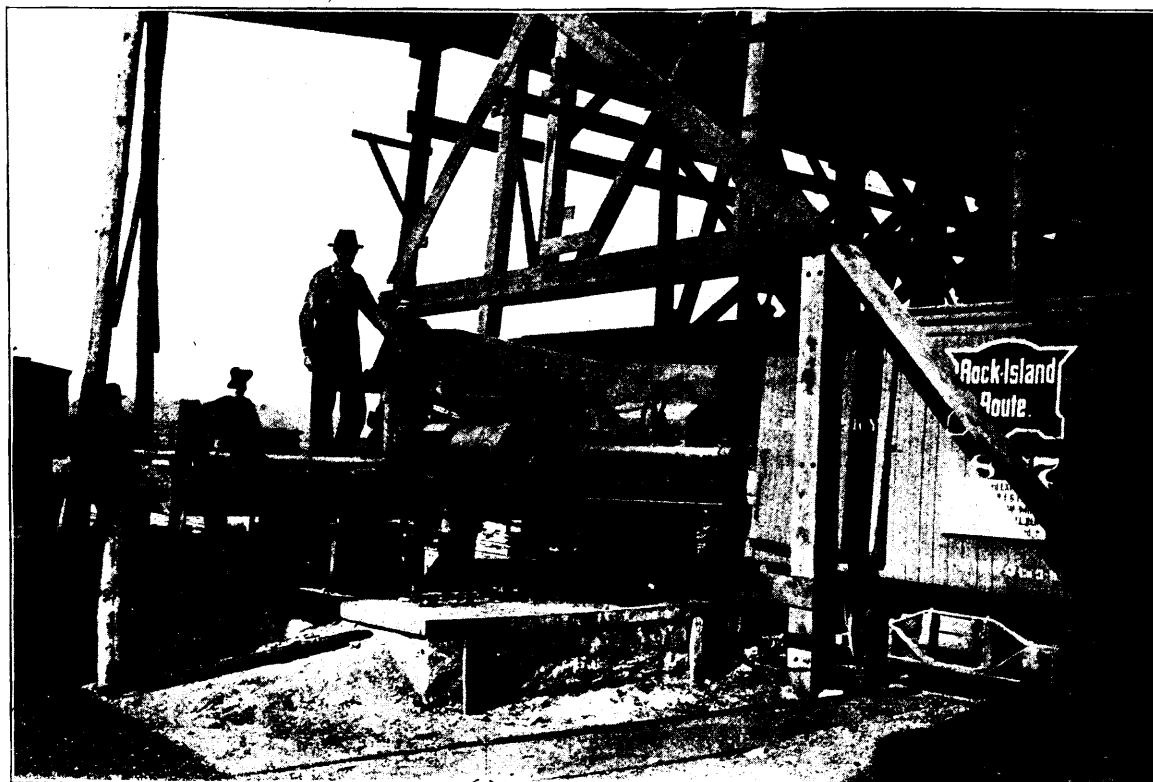
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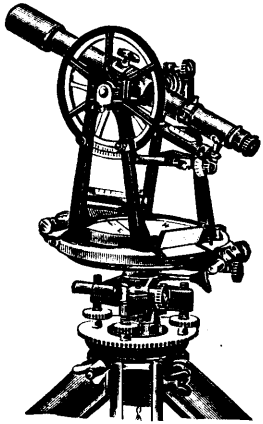
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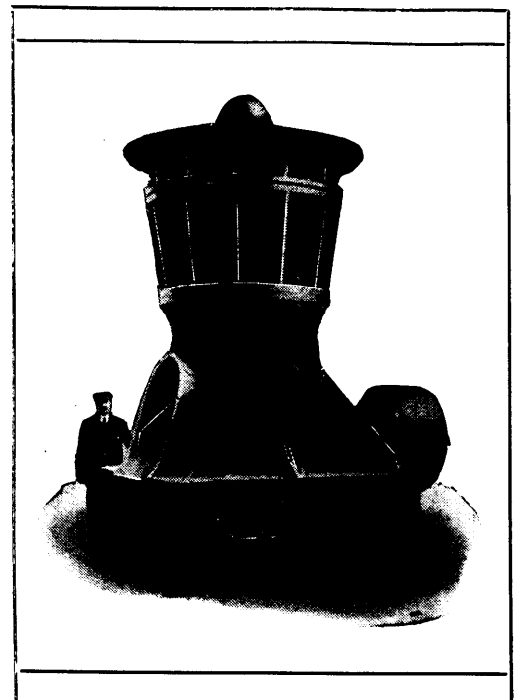
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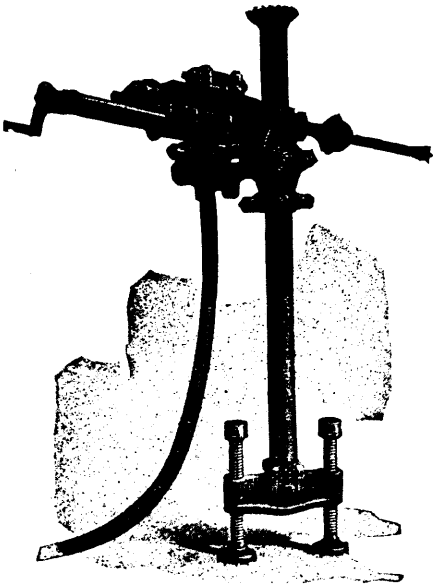
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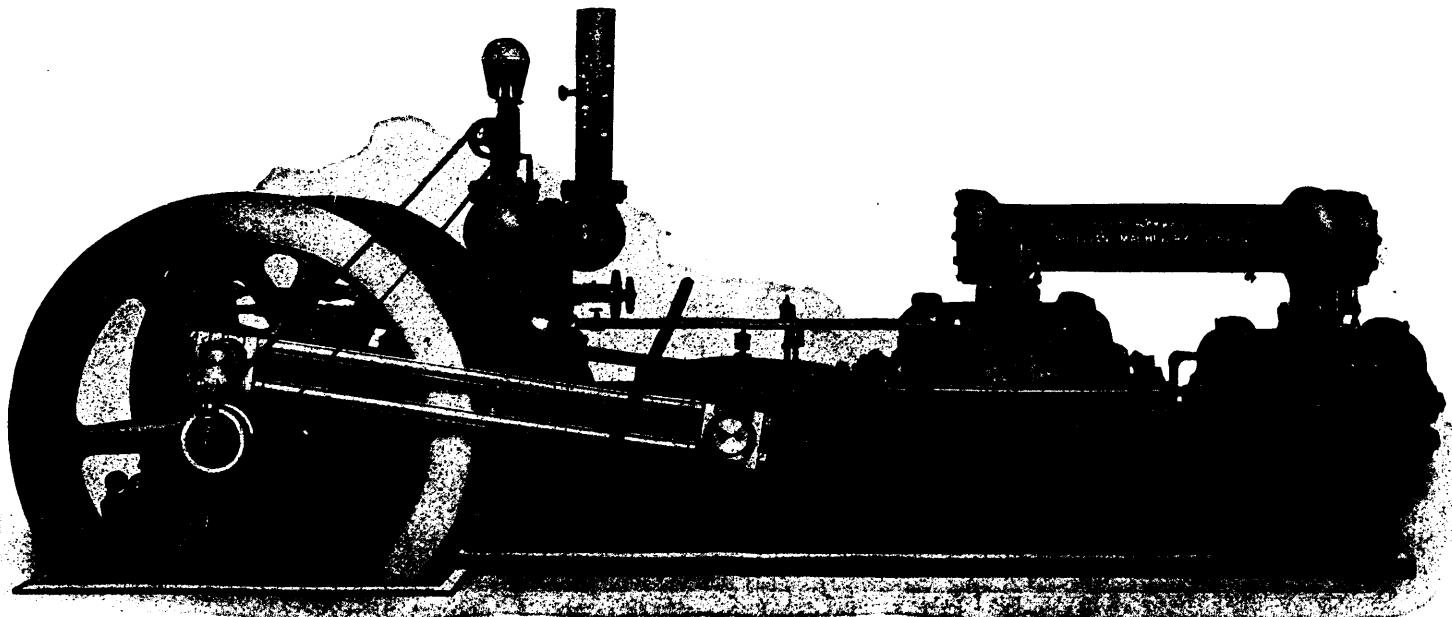


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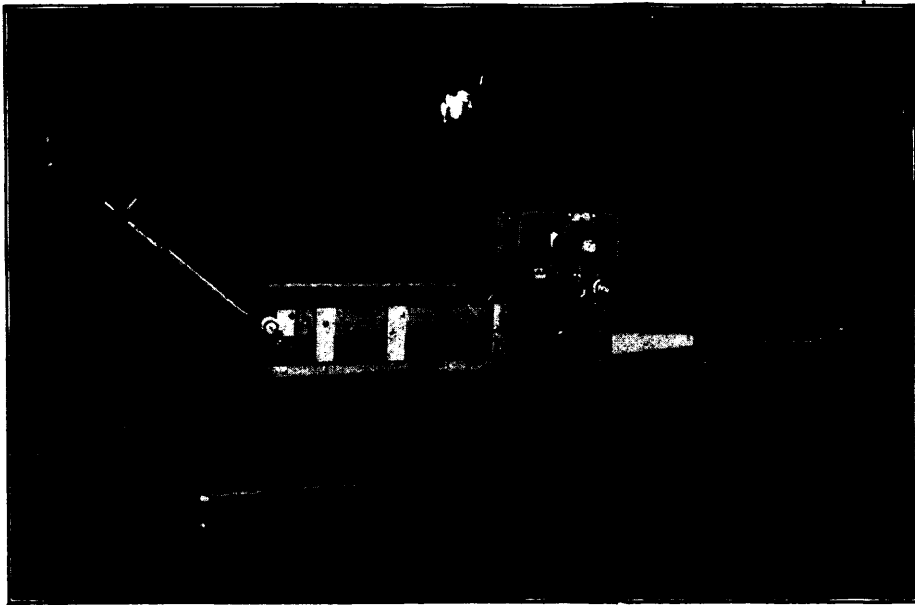
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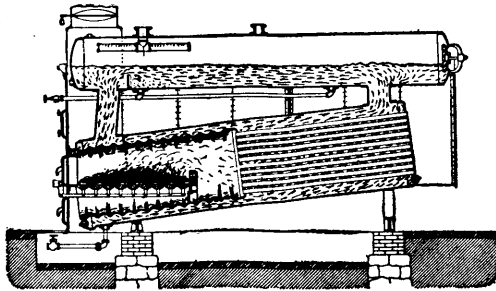
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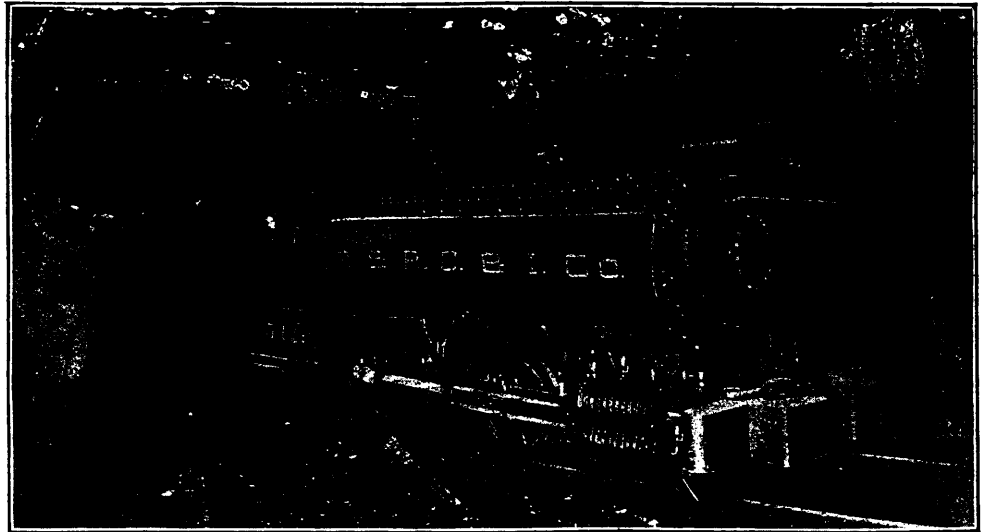
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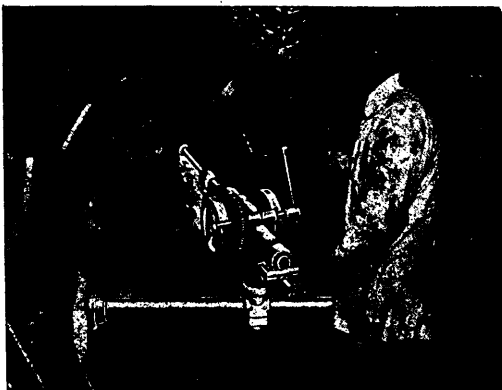


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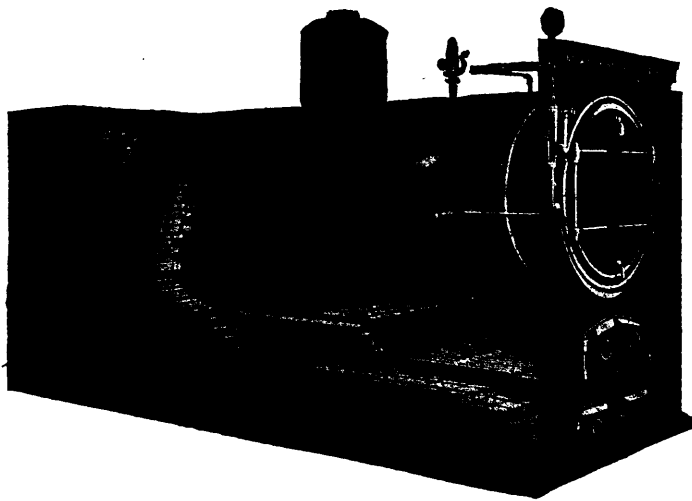
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remarks as to the unsatisfactory results which have followed attempts to separate the zinc from the lead in the ores which Mexico produces. Neither magnetic nor wet methods of separation would appear to have filled the need. In view of Mr. Malcolmson's paper, it would appear probable that the United States may again shortly be a possible field for the sale of B. C. lead ores.

That heroism is not confined to the soldier nor to the fireman, but is often met with in the more prosaic walks of life, has once again been demonstrated by the miners of the Union Mine in Virginia City, Nevada, the hoisting plant of which was burned in July. Shortly after the fire several miners entered a tunnel which at the time of the fire had been bulk-headed, and removed this bulk-head. Some of the miners venturing beyond the bulk-head to ascertain the damage done to the shaft and workings by the fire, were overcome by carbon di-oxide gas. Their fellow-workmen who remained near the mouth of the tunnel heard a faint call, and rushed into the inner workings, filled with the deadly gas, to rescue their comrades, one of whom was dead when they reached him. As the result of their daring and staunchness the rescuers are also very sick men; they knew what to expect before they entered the mine workings, but this knowledge did not prevent them rushing to the rescue of their comrades when help was necessary.

This fire furnishes another emphatic condemnation of the practice of putting head-frame, hoisting machinery, change-room, compressor, and practically all the surface equipment of the mine, under one roof; even though the buildings had been of corrugated iron, the danger of fires from other parts of the building being communicated to the head-frame, and thence to the timbers below in the mine, is too great for any manager or corporation to chance such a risk. Furthermore, the danger to men underground which may arise from the complete destruction of the head-frame and hoisting gear is too great to be entertained by any sensible manager.

The Review has at different times noted the development in the Similkameen Country which has been made by the Nickel Plate Mine during the last three years. Recent advices are to the effect that the results are likely to be fully up to what was predicted. The forty stamp mill was started this

A determined effort is noticeable in some of our B. C. exchanges to boom the oil lands of South-East Kootenay and Southern Alberta. As yet the only reports of authorities are the old ones of Dr. A. R. C. Selwyn (1891) and of Dr. G. M. Dawson. That oil is frequently found on the stagnant pools of water in this section is a matter of common knowledge, but that oil exists in commercial quantities, and can be obtained by drilling and pumping yet remains to be demonstrated. The Review is keeping a watchful eye upon developments, and has a correspondent in the field, whose views will shortly be laid before our readers.

We reprint in this issue, from the Lead and Zinc News, an article by the well-known engineer, Mr. J. W. Malcolmson, on the Custom Smelting Industry of Mexico, because of Mr. Malcolmson's expressed opinion that the supply of Mexican lead ores is permanently below the demand; and because of his

month, and a clean-up made at expiration of the first 24 hours' run; the reported yield was about \$10,000, but the tonnage crushed was not given. As a maximum it would not exceed 150 tons, and as a minimum it should not have been less than 100 tons; the yield per ton, therefore, was somewhere between \$70 and \$100. Doubtless this is far above what the mine will average, taking one month with another; at the same time the ore is arsenical, carrying much mispickel, and there will be a very considerable addition to the yield from the chlorination or cyanidation of the concentrates. The results must be very encouraging to the executors of the Daly estate, who have expended large sums for more than three years, but they will be still more encouraging to, and effective with, the owners of claims in the adjoining Similkameen country, who have been delaying work upon their own properties until results were obtained from the Nickel Plate. The Review extends its congratulations to Mr. Rogers for his persistent work and his now visible success.

A Practical School of Mines.

In a recent issue of that admirable weekly, the Mining and Scientific Press of San Francisco, mention is made of an innovation which the State School of Mines of New Mexico has made for the purpose of giving the students of that institution practical experience in actual mining. This innovation consists in the purchase of a mine in that State, where the students actually work under instruction, and free from the petty jealousies and unreasonable secrecies which are sometimes evident among the superintendents and foremen of the mines where students of the summer schools of the larger universities are permitted to have a few weeks' underground experience.

The article has suggested to the Review the possibility of some of our Canadian millionaires presenting to McGill, Toronto or Queen's Universities a partially opened and partially equipped mine, where practical instruction for considerable periods of time might be possible. As our esteemed contemporary fitly says—the young miner must be taught self-reliance, and required to take the initiative very frequently; where the mining school controls the mine and the commercial phase is subordinated to the educational results accruing to the students, opportunities are afforded which never obtain under the conditions existing about mines which are being run as business enterprises. Very clearly is this the case in regard to many items and small matters of teaching, which, though insignificant in one sense of the term, are exceedingly important factors in a complete mining education. For example—the timbering, track-laying, surveying, care of underground machinery and ropes, and a host of similar matters, which are rarely, if ever, brought to the notice of the student in a summer mining school.

The suggestion pre-supposes a condition which the Scientific Press makes no allusion to in its article, viz.: the possession of a teaching staff which is competent to act as instructors in the actual work to be done about a mine. Without in the least desiring to make any imputation against any of our

mining schools, it is yet a matter of absolute knowledge that the majority of the instructors in the art of mining, and its allied subjects, are not selected because of their previous experience in actual mining, but because of their supposed proficiency in the art of imparting the knowledge they possess to other people. Nevertheless, we beg to suggest to the great benefactor of McGill University, Sir William MacDonal, the advisability of purchasing one of the abandoned copper-lead-zinc properties in the Eastern Townships of Quebec, and of presenting it to McGill University, with a fund which shall provide for its equipment in a modest way, trusting to good fortune that the work of the students may annually produce such an amount of merchantable ore as will partially contribute towards the payment of running expenses. The Review is quite willing to give its professional advice respecting the selection of such a property to any benefactor contemplating such a donation, and without fee. It has, indeed, often struck the editor of this paper that if the amount of money which has gone into the mining and metallurgical laboratories of McGill University had been expended in practical machinery, enclosed in a weather proof shed on an actually producing mineral property, the returns from the investment, in the shape of largely increased knowledge to the students, would have been much greater.

Like our contemporary, we admire the innovation which the New Mexican State School of Mines has made, and we think that its example can be followed with advantage by all similar institutions which are situated in the neighborhood of producing mineral regions. The kindergarten theory is applicable to the school of mines—it is much easier to teach something through the hand and eye than it is through the eye alone, and perhaps it is pertinent to recall to the officials of these higher institutions of learning that mining is, after all, but an art, though it may be founded upon truths of science and upon mathematics.

Adequate Supervision of the Mining Industry.

In an article apropos of the proposed Department of Mines or Bureau of Mining for the United States, our esteemed contemporary, the Mining World, in its issue of July 30th, points out that, although the United States is the greatest mining country in the world, it is the only nation which does not give, or provide, adequate supervision to the mining industry. Its remarks might be made applicable to a very large extent to the condition of things now prevailing in Canada. Of course, Canada can not compare for a moment with the United States in the variety and value of its mineral products, yet the tremendous advances which have been made during the last ten years in the value and volume of the mineral products of the Dominion make applicable many of the statements which the Mining World has seen fit to use respecting the condition of the industry in its relation to Government supervision in the United States.

The value of the mineral products of the United States for the year 1880 is given at \$369,319,000; in 1899 the value as recorded was \$976,800,000, and for 1900 it passed the billion

dollar mark, a threefold increase in 20 years. In Canada the value of the mineral products obtained for the first year on record (1886) was \$10,221,000 ; in 1900 the value of the total mineral production of Canada amounted to \$64,618,000, of which \$40,500,000 was metallic, an increase of sixfold in fourteen years. Comparison of these figures shows clearly the relative subordination of Canada as a mineral producer, but a production of \$64,000,000 justifies the establishment of some department, or separate bureau, which should have the care and fostering of this industry for its chief aim and object.

In the year 1902, at the Annual Meeting of the Canadian Mining Institute, this subject was introduced under the topic of "The National Importance of Mining," and discussed freely by many members of the Institute and some introduced guests, and the importance of the matter was thoroughly demonstrated. The C. M. I. had reasons for congratulation in the manner in which these suggestions were received by the Minister of the Interior and by the distinguished gentleman who now occupies the position of Dominion Superintendent of Mines ; at the same time it must be said that during two years which have since elapsed little or nothing has been accomplished by the Government in initiating such a department. The Review, in presenting this topic again to the attention of its readers and of the Government, is but emphasizing the points which were clearly made at the session of the Canadian Mining Institute just referred to. The necessity for a separate Department of Mines, associated, perhaps, with the Geological Survey, is greater than ever. The mining industry of Canada has grown in spite of the unfavorable influences of the boom period which existed from 1895 to 1900 ; to-day the mining industry of B. C. is on a sounder and safer footing than ever before ; to-day the mining industry of Ontario is solid, and has promise of far greater realization than it ever before enjoyed ; similarly the mining interests of the eastern Province of Nova Scotia are on a better footing than ever before ; the coal trade, the iron trade, and the gold mines of our easternmost province are to-day doing as well, if not better, than they ever did.

That the mining industry throughout the Dominion is steadily progressing is not due, in any sense, to any measures passed or initiated by the Government, but solely to the efforts which individual and private corporations have made. New and complex problems continually arise in the conduct of mining business, and they are problems which are never satisfactorily solved by men who are not equipped with knowledge for that purpose. Excellent citizens as the respective heads of Government bureaus may be, yet unless they are more or less experienced and trained in the line in which their duties lie, they must be more or less inefficient, and incapable of meeting the demands made upon them. The Department of Mines must necessarily be controlled by an experienced man, who need not (and should not) be a politician of any type, but should be a man with the quality of trained brain and with the experience that would ensure the proper discharge of his complex and trying duties, and who would inspire confidence among the mining fraternity. He should be a man familiar with the

resources of the country from east to west, and with the needs of the industry ; he should be a man more or less personally familiar with all the different provinces and with the different needs and necessities of them, and, furthermore, he should not alone be a man of book-learning and of theoretical knowledge only, but a man who has had some personal and practical experience of the business difficulties which the various laws of the provinces impose to a greater or less extent upon the mining industry.

Lawyers expect the Deputy Minister of Justice to be a lawyer, learned in the profession, and experienced in the practice of law ; why should not the mining profession expect the deputy in charge of the Department of Mines to be a miner, learned in the theory and experienced in the practice of mining ? There is no reason why they should not, and the Review believes that the Hon. the Minister of the Interior fully and clearly recognizes that the head of such a department must be a man of such learning and of practical experience.

The Review imagines that the difficulty the Minister has seen is that it has been objected that, since the mines in the different provinces are under the jurisdiction of the respective mining acts of those provinces, the Dominion can not very well interfere with them, or undertake to manage or control a Dominion Bureau of Mines which should not have full jurisdiction. In so far as the adjudication of the various provincial laws is concerned, this objection is well founded, but the speakers at the Mining Institute meeting already referred to went beyond this narrow view, and while admitting that no conflict or interference was possible, yet showed clearly how the Dominion could greatly assist and help forward the mining industry without any reference whatsoever to the various and complicated laws which govern it in different parts of the Dominion.

As was remarked in one of the papers read at the Mining Institute meeting, the United States also has no jurisdiction in many of the matters relating to mining in the Western States ; once a patent is obtained to a mining claim in a Western State, the future guidance of that mine is a matter of State regulation only. Yet no government in the world has spent so much money or given as much expert attention to the geology, methods of working, and collection of statistics as has the Government of the United States.

The necessity for a correct and displayed collection of facts relating to the mining industry, the equal necessity of maps clearly showing the geology, topography and physical characteristics of the important mining sections, the necessity of some Dominion law permitting the correct inspection of mining and metallurgical works, and the collection and tabulation of mineral statistics, were strong points that were made, but to the Review it seems as though an equally important point had not been sufficiently emphasized, and that is—the preparation of monographs upon the different commercial minerals, their occurrence, their abundance, modes of mining, and methods of metallurgical treatment ; above all other points this would appear to be one of the most important.

The Nicola Coal Field.

Great activity prevails in this section in consequence of the steps which the C. P. R. is taking to test its merits as a coal producing field, and the granting of a charter by the Federal Parliament for a railway to run from Nicola to Spence's Bridge. Five different corporations are busy prospecting in the district; two drills are at work on the Coldwater River, and another is on the way to this section, and so far the only coal discovered in workable quantity is of a low bituminous character, just a little removed from lignite; there is, however, a probability that a good grade of bituminous coal may exist, as samples of such have been tested which gave as high as 60 per cent. of fixed carbon.

Dr. Ells, of the Geological Survey of Canada, has been detailed to make a thorough examination of the section, and has already arrived at Nicola. The result of his labors will be awaited with much interest, since good coal from this district would mean cheaper fuel for all purposes from Revelstoke to the Coast, and on all branches of the main line of the C. P. R. west of the Rockies.

Important Iron Ore Discoveries.

On Hooker's Creek and Gray's Creek, both of which flow into Crawford Bay, 25 miles east of Nelson on Kootenay Lake, a genuine body of high grade specular hematite has been discovered. It is contained in a ledge 20 feet wide, dipping at an acute angle between walls of dolomite and conglomerate. The strike of the ledge is N.W. and S.E., and it has been carefully prospected and located on nine claims, the original staker being George McMillan, an old prospector, and one of the Klondyke pioneers. Assays give 55 to 60 per cent. of iron, with traces only of sulphur and phosphorus; silica is rather high, but this analysis may be accounted for, both as to silica and sulphur, by the fact that all the samples were taken at the surface, affording chances for the diminution of sulphur and corresponding increase of silica. The property is very accessible and at a low elevation. Three miles of aerial tramway would suffice to land the ore on board barges on Crawford Bay. The significance of this discovery is that it clearly proves that the hematite deposits of the Goat River section are not confined to the narrow limits previously assigned. Although the Kitchener deposits do not extend beyond Iron Mountain, these later locations (20 miles to the north) are almost in a direct line, and go far to demonstrate the existence of a sufficient quantity of ore to justify the ultimate establishment of a steel industry in the Kootenays. No higher grade Bessemer ore exists on the continent than the Kitchener deposit, if it has any equal. Assay after assay taken across the ledge has given from 65 to 69 per cent of iron. The Hooker Creek ore, though of a lower grade, will work admirably with a pure ore like the Kitchener. There is abundance of limestone on Kootenay Lake, as well as in the immediate vicinity of the ore, and Fernie coal and coke would cost only \$4 and \$6 respectively, laid down in the neighborhood of Crawford Bay.

CORRESPONDENCE.

Patent Processes Again.

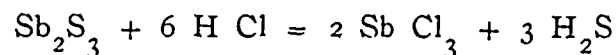
To the Editor:

Sir:—The man with a patent process usually finds a happy hunting ground in Nova Scotia. They turn up at irregular intervals, ply their wares diligently until they have succeeded

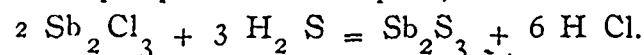
in corraling as much local and foreign capital as possible, and then they retire to other fields, leaving in many cases monuments of folly in the shape of abandoned works.

The last exponents of the patent process in the field here are three gentlemen, who have leased a shop on Grenville Street, where they are demonstrating what is known as the Ryder Process, by which, as far as can be learned, they make the modest claim of getting 100 per cent. of everything of any value in the ore.

A visit to the show brought back the days of our school chemistry lectures. Here on a counter are arranged beakers, Wolff bottles, etc. The ore under treatment at the time was an auriferous antimony ore, which is placed in vats, in hydrochloric acid, assisted by heat from a pipe through which steam passes; by this process the sulphide of antimony is dissolved, leaving the gangue, gold, and a small percentage of metallic antimony which occurs in the ore, undissolved. I was informed that the sulphuretted hydrogen formed by the treatment of the second batch of ore would be used to precipitate the chloride of antimony formed from the first batch, and thus practically no hydrochloric acid or sulphur would be lost. I assume they are relying on the following reactions: first, the dissolution of the sulphide, thus:



2nd. The re-precipitation of the sulphide, thus:



Unfortunately there is the anomaly about chemical equations which is misleading to the uninitiated. The first reaction takes place in fairly concentrated solutions, the second in comparatively weak ones. To bring the acid obtained from the second equation up to the strength required for the first equation means either the addition of considerable quantities of fresh hydrochloric acid or the evaporation of the dilute solution, and consequent loss of acid owing to the well-known fact that, on the evaporation of solutions of gaseous acids, certain quantities of the acid, varying with the strength of the solution, come over with the distillate.

Besides precipitating the sulphide, these gentlemen precipitate the metal from its chloride by scrap iron, and make pigments other than antimonious sulphide by the addition of various salts; an array of beakers with other precipitates being on view.

Inquiry as to how it was proposed to save the gold from the residual insoluble matter appeared to somewhat raise the ire of the inventor, who informed me that he had not refused offers of professorships in the leading universities to come down to Nova Scotia to teach chemistry; he did not, however, mention the names of these universities.

The operation of the dissolution of the ore is carried out in sealed tanks, and herein appears to be the only patentable part of the invention, which is evidently very wide in its application, as the inventor informed me, amongst other things, that it could be used in desiccating fruit.

The promoters of the Ryder process are wished success in commercially demonstrating the claims they make for their process, and when they have accomplished this, but not until then, they may deserve success in the formation of the local company which they are floating to run the process in the Maritime Provinces.

Yours truly,

NOVA SCOTIA.

Halifax, Aug. 22, 1904.

The Nickel Deposits of Norway.*

By MAJOR R. G. LICKER, M. E., Sudbury, Ont.

The similarity of the older geological formations of Norway to those of Canada was pointed out by Mr. Thomas Macfarlane, F.R.C.S., forty years ago, in a series of papers published in the "Canadian Naturalist."

The west coast of Norway is occupied by the Archean or Primitive, as it is there called, the equivalent of our Laurentian. Gneiss and granitic-gneiss are the prevailing rocks, the others occurring only subordinately. The serpentine (or ophiolites, as they are described by Dr. Sterry Hunt) of the Laurentian, like that of the Norwegian Primitive, carries no nickel, differing in this from the serpentine and peridotites of the Silurian. A peculiar series of Archean rocks, called the Teledmarken, is described by the Norwegian Geological Survey as "obviously clastic," such as conglomerates, sandstones and clay slates, but besides these rocks crystalline schists, gneisses, granulites and hornblende schists also occur. The strata are folded and often traversed by granite dykes. The students of ore deposits have been puzzled over the nature of these. The veins are described as true fissure veins cutting the vertical strata at an acute angle. These are silver-bearing, filled chiefly with calcite. The silver occurs only where the veins intersect the pyrites-bearing bands of the country rock. These are the Fahlbands described by Mr. Macfarlane.

The celebrated Kongsberg, "The King's Mountain" mine, occurs on one of these series of fissured veins. It has been worked for over 250 years, and yielded in that time 898 tons of fine silver, but the great fall in the value of silver has rendered operations in recent years quite unprofitable.

It is in the Pre-Cambrian and Cambro-Silurian that the deposits of copper, nickel and cobalt occur. The copper mines of Roros were started in 1646, and are to-day more largely operated than ever. The ore averages 5 per cent. copper, is smelted in water-jacketed furnaces, the matte bessemerised and brought up to 99.50 per cent. This is refined. The works are up to date.

The Sulitjelma copper mines in Saltem are of more recent opening, having been first worked in 1887. At present 30,000 tons pyrites are exported and 450 tons of refined copper produced at the works yearly.

The island of Osterø is the largest on the west coast of Norway, and is situated about eighteen miles north of Bergen. It is embraced in the great development of the Archean rocks, which stretch along the coast from Bergen on the south to Hammerfest on the north.

Several ridges, rising occasionally to a height of 1,500 feet, traverse the island from east to west. These are composed of syenite, mica schist, hornblende schist, gabbro and diorites. Over a length of five miles interbedded masses and lenses of pyrrhotite are found running subordinate to the stratification.

At Fieldskuldnaes, near the shore, three promising outcrops of ore occur, but no development work has been done other than removing the overlying soil. Continuing eastward on the strike, considerable development work has been done in the beautiful little valley of Littland.

A shaft has been sunk 100 feet on the dip of the vein, and also two trial pits—one to the east and one to the west—proving the continuity of the ore for a length of 800 feet. Here it has a width of from six to nine feet and a dip of from

15 degrees to 20 degrees. The pyrrhotite is not compact, but mixed with hornblende, feldspar and quartz. The ore pile at the shaft assayed 2.35 per cent. nickel and 1.02 per cent. copper. From the level of the little lake an adit level could be driven in which would facilitate drainage, and give a good back of ore when driven towards the rising ground.

About 600 yards north, on the shore of the lake, another vein is seen, but under water. The width appears to be about 7 feet of compact pyrite and pyrrhotite.

Ascending the ridge, and at a height of 800 feet above the sea level. No. 4 mine of the Noonas group is reached; then the continuation up to Nos. 2 and 3. Here the ore bodies are more broken and dip at an easy angle, from 10 degrees to 15 degrees. The ore in places is compact, of a bronze-yellow color, and at other points is scattered through the underlying diorite. Samples from piles ready for shipment yielded:—From Number 2, 2.15 per cent. nickel and 1.21 per cent. copper; from Number 3, nickel 1.85 per cent., copper 1.95 per cent., showing that there was a considerable proportion of earthy gangue present.

Number 1 workings are at an elevation of 1,050 feet above sea level. The ore-bodies are irregular and detached. The north or hanging wall side is largely composed of hornblende schist and mica schist, the underlying or foot wall side showing more gabbro. Some copper ore of good grade, running over 7 per cent., was shipped from here, but the nickel contents were low. The average of the shipments from this point, however, ran about 2 per cent. copper and 2 per cent. nickel.

A good waggon road from the wharf to the highest working has been built, while the ore from Numbers 2, 3 and 4 was conveyed by wire cable to the shipping point, a distance of 1,500 yards. The deposits at Littland and Fieldskulnaes are still more convenient to the wharf, where vessels of the very largest tonnage can lie in perfect safety in the well-protected fiord of Lonevaag.

South of Bergen about ninety miles, and about seven miles out from the harbor of Haugesund, lies the island of Foeoe. It forms one of the interesting group which protects seaward the entrance to Haugesund.

These islands are composed of granites, syenites, quartzites and schists. A deposit of compact sulphides has been opened up on the island of Foeoe, and about 4,000 tons of ore shipped. A vertical shaft has been sunk to a depth of 120 feet, and levels extended east and west for a total distance of over 300 feet; a winze has been put down near the face of the east level to a depth of 20 feet. These workings have been in ore all the way. The ore-body strikes east and west, and dips at an angle of about 45 degrees south. Its thickness is irregular, running from four feet up to sixteen feet, and lies conformable to the stratifications. It has the appearance of three lenses, whose ends slightly overlap, and their continuation in depth has not yet been determined. The country rock is rather fine grained gabbro, with narrow bands of hornblende schist interstratified on the north side.

The ore is hard and free from gangue. About 600 tons selected for copper were shipped to England, and yielded 8.50 per cent. copper. Two cargoes of run-of-mine were shipped to New York, and assayed 2.25 per cent. nickel and 2.25 per cent. copper.

The shaft is situated within 40 yards of the loading chute, underneath which vessels of 5,000 tons can load in any weather, as the cove is perfectly land locked. The facilities for shipping could not be excelled.

* Paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

In the southern part of Norway the important nickel mines which have been opened are those of Evje, Ringerike, and Askim.

The Evje mines are situated on the mountain range which forms the eastern boundary of the Otter Valley, at an elevation of 500 feet above the river. The geological formation is very similar to that described at Osterø and Fococ. The schists are tilted to a high angle, and by contraction or lateral pressure have become corrugated, these corrugations running at right angles to the strike. The openings produced in the foliation have become filled with iron sulphides carrying nickel and copper, but sometimes a pinkish colored feldspar occupies the full width of the opening. Occasionally fine crystals of tourmaline are found in it. These ore deposits form, therefore, a series of lenses, more or less connected, or they may be described as a saddle reef, only instead of following each other vertically, as in the gold-fields, they form a series of saddles in horizontal series, somewhat flattened, so that the flaps touch each other. These may be described as the leaders, which guide the miner in following up the series of ore deposits.

The ore is of good grade, according to many analyses made by Messrs. H. H. Vivian & Company, who worked the mine for some years; the average runs from 3.30 per cent. nickel to 4.05 per cent., and 1.00 to 1.30 per cent. copper. Cobalt is always present, some assays showing as high as 0.50 per cent.

This ore is carted down hill about three miles to the river bank, where it is put on the roast beds and calcined. Care is taken to retain what we should consider a high proportion of sulphur, the object being to produce a matte from first smelting carrying 12 per cent. nickel and 4 per cent. copper. The loss in slags being kept down to .20 per cent. The matte is taken to the open hearth, where it is brought forward to a matte carrying 65 per cent. to 70 per cent. of the combined metals. An average analysis is given as nickel and cobalt 50.90 per cent., copper 17.00 per cent., iron 9.30 per cent., and sulphur 22.80 per cent.

The main shaft has reached a depth of 91 meters (290 feet). On the west side a face of good ore is exposed. On the 80 metre level a body of ore 16 feet wide by 13 feet high was being stoped; length undetermined.

Pumping and hoisting are effected by turbine, driven by a sixty feet fall of water, on the Odde River; the power being conveyed by wire rope. The works are situated near the falls of the Odde River, which furnishes power for all the machinery required. If this power were developed, it should be equal to 2,500 horse power. No mining location can surpass this for facility of cheap development. The ground is favorable for an adit level, which would give a back of 500 feet on angle of dip. The power for air-compressors, electric motors, etc., would be furnished by water power on the spot.

The mining district of Ringerike is one of the most beautiful in Norway. The Tyrifjord, with its surrounding mountains and numerous fertile valleys watered by clear mountain streams, reminds one of the impressive scenery of the Eastern Townships.

The railway runs up the charming valley of the Drammen to the Randsfjord and other great lakes stretching down from the north. The mines of Ertelien, Langedal and Stovernangen have furnished the smelting works at Vacleren with over 50,000 tons of ore. The cost of this delivered was about \$1.75 per metric ton. The average contents was 2.10 per cent. nickel, 1.00 per cent. copper. Cobalt was usually present to the amount of 0.20 per cent.

Mr. Macfarlane, who spent several years in that district of Norway, says: "The fahlbands in the neighborhood of Ertelien and Ringerike have not been so carefully studied as those of Kongsberg and Skuterud, nevertheless it admits of no doubt that the nickel mines of the former locality occur on impregnated zones of rock like the fahlbands. The deposits are irregular masses of magnetic iron pyrites containing 2 per cent. metallic nickel. Although a definite veinstone is not observable, it appears from the presence of selvages in various places that the deposits partake of the nature of veins." From personal observations I am disposed to agree with this description, as the conditions under which these ore deposits occur, are different from those already described.

The ore is found interlaminated with the schist, and two tons have to be broken to furnish one ton of smelting ore. These schists dip at a high angle, and are cut in two places by diorite dikes. The surface workings extend over a length of half a mile. The ore is conveyed to the smelting works by wire tramway, and is treated in the same manner as that at Evje.

At the smelting works the plant is driven most of the year by water power. There is an abundance of wood on the company's estate both for mines and fuel as well as for building timber. Coke brought by rail from Drammen costs \$5.00 a ton, and labor is abundant and cheap. The manager estimates that he could deliver 50,000 tons a year to a smelting works.

The cobalt mines at Skuterud, of which Mr. Macfarlane was for several years manager, are described by him as occurring "on a fahlband which has been traced about five miles, the rock being quartzose mica schist. Layers of impregnated hornblende and actinolite schist are also of frequent occurrence. The rocks run north and south, and have a dip nearly vertical; sometimes inclined slightly to the east, sometimes to the west. In these rocks the following metallic minerals have been observed:—Magnetic iron and copper pyrites characterizing the fahlband; cobalt glance; cobaltine; cobaltiferous-mispickel; magnetic iron ore; graphite and molybdenite are found more sparingly, impregnating the fahlband at certain places. They seem to form a succession of small layers running parallel with the foliation of the rock. The fahlband itself has a breadth of from one to five fathoms."

These ores were crushed in a stamp mill and concentrated on percussion tables. The concentrated ore was roasted and smelted in reverberatory furnaces. The matte or Zaffre, containing about 30 per cent. cobalt oxide, was shipped to England, where it was manufactured into pure cobalt oxide and smalt.

The nickel mines of Askim are thirty-three miles by rail from Christiania and forty-one miles distant from the port of Fredrikstad, with which they are connected by railway.

The low mountain ridge of Romsaas, rises out of a very fertile valley to a height of 250 feet. The country rock is here similar to that of Ringerike, but is more broken and disturbed with diorite dikes. The ore occurs in detached masses, having a length varying from 30 to 60 feet, with an average thickness of six feet. Occasionally the vein or fissure is filled with feldspar and a little hyperstene. About 30,000 tons have been mined, one-half of which was picked out by hand for the smelting works. The average of this was 2.40 per cent. nickel and cobalt. Some of the ore was roasted and other lots smelted raw, so that the first matte was low grade and irregular, running from 5 per cent. to 7 per cent. This was roasted and subjected to another smelting, which brought the nickel contents up to 35 per cent. No attempt

at systematic development of the deposit has been made, although the location offers every facility for so doing. An adit level can be brought in from the low valley and the whole mineral zone cross-cutted.

The mineralized zone has a length of 350 yards and a width of 100 yards. A large concentrating plant would be required, and it is very doubtful if this could be made to pay at present prices of nickel and cobalt. The concentrates do not carry over 3.50 per cent. to 4.00 per cent. nickel and cobalt, with about 0.50 per cent. copper.

The Glommen River, the largest in Norway, tumbles over immense falls within 1,500 yards of the mine. A company has just completed a plant which develops 45,000 horse power, and is prepared to furnish electric current at the rate of \$15.00 per horse power per annum.

It will be seen by the foregoing that although there are in Norway many extensive bodies of pyrrhotite carrying nickel and cobalt, yet they are too scattered and too low grade to successfully compete with the great mines of New Caledonia and Canada under present conditions. The particularly favorable position of Osterø and Focøe for shipping ore to foreign markets, or for the importation of fuel, might enable them to be worked on a moderate scale.

The owners are hopefully waiting for the enforcement of the export duty on Canadian ore and matte, which they believe will again give Norway a large share of the European nickel market.

The Development of Coal Mining in Canada.

Contributed by WILLIAM BLAKEMORE, M.E.

Nothing in connection with the mining industry in Canada is more gratifying than the fact that, of all its important branches, coal mining is at once the most extensive and the most progressive. Prosperity in other departments has ebbed and flowed; the silver lead industry has receded from its 33,000 tons in 1900 to 12,000 tons last year, only to start again on the up grade this year under the stimulus of the bounty and enhanced prices. Copper has fluctuated greatly both in tonnage and price, yet the unlimited possibilities of the low grade deposits of the Boundary have more than offset the heavy fall in tonnage and values in the Rosslund Camp. The first flash of success in the Yukon has passed, and gold recoveries have fallen from \$25,000,000 in 1898 to \$16,000,000 in 1903. Coal alone has maintained a steady and practically unbroken record of increased tonnage, widespread development and enhanced profits. In ten years the output has risen from 3,783,499 tons to 7,996,634 tons.

The most gratifying feature of this development is that hand in hand with it have progressed the manufacturing industries which alone can build up a prosperous nation. The basis of all these is cheap and abundant fuel. It is this which first enabled England to become the pioneer of manufactures, and we have not yet ceased to marvel how nearly 200,000,000 tons of coal are mined annually in a territory smaller than Nova Scotia or any New England State. It is the same bountiful provision of nature which has enabled the U. S. to forge ahead and finally become a formidable competitor, not only of Germany and Belgium, but of the Motherland as well. That Canada will be able to follow suit is daily becoming more evident. To say nothing of textile manufactures, which perhaps depend more particularly on water power, take those lines which are inseparably connected with the use of coal for fuel and smelting purposes, the allied iron and steel trades; in 1898 the

total value of exported goods of this class was \$606,082, in 1903 it was \$3,263,940, or an increase of 500 per cent. Such an increase shows that the natural course is being followed in Canada, and that "pari passu" with the developments of coal mining the industries properly associated with it are keeping pace. This is the hopeful augury for the future of Canada, the forging ahead of the "secondary industries," as Mr. Chamberlain calls them. It would avail us little to produce pig iron, or the cruder qualities of iron or steel, if we did not proceed to their manipulation in finer form, calling out the intelligence and all the higher qualities of our people; and of this coal is the foundation.

We have suggested that it is abundant and cheap—let us see how far this statement can be verified.

Nova Scotia has, for upwards of 150 years, been a producer, but it has only been during the last 10 years that she has known any expansion. Now, instead of the General Mining Association of the Georgian era and the earlier Pictou mines, we have in the province more than 20 shipping companies, and an output which is rising by leaps and bounds. One company alone is likely to reach 3,500,000 tons this year, and at least four others have equal potential capacity. For the first time in her history she has exported coal to Europe, and, with English companies (which first exploited her mineral wealth) again entering the field, it is certain that in the near future Nova Scotia coal will be found cheaper for the purposes of English manufacturing than the deeper native seams, which alone will be available in the Old Country; when that day arrives the annual output of N. S. will not be reckoned by millions, but by tens of millions.

It is nearly ten years since the Review first discussed the possibilities of such a development and stated that when N. S. coal could be delivered at British ports at \$3.00 a ton, the demand would be practically unlimited; this will be effected as soon as steel makers in England work their mines on this side, and eliminate the middleman's profit, and that is on the high road to accomplishment.

It must not, however, be thought that Canada looks alone, or indeed chiefly, to an export trade for the building up of the industry of the Maritime Provinces. The establishment of those gigantic enterprises—the Nova Scotia Steel Co. and the Dominion Iron and Steel Co.—are a sufficient reply to such a suggestion. The former has achieved a splendid success, and the latter will yet emerge from its difficulties to furnish crude material for many a workshop and factory.

In British Columbia, Alberta and the Northwest the outlook is still brighter, and this is a marvel, because at present it is only a pioneer country, with scarcely a single manufacturing industry started. Yet here we have the finest coking coal on the continent and every condition requisite (except population) for the development of a steel industry which would supply the West with products essential to the use of civilized communities—which are now being hauled 3,000 miles. The problem of population is rapidly being solved by the thousands who are pouring into the Northwest, and meanwhile instead of two mining companies on the coast, the Dunsmuir and the New Vancouver Co., and two small ones in the interior, with an output of 1,000,000 tons a year, we have to-day ten shipping companies, with a capacity this year of 2,500,000 tons, and at least five others developing. It is worth while noticing the distribution of these companies to illustrate the widespread character of their operations: the Dunsmuir and the Western Fuel Co. at the coast; the Crow's Nest Pass Coal Co. at Fernie, Morrissey and Michel; the Alberta Coal and Railway Co. at Lethbridge; the McNeil Co. at Canmore

and Anthracite; the C. P. R. at three points, Banff, Bienfait (Assiniboua) and Hosmer; the Western Canadian at Frank; the International Co. at Coleman, to say nothing of at least as many more who have just started up in the Blairmore, Flathead, Elk and Nicola districts. Up to date these have supplied B. C. smelters, the whole of the steam and domestic trade of B. C. and the Northwest, the San Francisco market, and latterly the Montana and Washington smelters and railways. Every grade of coal, from anthracite to lignite, is being mined in the West to-day, and over an area 1,000 miles long from east to west, and 200 from north to south. Alongside the metalliferous riches of the Rocky Mountains nature has placed her best smelting fuel, and for hundreds of miles across the prairies—where, for ever, wheat raising must be the only industry—she has laid boundless deposits of lignite, suitable for steam and domestic uses. On the route of the Grand Trunk Pacific these are as plentiful as on the C. P. R., and it is doubtful if better coal has been found in the West than at Berkeley Falls. It is a matter of common knowledge how the Yukon is now mining its own coal, and there is no reason to doubt that as far east as to the Laurentians fuel will be found.

So far, however, Central Canada has no native coal, and the great industrial centres of Ontario have to draw their supplies from the United States. Luckily water carriage minimises this disadvantage, but it is nevertheless a handicap, and goes far to explain why Montreal, with its base of supplies in the Maritime Provinces, is rapidly distancing Toronto as a manufacturing centre, and takes—as it does this year—more than 1,200,000 tons of coal by the St. Lawrence route. Whether the deficiency will be ever made good by discoveries in Ontario remains to be proved. Assuredly relief must come—if at all—from Northern Ontario, and the survey being made by the Government in that section will be followed with the greatest interest.

The Exploration of the Ontario Iron Ranges.*

By A. B. WILLMOTT, Sault Ste. Marie, Ont.

For the past few years there has been considerable examination and discussion of our Ontario iron ores. The geological similarity between certain belts in Ontario and those found south of Lake Superior has been recognized. It has been claimed, especially in old reports, that Ontario and Quebec abounded in iron of the finest quality. Our politicians, always desirous of flattering, tell us so to-day. Yet the Hamilton, Soo and Midland furnaces notwithstanding much search, have only one large producer on which to draw to-day. In 1902 these furnaces consumed 93,000 tons of Ontario ore, and were forced to buy 94,000 abroad. Still I am inclined to think that our politicians will prove right in the long run, and that our lack of ore bodies is due to the fact that we have not sought them in the right way. We have numerous surface indications, the interpretation of which it is the purpose of this paper to discuss.

Geographical Distribution.—These iron ranges are found from the Lake of the Woods on the west, to the Ottawa River on the east. Just as we have the Menominee, Marquette, Gogebic, Mesabi and Vermillion ranges skirting the American shore of Lake Superior, so we have the Mattawin, Animikie,

Nipigon, Michipicoten and Batchawana ranges skirting the Canadian shore. The location of these and many others, together with notes on them, are given by Professor Miller in a report published by the Bureau of Mines for 1902. The more important seem to be the Step-Rock-Atikokan, the Hunter's Island-Mattawin, the Animikie, the Nipigon-Long Lake, the Michipicoten, the Hutton, the Temagami and the Eastern Ontario.

Geological Range.—These iron ranges belong, with one exception, to the oldest geological formations. North of Lake Superior, as south of it, three iron bearing ranges are recognized. The oldest is that of the Lower Huronian; following this the Upper Huronian, and the third, is the Animikie.

The only range found in the Animikie is that extending from Gunflint to Port Arthur and east. It is to be the subject of a paper before this meeting of the Institute, and will not be further described here. The Mesabi, the Gogebic and the Menominee ranges of the United States, together with a part of the Marquette range, are the geological equivalents of the Animikie. These ranges produce 75 per cent. of the ore of the Lake Superior region. We have as yet no producing mine in rocks of this age. It should also be noted that the Animikie rocks are confined to a small triangular area near Port Arthur, unless the shales and tuffs within the nickel belt at Sudbury prove to be of this age.

Upper Huronian rocks are more widely distributed. The typical area is that north of Lake Huron from the Sault to Sudbury and beyond. Wherever Huronian areas are shown on our geological maps future detailed work will probably show both the upper and lower divisions. The Upper Huronian, has, however, not proved prolific in iron. With the exception of the larger part of the Marquette range there are no producing mines in rocks of this age. About 16 per cent. of the product of the Lake Superior region for 1900 came from the Upper Huronian. The prospects now being worked in Deroche, and adjoining townships, north of the Sault, seem to be of Upper Huronian age. So also the mine in Aberdeen Township, from which several vessel loads of hematite were taken a number of years ago. The hematite patches in quartzite in the Townships of Long, Rutherford and elsewhere, on which some work has been done, are similar in appearance and of the same age. The ore is of high grade, but so far small in quantity. It should be noted here, for the benefit of anyone consulting American literature, that the Upper Huronian of Canadian writers is the equivalent of the Lower Huronian of American writers, they having wrongly correlated the Animikie with the original Huronian, whereas it is a later formation.

The lowest and oldest of the three iron-bearing formations, i.e., the Lower Huronian, is much the most widely distributed in Ontario. It has given us our only producing mine of any size; and our most encouraging prospects are in rocks of the same age. South of the line the Vermillion range is of the same age, and a few small, worked-out properties on the Marquette range also belong here. In 1900 less than 9 per cent. of the Lake Superior production was of Lower Huronian origin. With the opening of the Helen the percentage was somewhat increased.

It is in rocks of this age that our main supplies will, I believe, be found. The occurrence of the iron belts, their form, composition, etc., thus become of great economic interest. In every area shown as Huronian on our geological maps, wherever in the region of the Great Lakes the green schists are found, there also have been found, or will be found, the sediments of the iron ranges. These may be small in extent,

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representing only the last remnants of a large area, or they may be a long and narrow belt. In no case has a band half a mile in width been found. Usually there are a series of lenses arranged for the most part in a row, or occasionally in a few parallel rows. At other times the iron belts persist for many miles, in long, narrow bands enclosed on either side by green schists. The Hunter's Island and Mattawin belts are good examples. The Nipigon Long Lake range is perhaps continuous for seventy miles. The Michipicoten range is nearly as long, but is frequently interrupted.

Character of the Rocks.—The Lower Huronian rocks of the Vermilion and Michipicoten ranges have been somewhat carefully studied, and may be taken as characterising the other ranges. At the base of a series in both regions there is a massive greenstone, elliptically parted; this is the oldest known rock of the Lake Superior area. Overlying this is the iron formation. Later are intrusive granites, porphyries and greenstones. The whole have been bent in great longitudinal folds and closely pressed. The original sediments now stand nearly vertical. The massive greenstones have now a cleavage developed in them by pressure which corresponds closely with the bedding of the sediments. Metamorphism has so changed many of the latter that it is now difficult to distinguish some of the greenish sediments from the schistose greenstones. The comparatively thinly bedded sediments, when upturned on edge, make quite narrow bands in the older greenstone schists, even when doubled, as they probably are in most cases. The longitudinal folding sometimes produces one belt; sometimes several parallel ones.

In addition, a transverse folding has usually taken place, crumpling steeply the longitudinal fold. The bottom of the longitudinal fold, could we see it, in place of remaining straight has been bent into a series of hills and valleys. So also the top, but denudation has in most cases destroyed the surface appearance. Usually the hills resulting from the transverse folding have been cut down more than the valleys; in some cases until they have entirely disappeared. In the Michipicoten area the iron range hills now standing are, in many cases, the bottoms of the transverse valleys. It is in these cases useless to drill in the green schists between two iron formation outcrops with a view of finding a buried portion of the iron range.

The iron range rocks have been frequently described. They include iron carbonates, ferruginous cherts, pyritic chert, banded ore and jasper and lenses of ore and of pyrites. Banded jaspers and cherts are the most common and the most characteristic. Carbonated schists are commonly associated with the iron formation in the Michipicoten region.

Formation of Ore Bodies.—It has been conclusively proved by Van Hise and his associates on the United States Geological Survey that the lake iron ores are the result of concentration by descending waters. The source has in most cases been iron carbonate, though iron pyrite in the Michipicoten and iron silicate in the Mesabi have been important factors. Ores seem to have been concentrated in every case in an impervious basin. This in the Lower Huronian, is usually the upper layer of greenstone underlying the iron formation which has been folded in a trough. Transverse folding has made the trough a basin. Such would appear to be the case at the Josephine and Frances in Michipicoten and at the Chandler in Minnesota, and elsewhere. It is also true of the Helen, though at this mine there is a second cause at work.

Basins are also made by impervious layers of slate within the iron formation itself. These frequently defeat their use-

fulness by making several small basins instead of one large one.

Dikes cutting across the formation, particularly where a pitch occurs, frequently form one side of a basin. This is true of the Helen in part. A dike crosses the formation at right angles, dipping perhaps ten degrees in the same direction as the formation pitches. As green schists undoubtedly form the bottom of the trough, an impervious basin should exist on the side where they meet in an acute angle. There is some ore here beneath the bottom of Boyer Lake, how much is not yet known. The main body so far discovered, however, is on the opposite side of the dike, i.e., the dike forms the foot-wall. Several dikes of similar character cross the iron formation near Iron Lake. One of the best surface shows on the Michipicoten range occurs in connection with one of these.

Favorable Indications.—From a consideration of the above facts and theories regarding the formation of iron ore bodies we are led to the following conclusions regarding surface indications:

(a) An impervious basin of schist or greenstone surrounding and underlying the iron formation is favorable. This basin can frequently be seen at the ends of the shorter belts, as at the Helen, Josephine and Frances. The central parts of the longer belts are not likely to give definite evidence on this point.

(b) If the basin is in the form of a pitching trough it is still more favorable. On the strength of this and other reasons drilling was carried on at the Frances and at the Josephine and ore bodies located far below the surface.

(c) The crossing of the iron formation by a dike is favorable, as it may chance to form one side of an impervious basin. At any rate it has promoted the circulation of water by fracturing the formation.

(d) Contact planes, either within the formation, or between it and other formations, are favorable, because here movement has frequently taken place and the circulation of water promoted.

(e) The more broken and crumpled the jasper and chert the better, because circulation has here been good.

(f) The less the amount of iron in the banded jaspers on the surface, the better the prospect of finding ore in the bottom of the basin. A regularly banded jasper and hematite is not likely to have been concentrated downwards.

(g) The presence of any carbonate of iron is an unfavorable sign. It shows that concentration is not complete, perhaps not begun. It is true there is a large amount of siderite adjoining the Helen on the east. The ore has, however, been made, I think, from what was the continuation of this hill of siderite westward over Boyer Lake. At the Josephine no siderite occurs in the numerous drill cores on the islands in the lake. Nor does siderite occur in the Frances outcrops or cores.

(h) A sufficient width of iron formation is necessary. One hundred feet is too narrow to yield an ore body of any size; four hundred is better. The Helen formation is over nine hundred feet; the Frances, six to nine hundred; the Josephine, two hundred and fifty feet at a depth of four hundred feet.

(i) The presence of impervious layers of slate, etc., in the iron formation is unfavorable. The result is to make a series of basins each one too narrow to produce any large concentration. The Michipicoten range at Iron Lake exhibits this character. No deep work has, however, been done to prove the underlying basin.

(j) The points where the iron ranges cross low ground are the most favorable. Van Hise states that experience on

the south shore of Lake Superior shows that the ore bodies are found below the crests but above the low grounds. In Michipicoten the lowest points on the range have proved most favorable at the Helen, Josephine and Iron Lake. At the Frances there is an isolated hill of ferruginous chert rising 200 feet above a level plain. Ore has been found nearly six hundred and fifty feet below the top.

(k) The presence of magnetite is an unfavorable symptom. In very few mines on the south shore of Lake Superior is the ore magnetic. In the Michipicoten range, where magnetite is found, intrusive granites or other igneous rocks occur. These intrusives are mostly of Upper Huronian or Keweenawan age. Little concentration took place before these intrusions, and apparently none since. So also in the Mesabi range, the Keweenawan overflow prevented the formation of merchantable ore bodies in the eastern part of the range. The same condition probably operated in part of the Port Arthur district. Because an iron range is magnetic is, however, not sufficient ground for condemning it. On the contrary, one of our best ranges, that of Hutton, is mainly magnetic.

Methods of Exploration.—Assuming that a given area of country is to be prospected for iron, I believe the following things should be done, and in the following order:

(1) Determine the geological boundaries of the different formations, particularly of the lower Huronian.

(2) Cross the latter, at right angles to the strike, at intervals of a mile. Wherever any indications of the iron ranges are found this interval should be reduced to one quarter of a mile. The valleys of streams should be examined for boulders of iron and of banded jasper. From a boulder found in the valley of the Magpie River I was able to point out in my first report on Michipicoten that iron rocks similar to the Vermilion range occurred in the district. A dip needle should be carried, but I do not believe it worth while to make notes of the readings, and a map unless something of value is found. Where the intervals are reduced to a quarter of a mile an attempt should be made to get complete sections.

(3) The iron range found, an accurate geological and topographical map should be made. This should show the outcrops of rock, the kind, the strike, dip and pitch, the length and width of the iron formation, dikes, if any, the position and depth of the basin, if possible. This last is a most important point, but also a difficult one. The pitch of the basin can sometimes be inferred from that of the cleavage of the adjoining schists. Again, the direction of the opening of the V-shaped banded jaspers is a guide.

(4) Surface stripping should be undertaken while the geological map is in progress. This form of development is enormously cheaper than rock work. To say nothing of the assistance derived from it in determining the geological structure of the location, this superficial work is just as likely to locate ore bodies as are hollow shafts put down at random. It is well established in the Lake Superior area that all ore bodies somewhere reach the rock surface. Surface work should uncover the contacts and other likely points for ore deposition. Rock work, because of its greater expense should not be started until thorough trial has failed to find ore at the surface. If ore is found it should be followed.

(5) If an ore body is not found, and the indications are favorable, deep work must be undertaken. This will usually be the condition. A choice must be made between shafts and tunnels and diamond drilling. The latter is usually to be preferred because

- (a) It proves ground to a given depth cheaper, and
- (b) It does the work much faster.

It is to be remembered also that the prospect shaft will, in most cases, turn out to be very poorly located for economical mining, and is apt to be discarded. There is a great advantage in knowing the shape and size of an ore body before locating the shaft and installing the surface equipment. This knowledge can certainly be got best by means of a drill.

(6) The location of the holes is of prime importance. The first ones are naturally directed to finding ore; the succeeding ones to determining quantity. Ore is most likely to occur along the sides or bottom of the basins and along dikes or other planes of contact. As the schists which surround our iron formations can be drilled two or four times as fast as the banded jasper it usually pays to locate holes in the schists crossing into the jasper near the point which it is desired to reach. Vertical holes, parallel or nearly so with the bands of jasper, are to be avoided. They are very expensive to drill, and the record brought from a band of ore, say, two inches wide, is very deceptive. The crossing of the banded jaspers at a high angle is safest. To reach the bottom of a basin of unknown depth, probably the best way is to put down several holes from a point to one side, at successively higher angles. The depth to which these infolded iron formations go is surprising. At the Josephine the iron formation is less than three hundred feet wide, but it has been proved to a depth of seven hundred and fifty-eight feet below the lake level, and may go much deeper. At the Frances, the total length of the iron formation is 1,450 feet and the maximum width nine hundred feet. This short and narrow lens in the schist has been proved to a depth of over eight hundred feet, and may go further.

In both these cases ore has been found by probing for the bottom of the basins. At the Josephine there was no ore visible at the surface, and the banded cherts in the islands of the lake were most impoverished. At the Frances a small pocket of ore out-cropped, which soon gave out in depth. In both cases theory said test the basins, and in both cases ore was found.

This is what I meant when I said at the start that our lack of ore bodies was because we did not look for them properly. There has been, during the past two years, some intelligent and systematic explorations of the Steep Rock, Animikie, Michipicoten and Hutton ranges. In most cases, I am glad to say, this kind of work has resulted in the discovery of ore bodies. The amount of work of this kind done in Ontario, on all our ranges together, is trifling, compared with that done on the Vermilion range alone, between Tower and Ely, a distance of twenty-five miles. The time has gone for running through the woods with a canoe and a pick. We have found our iron ranges, and in large numbers and great size. The question now is: What is in the bottom of them?

The Crow's Nest Pass Judgment.

The following is the text of Mr. Justice Martin's judgment in the matter of Leadbeater vs the Crow's Nest Pass Coal Company:

Five test actions were consolidated by agreement, and evidence given in support of two charges of negligence by the defendant:

1. The use of a bonneted Clanny lamp, which, it was contended, was defective and not a "locked safety lamp."
2. The accumulation of dust to a dangerous extent.

In regard to the first, it is sufficient to say that it was clearly established that the type of lamp so used, while not perfect (which, indeed, no safety lamp in reality is), yet is in

very general use, and reasonably fulfils the statutory requirements. This was, in fact, practically conceded on the argument.

In support of the second charge the plaintiff advances the theory that the explosion was essentially one of coal dust; while in answer to that the defendant company maintains that, as in every explosion in a mine of this nature, dust may have participated in it to an immaterial and unascertainable extent.

In support of these conflicting theories a great body of evidence was adduced in a trial lasting more than three consecutive weeks, and even if it were desirable for me to do so when discharging the functions of a jury on pure questions of fact (and I do not think it is), it would be almost an impossibility to attempt to review in detail all the evidence which I have listened to and weighed in a trial of such duration and complexity of fact, though not of issue. Dealing with such explosions as these, it is manifest that there is much that must remain a mystery, for no witness has been bold enough to thoroughly understand the forces of nature when disturbed by man in such undertakings as those under consideration, or give other than a speculative account of the cause of ignition, or even fix upon the precise locality of the explosion's origin. But approximately I have no reasonable doubt that some unascertained point in McDonald's level must be taken to be the place of such origin.

The next fact to be determined is, was it a gas or dust explosion? In arriving at a conclusion on this vital point, wherein science plays so great a part, the court is very largely in the hands of experts, and, in determining what weight shall be attached to their testimony, will be guided by their apparent competency and disinterestedness. Applying, then, the opinions of these witnesses to requisite facts which have been proved to my satisfaction, I am forced to the conclusion that on the evidence it must be held that this was essentially and substantially a gas explosion; and of such a nature and extent that, quite apart from any possible augmentation by dust, it was alone sufficient to cause, and consequently must be held to have caused, all the results which the plaintiffs necessarily assumed the onus of attributing to a dust explosion. In this relation I think it proper to say that I accept as substantially correct the defendants' contention as regards two facts of paramount importance, viz., (a) the state of affairs at the overcast; and (b) in the main entry generally; and largely as a consequence thereof I am satisfied that the explosion properly so called did not pass through the main entry; though, if the dust theory be accepted, that is the place of all others throughout the length of which it must have passed in the condition of that mine. There is nothing, in my opinion, in the conclusions of the coal dust committee (second report, 1894, p. viii.) which, having regard to the circumstances of this case, conflicts with this view; though it is apparent that there is still much to be learned on the interesting and important subject of dust in coal mines.

Such being the opinion I have arrived at, it is not necessary to consider any other matters, which become immaterial, nor to refer to cases cited, because on the above facts so found no negligence can be attributed to the defendant company.

It follows that the test actions must be dismissed with costs.

The Custom Smelting Industry in Mexico.

By JAMES W. MALCOLMSON. Reprinted from the Lead and Zinc News.

The rapid growth and development of the silver-lead smelting industry in the Republic of Mexico was due primarily to

the Windom decision in 1892, imposing a duty of one and one-half cents per pound on lead in ores imported from Mexico into the United States. The result of this decision was that over \$35,000,000 has been invested in silver-lead smelting enterprises in Mexico, and large profits have been made ever since; incidentally, it might be mentioned that treatment rates on silicious ores in Colorado went up \$1 to \$2 per ton on account of the reduction in the supply of lead coming there from Mexico.

Before the customs smelters were established in Mexico in 1891-2, the larger proportion of the ore was treated more or less unsatisfactorily by local methods at the points of production, but to-day most of it is shipped to the smelters. Between 80 and 90 per cent. of the entire silver and gold production of Mexico is founded in silicious ores, and it is in the purchase of these ores that the greater part of the profit is usually obtained in custom smelting.

At the present time all custom smelters are operated at their full capacity, and new furnaces are being erected, but the development of the silicious gold and silver mining industry has gone far ahead of the available furnace capacity. Ores containing the precious metals in association with lead, lime and iron or manganese are scarce, and as they usually contain little gold or silver, it is never possible to impose a high treatment charge, even when there is a scarcity of silica. Better prices are being paid to-day to the miners of lead ores and of lime and iron fluxing ores than ever before. The demand for such ores is far in excess of the supply; barren iron is shipped to the smelters from the deposits of iron stone at Durango, Monterey and Jalisco, while limestone is quarried in the vicinity of the smelting plants.

Treatment rates on silicious ores have been raised to such a degree that many mines have been shut down, and prospecting is now at a low ebb.

The condition of the lead mines in Mexico to-day is causing the custom smelters considerable anxiety, and many thousands of dollars are being spent by their mining departments annually in search for lead or silver-lead ores. Every inducement is given to the independent producer to mine these ores, and treatment rates are very low; but the lead shortage appears to be permanent. Throughout northeastern Mexico, in Nuevo Leon, Coahuila and Chihuahua, the lead mines are gradually becoming less productive in depth, or they are changing into a leady zinc ore, sometimes in the form of carbonate and sometimes sulphide. It seems quite impossible to separate zinc from lead carbonates, and, although a large amount of money has already been spent on magnetic and wet methods of separation of the closely grained lead and zinc sulphides, the results obtained so far have not given any satisfactory return on the investment. In magnetic separation, the first cost of the plant is extremely high, and the daily output so limited that it is not profitable to separate lead from zinc sulphides low in gold and silver values. On account of the chronic shortage of lead ore and the unsatisfactory character of the lead ores now being mined, one of the leading smelting companies has definitely abandoned, at Aguascalientes, the use of lead as a base or collector of the gold and silver contents of the smelter charge, substituting copper matte for that purpose.

The advantages which copper matte has over lead as a vehicle for the concentration of the gold and silver contained in silicious ores are numerous.

1. A lead furnace of standard size will smelt from 100 to 150 tons of charge (ore and fluxes) daily. The same furnace, when altered and operated as a copper furnace producing

copper matte, will smelt from 200 to 300 tons of charge per day, thus doubling the capacity of the plant, with practically the same investment in construction.

2. A lead furnace must necessarily run at a low temperature to prevent metallurgical losses, the slag must be more fusible and more carefully regulated than in a copper furnace. A typical lead furnace slag will contain 34 per cent. silica, 21 per cent. iron (FeO), 23 per cent. lime. A copper matte furnace is operated at a higher temperature than a lead furnace, and less attention is necessary in forming the slag; the iron and lime percentages may be altered within wide limits, according to the ore supply, and the furnace charge may carry as high as 50 per cent. of silica. In custom work it is desirable to carry as much silica and as little iron on the charge as possible, on account of the condition of the ore supply. A high percentage of lime also makes a light slag, which separates rapidly and thoroughly from the heavier matte carrying the silver and gold.

A modern copper matte furnace slag will contain 45 per cent. silica, 15 per cent. iron, 28 per cent. lime. In other words, in a lead furnace smelting 125 tons of charge with 34 per cent. silica in 24 hours, 42.5 tons of silica will pass through the furnace, while with copper matte, smelting 250 tons charge per day, containing 45 per cent. silica, 112.5 tons, or nearly three times as much silica, can be handled in the same time.

3. Sulphur in ores smelted in lead furnaces must be got rid of by preliminary roasting, at an increased cost of \$2 to \$3.50 United States currency per ton; in matte furnaces this sulphur is utilized in the copper-iron matte produced, the cost of roasting is eliminated, and with an excess of sulphur, as there usually is, the coke consumption is reduced, part of the sulphur being utilized as fuel.

4. Copper matte is a more efficient collector of the precious metals than lead, and copper can be enriched with gold and silver to a much greater degree than lead, without loss. Silver lead bullion is usually exported from Mexico containing 19 kilograms of silver and gold per metric ton; copper bullion can be enriched safely to contain 20 kilograms of silver per ton, and therefore only one-half of the amount of copper is required to the ton of charge.

The increase in the production of copper in Mexico is noticeable. In the year 1850, the production of the entire globe was estimated at 30,000 tons; in 1891 the production of Mexico was 900 tons; in 1903 it was 48,000 tons, equal to one-fifth the output of the United States.

Of the 1903 production of Mexican copper, 35,000 tons came from northern Sonora. The copper from Sonora, like the lead from the northeastern part of the republic, carries very little gold or silver. The copper exists as sulphide, which is concentrated and reduced in blast furnaces to matte. The matte is bessemerized without enrichment, and the bullion, assaying 99 per cent. copper, with very low gold or silver contents, is shipped to the refineries of New Jersey. Mr. James Douglas, in an article on Arizona copper mines, mentioned that the new Copper Queen works at Douglas, on the Mexican frontier, were being designed to take custom ores of copper, gold and silver, and added that "though there is no intention of invading the market for lead, it is the intention of the Phelps-Dodge Company to enrich the copper bullion with gold and silver," hoping to secure ores from Mexico.

It is not possible, however, for the Nacozari, Cananea or Douglas smelters in or near Sonora to reach the silicious gold and silver ores of Mexico, which are so badly in need of smelter facilities. These ores are not in northern Sonora, but are found at Parral, Guanajuato, Pachuca, Zacatecas, Catorce,

Durango and Oaxaca, on the central plateau of Mexico, and it is inevitable that the Sonora iron-copper mattes, instead of being bessemerized and shipped as at present by way of El Paso, Texas, overland to New Jersey, will in future be shipped to railroad centres in the central portion of Mexico, and there used as a collector of gold and silver, when they will resume their journey via Tampico by sea to New Jersey.

While the recent announcement of the intention of the American Smelting and Refining Company, the owners of the copper smelter at Aguascalientes, to secure control of the Cananea Consolidated copper mines in Sonora, is probably premature, it is an indication of the desire of that company to control a supply of copper sulphide, and when it is remembered that last year the Aguascalientes smelter made a greater profit than all the smelters in Colorado put together, the importance of permanent control of copper sulphides as a base for operations, whether in the shape of high-grade ore, concentrates or matte will be appreciated.

In view of the fact that it is desirable to change the present transport of Sonora copper so that it will pass the silicious centres of the Mexican Republic on its way to the eastern refineries of the United States, the Government has under consideration a tax on the exportation of copper bullion without precious metal values and on ores or concentrates high in copper only, which will be removed after the copper is enriched before final exportation.

Probably the movement of copper mattes from Sonora and Southern Arizona to the gold and silver districts of Mexico will finally take place in any event, and the present unsatisfactory gold and silver situation will be relieved permanently, but the contemplated action of the policy of the United States will materially hasten the change. At the present time the movement is just commencing, and profits on silver-gold custom smelting operations using copper as collector instead of lead, will probably be large for some years.

Coal Dust.

"How best to guard against the dangers of dry coal dust in underground workings is a subject beset with difficulties. The mining inspectors have had the subject before them at several of their meetings without any definite result. This is not the fault of the inspectors, but because it seems impossible either to clear the dust out of the mines or to keep it constantly in such a damp condition as to be innocuous. The quantity of dust made in some seams is immense, and scattered over a wide area of the workings. The dust collecting on the main roads can alone be practically dealt with, and this is all that has hitherto been attempted. In such parts of the mine the quantity can be diminished somewhat by watering the surface of the coal in the trams before they leave the inner workings, and adding salt to the water makes this expedient more effective; something can also be gained by seeing that the trams, when made of wood, are kept dust-proof by good joints between the boards, especially the joint where the lowest sideboard rests on the bottom of the tram. It is at this joint that the greater part of the dust escapes, but when all these precautions have been taken the roads are still dusty, and watering and removal have to be constantly resorted to. Standpipes at intervals, to which a hand hose can be attached, has

been found to be the best practical method of keeping the roads damp. This subject of damping has recently become even more difficult and complicated in consequence of statements from Continental coal fields that spraying mines with water very materially facilitates the spread of ankylostomiasis."—Iron & Coal Trade Review.

The Canada Corundum Co.

The Canada Corundum Company, which has from the Ontario Government the right to first selection of corundum-bearing properties in the corundum-bearing areas, has about completed a new 300 ton mill at its works at Craigmont. The company has had in operation a 40 ton mill for the past three years, but the demand for its products has become so extended that greater facilities have become imperative. It has purchased a controlling interest in the Hart Emery Wheel works at Hamilton, which will be enlarged and made the largest corundum wheel works in Canada. D. G. Kerr, of Almonte, has been secured as mine manager. The company is shipping largely to the United States, France and Germany, and now has its own offices in Paris and Berlin. The company has deposits in the townships of Raglan, Radcliffe, Brudenell, Carlow, Dungannon, Sebastopol and Monteagle, that in the latter township being blue, akin to the sapphire, and very superior in quality. It is so situated that the ore can be brought to the present mill by water. At present the mill is turning out 12 tons of corundum a day, which will be doubled in a short time.

Tin in South Africa.

It is reported that the vast mineral wealth of South Africa has received an important addition by the discovery of lode tin. Tin has been for some time a dream of the prospector. The supply at present by no means equals the demand, and the price of the metal is therefore high. It is quoted at £120 (about \$600) per ton, and there is no apparent reason why it should fall from this. Tin ore is also easy of reduction. The metal is found combined only with oxygen, forming the mineral cassiterite from which the pure metal is easily extracted. The mineral has been found in three different places in the new colonies, and promises to be a source of great revenue.

The London Critic says that an Antipodean expert is raising an alarm as to the future of some of the great copper and lead companies. Official figures, he submits, suggest that the end of many of these mines as large producers is near. Comparatively few of these mines, of course, supply the bulk of the world's copper and lead. For example:—

In 1900 Colorado had eight mines producing 80,000 tons lead, including the Lake mine with an output of 24,000 tons. Five Broken Hill mines produce 120,000 tons lead from approximately 1,200,000 tons ore. In copper, such producers as the Anaconda, United Verde, Calumet and Hecla, and Rio Tinto are down to very deep levels, and waste dumps and tailings, are becoming used up. To get much metal from very

poor ore soon tells a tale. New discoveries are made infrequently. On a 10 per cent. basis of recovered lead from each ton of ore, Broken Hill at present rate would exhaust 12,000,000 tons of ore in ten years; and it takes that much to maintain the world's lead supply for less than 18 months.

Therefore, the gentleman concludes, "as a whole, consumption is rapidly outpacing development; and must produce a highly speculative range of prices."

Mr. J. H. Curle, author of *The Gold Mines of the World*, writing in the "Scotsman," surveys the principal gold mines of the world, forecasting that this year the production will be larger than ever before—viz., about £70,000,000. "About £50,000,000, in equal parts, will come from South Africa, Australasia, and the United States, and the next largest yields will be from Siberia, India, Mexico and Western Canada." The Transvaal, he believes, will soon produce an average of £25,000,000 a year; and he looks to the high-water-mark of the world's gold production being reached about five years hence.

Appraisal of the Value of Coal Lands.

By H. M. CHANCE, Philadelphia, Pa.

(To be read at Lake Superior Meeting of the American Institute of Mining Engineers, September, 1904.)

In recent years an important function of the mining engineer has been the appraisal of the value of mining properties required by those planning consolidations of a number of individual operations.

In no field of productive industry have the economic results attainable by consolidation been more clearly shown than in the mining regions of the United States. In many important mining centres unification of ownership of the most valuable properties has already partially or completely been attained, and in other districts projected absorptions and consolidations await only favorable financial conditions for their consummation. The coal mines of Colorado, of Wyoming and of Utah, the anthracite mines of Pennsylvania, the Connellsville coking-coal mines, and large areas of bituminous coal land in Pennsylvania, in Ohio, in the Indian Territory and in other portions of the United States, are now largely controlled by a few corporations operating on a large scale, or by a number of corporations working in harmony because of an affiliation and inter-leaving of interests.

The tact of keen financiers and the diplomacy of men of great administrative ability are the chief operative forces in conceiving and accomplishing such consolidations, but in formulating and maturing them the services of the mining engineer are often required to supply the facts upon which they must be based. For this purpose the expert is expected to furnish full and complete reports covering the quantity of ore, coal or other mineral available, its value per ton, cost of mining and treatment, etc.

The paucity of literature covering this field of work may be attributed to the fact that experts reporting upon coal property, under past economic conditions, commonly have not been expected to include such an appraisal as a part of the report covering the property. The function of a mining en-

gineer or geologist generally has been to examine undeveloped property, reporting to intending purchasers the thickness, quality, number and yield per acre of workable coal beds; the purchaser determining whether the price asked for the property is satisfactory. In recent years, since the consolidation of developed properties has been in vogue, the engineer more frequently has been called upon for appraisals of the commercial value of going concerns, including the value of land, plant and improvements, and the good-will of the business.

In many cases this work is divided between the geologist, the consulting mining engineer, the constructing engineer and the expert accountant, each of whom, separately or jointly, is asked to report; the first upon the quantity of workable coal; the second upon the cost of mining, capacity of mines and value of improvements and developments; the third upon the value of plant and outside equipment; and the fourth upon the cost, return and net profits as shown by the operating company's books. These reports furnish material from which the financier may determine the relative values of the properties under consideration, and what sum they are fairly worth. To use this information intelligently requires sound business judgment, for the price asked by the vendors must always be greater than the aggregate value of land, plant and improvements shown by these several reports, because it includes a sum representing the value of the "good-will" of the business, or its "position in the trade."

The engineer actively engaged in the development or management of coal properties rarely has such relations with the financial management as qualify him to make commercial appraisals; and to a recognition of this fact must be attributed the practice of some financiers in relying upon their own judgment in reaching conclusions concerning the value of coal property. Doubtless, in a majority of cases, the financier is the best judge of commercial value, and if supplied with the necessary data covering acreage, quality, yield per acre, cost of mining and past profits, his conclusions are generally correct. But that grave errors of judgment may occur through misinterpretation of the facts presented by the engineer, or through a failure to grasp important economic conditions, is evidenced by excessive prices sometimes paid for coal property, and the consequent over-capitalization and bonding.

Therefore it is essential that the engineer should qualify himself for undertaking the commercial appraisal of coal properties, because much work of this nature will be required in all of the important coal mining districts before the consolidation of interests is complete in each district. To do this work efficiently he must add to his training as an engineer, a knowledge of the economic conditions affecting the cost of production and transportation, the element of competition, the market possibilities, and something of the acumen of the trained man of business—"the man of affairs."

The purpose for which an appraisal of mineral property is desired will determine the choice of method or combination of methods to be used. If it be desired to ascertain the price that can be realized for the property and franchises of a corporation, if these be disjointed and separately sold, the method must differ from that employed when the object is to determine the real value of the properties to owners capable of profitably operating them. At the outset it is usually possible to eliminate from consideration the methods based upon forced-sale valuations, first, because such valuations are commonly untrue, erroneous and misleading, and, second, because modern business methods rarely permit the owners or creditors of large properties to consider disintegration, the course adopted almost invariably being to preserve the integrity of such pro-

perties unimpaired, because of the larger profit and greater value obtainable from them as a whole than could be realized in the aggregate from the several parts. Other methods have been applied to problems of this kind, among which the following may be noted:

1. A method occasionally used in the past is to determine the value by adding to the cost of the land the cost of the improvements and a reasonable remuneration to the party which has successfully developed the property.

2. A method modelled after the common practice of real estate appraisers is to determine the value by prices at which property of similar character in the immediate neighborhood has recently been sold.

3. A method ably elaborated by Joseph S. Harris several years ago for the purpose of appraising the value of coal lands owned by the Philadelphia & Reading Coal & Iron Co. has been adopted by many experts for general purposes. By this method the total workable coal in the ground is first determined, and valued at a certain sum per ton, this estimate being based either upon what the coal would produce if leased upon a royalty, or upon the profits of mining. Using as a basis the rate of increase in production, as shown by past experience, the probable yearly increase of output is calculated, and from these figures the probable revenue is calculated for each year of the period during which the assumed output can be maintained, or until all the coal is mined. Then the probable future earnings of the land, either by royalty or through operation, are capitalized at their present money value, by the usual formulas for deferred payments, at a certain assumed rate of discount. In his report on the coal lands above referred to, Mr. Harris clearly shows that the present money value of coal land depends largely upon the time at which development is to be commenced, the time elapsing before maximum output is attained, and the time to be occupied in exhausting the tract,—the present money value decreasing rapidly as any of these variables is increased.

4. Another plan more generally used is to assume that the property can be operated at a certain yearly output, and can maintain this output for a fixed term of years at an average profit per ton extending throughout the whole period, and not providing for any increase in output beyond what may be already in sight. The capitalized value of such yearly earnings is taken as the appraised value of the property.

5. In recent years it has become common to base the value upon the actual net earnings, allowing for such reasonable increase as the conditions of the trade indicate may be expected within one or two years, and for which improvements and plans have been projected and provided, treating the proposition from a business standpoint as a going and growing business, which fairly should be worth the price which the earnings justify, provided it be not grossly in excess of the appraised value of the land, plant and improvements, as reached by other methods.

The first method may be dismissed without serious consideration, because it is impossible to determine what would constitute a reasonable profit to the operator developing a tract of land, and, further, because this method ignores the value of the business that the operator has established and the enhancement of land-values due to the development of the property.

The second method is discarded for similar reasons, also because it fails to recognize the fact that the price paid for coal property is a measure only of the value placed upon it by the vendor, who, if not in a position to operate it, may be willing to part with it for much less than its real value. In buying from original owners, coal operators rarely pay full prices, but almost invariably what they believe to be a small fractional part of the real value.

(To be continued.)

Associated Silver Lead Mines of B.C.

The annual general meeting of the Associated Silver Lead Mines of British Columbia was held at Sandon, B.C., on Tuesday, 16th August. The meeting was attended by nearly all the large lead producers of the province.

Officers were elected as follows for the ensuing year:—President, Alfred C. Garde; vice-presidents, James Cronin, W. S. Drewry, W. S. Jenkins, William Hunter and George Alexander; executive committee, Messrs. John L. Retallack, Geo. D. Potter, Norman Carmichael, Louis Pratt, W. E. Zwickley, H. Giegerich and N. J. Cavanaugh; treasurer, Oscar V. White; secretary, N. J. Cavanaugh.

Mr. Garde made a report of what the Association had accomplished during the year then ended. He alluded to the revival of the lead mining industry and to the present cordiality existing between the miners and smelters. The help which the Dominion Government had extended towards the mining of zinc was noted, and congratulations were due the Associated Silver Lead Mines of British Columbia for the results which their efforts had brought about. A resolution thanking the Dominion Government for the legislation granted was unanimously passed.

The Association has been in existence a little over a year, and has been fairly successful in its work. Four new members were introduced at the meeting.

CHEMICAL NOTES.

On account of the reported discoveries of tin in the Yukon Country and in Ontario, we deem it of importance that the following paper by J. H. Collins, which was read before the London Institution of Mining and Metallurgy on the 19th of May should be republished. The importance of finding a new source of tin is recognized in the metal world, and the Review has the hope that the publication of what is known respecting this metal will be of service to prospectors and engineers:

THE SOLUBILITY OF CASSITERITE.

For practical purposes on the mine there is no method of assay known which is likely to supersede fanning; for, although the weight of 'black tin' obtained from a given sample by different operators may vary considerably, the actual quantity of contained metal will be, in skilful hands, very nearly the same.* For scientific estimations the old Ecole des Mines method of reducing by fusion with KCy and weighing as metallic tin is easy and accurate.†

In the assay of "black tin" by the direct fusion method a previous cleansing by boiling with acid is often recommended, the supposition being that cassiterite is altogether insoluble under such treatment. This, however, is by no means the case; in fact I long ago noticed that some varieties of natural peroxide of tin were very freely soluble in HCl when in a fine state of division, and that even when HNO₃ had been added to the HCl, some tin was apt to go into and remain in solution for a considerable time.

Early in the year 1903 a very distinguished metallurgist wrote me from the United States to the following effect:—

"You will probably be surprised to learn that native oxide of tin may be dissolved completely in dilute H₂SO₄ in presence of zinc. I presume it is the nascent hydrogen which does the work, but if anyone had suggested to me the possibility of such a method being applicable to native tin oxide, I should have used 'strong language'; but we 'live and learn.'

Remembering my previous experience of the solubility of cassiterite, I believe I mentioned this remarkable statement of my metallurgical friend to some members of this Institution before making any further experiments, but lately I have made a few tests, the results of which seem to me to be decidedly interesting. I began by taking half a grm. of five different substances in fine powder, reducing them by KCy in a porcelain crucible, dissolving the fusion in hot HCl, precipitating by H₂S, igniting the precipitate, and weighing as Sn O₂.

No. 1 was found to contain 99.2 per cent. of peroxide of tin; No. 2, 94.0 per cent.; No. 3, 68.0 per cent.; No. 4, 76.0 per cent., and No. 5, 94.5 per cent.

Half a grm. of each sample, in very fine powder, was then placed in a beaker with 20 cc. of dilute H₂SO₄ (1 to 5), and 2 grms. of pure zinc, and left over night. The solutions thus obtained were boiled, precipitated with H₂S, the precipitates collected, ignited and weighed, giving quantities of Sn O₂, as under:—

No. 1 gave 3 mg.—0.6 per cent. of soluble (out of 99.2 per cent.)
No. 2 gave 9 mg.—1.8 per cent. (out of 94.0 per cent.)
No. 3 gave 160 mg.—32.0 per cent. (out of 68.0 per cent.)
No. 4 gave 360 mg.—72.0 per cent. (out of 76.0 per cent.)
No. 5 gave 81 mg.—16.2 per cent. (out of 94.5 per cent.)

Similar treatment with dilute HCl gave very similar results.

From these experiments it is pretty clear that it is the wood-tin varieties which are in any important degree soluble. I have not yet come across any sample which is entirely soluble under the conditions named, but No. 4 comes very near to being so.

I do not pretend that these experiments are in any way complete or decisive, but they are at any rate suggestive, and I bring them before the Institution in the hope that some member who has a laboratory will follow up the subject in a more thorough way than I can find time or opportunity for at present."

*See remarks by the author in the discussion of Mr. Mackenzie's paper "Trans. Inst. Min. Met.," (vol. xiii), and also experiments reported by Mr. Richard Pearce ("Eng. and Min. Journal," p. 117, Jan. 21, 1904.)

† If lead, bismuth, arsenic, antimony, tungsten or other bases of group 2 are present, proper means must, of course, be taken for their elimination before or after the reduction, but many samples of black tin are obviously free from these bases, and may, therefore, be thus assayed direct. If such silica is present the tin will not readily form one globule. In such cases the whole fusion should be dissolved in hot HCl, and the tin precipitated by H₂S, when the sulphide may be calcined, or reduced before weighing, in the ordinary way.

‡ No. 1 consisted of cheap light-coloured crystals of cassiterite from Great Wheel Fortune, in Breage.

No. 2 closely dressed "black tin," of a fine brown colour, from Wheel Metal, in Breage.

No. 3, reddish-brown wood-tin from Mexico.

No. 4, greyish-brown wood-tin from Bolivia.

No. 5, a dark brown mixture of wood-tin and cassiterite crystals from Wheel Metal.

BOOK NOTICES.

The initial issue of a new mining monthly, the "Mining Magazine," has come to our table, and promises to hold an important position in the field of technical journalism. The form chosen by the management for the issue is that of an octavo of about 90 pages, which we commend for a publication containing articles of permanent merit. That the "Mining Magazine" has such articles is demonstrated by the contents of this first number, in which the well-known and authoritative names of Prof. John A. Church, Fred. L. Ransome, Carl Heinrich and Walter Renton Ingalls are appended to four leading articles.

Prof. Church's brief resumé of mining is a thought-provoking article, in which the older mining engineer will find much food for reflection. The Review is particularly struck by Prof. Church's optimistic view of the future of gold dredging, which voices the opinion ourselves have held for some few years. Mr. Ransome's sketch of the geographical distribution of metals in the United States is valuable, and will be used for reference by many readers, even though it reminds

one of S. F. Eamons' contributions to the Transactions of the American Institute of Mining Engineers.

Mr. Ingalls and Mr. Heinrich are both authorities on the topics of which they write, and Mr. Fleming's article on coal markets is exceedingly interesting reading.

In the editorial introduction promise is made of "carefully digested" information taken from current literature, and also an index to such literature. We trust it may be possible to carry out this promise without duplicating the similar work, excellently well done, which is offered in the pages of the "Engineering Magazine."

If the Review may suggest, it will advise not re-duplicating other periodicals' work, but the continuation of presenting original articles so well begun in this number.

"The Baraboo Iron-bearing District of Wisconsin" is the title of Bulletin No. XIII, recently issued by the Geological and Natural History Survey. This monograph has been prepared by Dr. Samuel Weldman, Geologist to the Survey, and contains 171 pp. of text, with 23 plates, numerous wood cuts and several maps. The volume is sent, on application to the Director of the Survey, Madison, Wisconsin, for the remarkably low price of 10c unbound, and 20c in cloth binding.

The Baraboo district is near the centre of the lower or southern half of Wisconsin, and occupies a portion of the two counties of Sauk and Columbia. Its locus is approximately 89 degrees 30 seconds to 90 degrees west longitude and 40 degrees 30 seconds north latitude.

The area covered by this district is about 225 square miles, which is traversed by two ranges that, starting from a common point on the east, diverge towards the west, and have a length of upwards of 25 miles.

The ore, which is mainly red hematite, occurs in the Freedom formation, which consists of two members, the upper being a dolomitic marble and the lower a quartzose rock, carrying the hematite. Analyses show an iron content varying from 52.50 per cent. to 68.80 per cent. with low phosphorous, .010 per cent. to .050 per cent. The Freedom formation is classified as Pre-Cambrian Sedimentary.

PERSONALS.

During this month a group of distinguished geologists have been in a field which is covered by the international boundary line between Minnesota and Canadian territory. The gentlemen composing the group are making a tour through Ironwood, Duluth, Hibbing, the Mesabi Iron Range, the Biwabik Iron Range, the Rainy River and Rainy Lake, the Lake of the Woods, Port Arthur and the north shore of Lake Huron, for the purpose of correcting and correlating the maps issued by the respective geological surveys of the United States and Canada.

The gentlemen in the party are:—Prof. C. R. Van Hise, President of Wisconsin University and a member of the U.S. Geological Survey; Prof. C. K. Leith, of Wisconsin University; Dr. C. Willard Hayes, U.S. Geological Survey; Dr. A. C. Lane, State Geologist of Michigan; Dr. Robert Bell, Deputy Director of the Canadian Geological Survey; Dr. F. D. Adams, of McGill University, Montreal; and Prof. W. R. Miller, Provincial Geologist of Ontario.

John Moore, the foreman of Johnson's Company, Ltd., was badly crushed at Thetford, Que., in an accident which occurred on Tuesday the 23rd of August. Mr. Moore was riding in a car containing crude asbestos, and was caught between a door post and the side of the car, sustaining internal injuries, which, it is feared, may prove fatal.

Mr. Anthony J. MacMillan, managing director of the Le Roi Mining Company, Ltd., passed through Montreal about the middle of the month on his way west.

It is stated that Sir Percy Girouard, late Commissioner of Railways in the Transvaal and Orange River Colony, may be asked by the Dominion Government to take charge of the Moncton-Winnipeg section of the Grand Trunk Pacific.

Mr. John Ashworth, of Ashworth & Morris, mining engineers, of Manchester, England, sailed from Montreal for England on the Tunisian, August 26th. Mr. Ashworth came to Canada some two months ago as an expert witness for the Crow's Nest Pass Coal Company, Ltd., in the suits for damage which were brought against that company in consequence of the memorable explosion which occurred at the No. 2 mine, Fernie, B.C. Mr. Ashworth is an expert on coal gas explosions and safety lamps.

Mining Share Market.

The Canadian market for mining stocks has been in a lethargic state for some little time past, and prices for most securities are merely nominal. Now and again a buying demand arises for some stock, on a favorable report, but the market is so bare that even an advance of the bid price brings out no stock, and the reason is not far to seek. Prices have gone down to such a low level that most holders have locked up their certificates, and prefer to hold rather than accept a few cents for what perhaps cost dollars.

The fact that many securities are intrinsically worth more now than two years ago makes no difference; the public is not interested in mining stocks, and will not venture. The outcome (as of all stock speculations) is problematical, but to those acquainted with the position of affairs in British Columbia the situation is very hopeful, and, as far as can be predicted, it only requires some profit to investors in the shape of dividends to again attract attention to mining investment.

Should any of the leading mines now working at a profit pay anything to their shareholders this year, no doubt people will become interested, but at present the entire absence of public news creates the impression that our mining industry is a thing of the past.

Apart from speculation, properties are being quietly absorbed by those who have some knowledge of values; mining has got down to a business basis, the newspaper boom is over, and the prospect for a

steady increase in the output of the mines is good. This is the foundation of success. Stocks can hardly go lower than at present, and, taking the record of history, they should steadily advance until another era of speculation carries them beyond intrinsic value.

The following list shows the quotations (bid and asked) which have been made during the month ended Saturday, August 27th, as supplied to the Review by Robert Meredith & Co. 57 St. Francois Xavier Street, Montreal.

	Asked.	Bid.
Canadian Gold Field Syndicate.....	.04½	.03½
Cariboo Hydraulic .....	.75	
Centre Star .....	.25½	.24
Deer Trail Cons. ....	.02	
Glant .....	.03½	.01
Granby Consolidated	3.12	3.00
Montreal and Boston .....	.75	.60
North Star .....	.02	
Novelty .....	.05	.01½
Payne .....	.03½	.03
Rambler-Caribou	18½	.17
Republic .....	.03½	
St. Eugene .....	.45	.35
War Eagle .....	.12	.11
White Bear .....	.04½	.03½

The above are the only shares which have been dealt with during the month. The volume of business has been so light that the above record of prices is but a reflection of the indifference with which Eastern Canada is viewing mining investments at present.

MINING NOTES.

NOVA SCOTIA

The St. John "Sun" reports that a topographical survey is being made of the property of the Maritime Copper and Reduction Company. The ore is stated to be of good quality, but the method of working the property will be decided upon by Col. Alperson, whose arrival was expected at the time of the report.

The July output of the Dominion Coal Company was 259,355 tons, obtained from the following pits:—

Dominion	No. 1	33,704
"	No. 2	47,273
"	No. 3	30,845
Caledonia	(No. 4).....	43,816
Reserve	(No. 5).....	65,517
Hub	(No. 7).....	17,117
International	(No. 8).....	21,083

Output 259,355 tons

The total shipments for the month were 294,272 tons.

The Dominion Steel Company, which has only a portion of its plant now running, is making profits in excess of the amount required to pay fixed charges. The Company is equipping its plant for the rolling of rails of heavy sections, and the first rails turned out will be standard 80-lb. rails. The bounty and the extra duty to be imposed under Mr. Fielding's dumping clause will give this company almost a monopoly of the production of steel rails, at a large profit, the Soo works not receiving as large a bounty sum on account of the large use of foreign ore.

The Dominion Tar & Chemical Company, a subsidiary of the Dominion Coal Company, are considering the erection of a creosoting plant to treat timber in Cape Breton. Creosoted timber has been proved to be fully as durable as kyanized timber, which is timber treated with a salt of zinc.

The Cape Breton Electric Company are now operating the street railway line in Sydney and North Sydney, and are furnishing the electric light for both towns. This Company also operates the inter-urban lines from Sydney through the various collieries out to Glace Bay.

The Intercolonial Coal Co., at West Hill, N.S., have been the pioneers in Canada of the firebrick industry. The first kiln was burned and discharged this month, and it is believed that the product will prove very satisfactory.

McNeil Bros., of New Glasgow, N.S., have asked for an exemption from taxation for a term of years, and for a bonus of \$5,000 in cash, for the iron working plant which they propose to build in Port Hawkesbury, at a cost of about \$35,000.

The Dominion Antimony Company has been getting some very beautiful ore in the bottom levels; this ore, which is mostly stibnite, with a little quartz through it, shows gold freely, and it looks very pretty on the black background. Recent shipments have produced returns varying from 40 to 45 per cent. of antimony and from \$50 to \$56 in gold. It is interesting to note that prior to Mr. McNeil's ownership of the property no gold was ever paid for by the smelters. If the ore shipped in the past contained an equal amount of gold to that shipped recently, nearly \$150,000 has been lost to the province through ignorance on the part of the shippers. We should say that the recent shipments contained none of the ore showing free gold.

ONTARIO.

S. Dillon Mills, mining expert, of Toronto, in a letter respecting pyrite smelting, says that where fuel oil can be had at reasonable cost it furnishes a convenient means of experimenting on the amount of extraneous fuel required with different varieties of ore, but also safeguards against chilling. The supply of oil can be adjusted so as to

furnish either a reducing or oxydising flame, and any irregularity in the working of the furnace can be regulated as soon as perceived, instead of having to wait the working down of the extra fuel with the stock from the furnace top. He gives an instance when, on one occasion, with three-fourths of a barrel of oil the furnace was prevented from freezing solid.

A company has been incorporated in Ontario, with a capital of \$2,000,000, and to be known as the Canadian Iron Company, Limited, for the purpose of developing the deposits of Bessemer Iron, which exist at Loon Lake, in the Township of McTavish, north of Lake Superior. Some years ago these deposits were examined in the interest of certain United States capitalists, and turned down. Recent tests with the diamond drill have convinced the company that they are valuable, and as they are only 15 miles from Lake Superior, shipment will be easy. The company is considering the establishment of a smelting plant at Port Arthur. Though the incorporators are all Toronto men, it is understood that the people chiefly interested live in Ottawa, where the head office of the company is to be. Tests with the diamond drill on another property are being made by a company in which Alex. Gunn and others, of Kingston, are interested. R. McConnell, of Ottawa, R. H. Flaherty and Wiley Brothers, of Port Arthur, are interested in iron properties there.

The Dominion Government is fairly committed to the French River and Ottawa Canal scheme, and Sir Wilfrid Laurier has declared that it must be a public work. The supplementary estimates contain an appropriation of \$250,000 for surveys of the route. The opening up of this line of communication will be of vast importance to the mining interests of Northern Ontario, affording ready egress and ingress to a large mining territory for the development of which cheap transportation is of the first importance.

W. G. Miller, provincial geologist, is making an examination of the district along the Temiscamingue and Northern Ontario Railway, in which valuable deposits of cobalt were found last year, with a view of finding out how far these deposits extend. He reports several new discoveries, and, though the veins are not large, there is a considerable quantity of mineral in the aggregate.

J. M. Bell, who was sent up to Michipicoten to look for extensions of the iron ranges, reports that he has followed a chain of lakes between Missinabi Station and Magpie River, hitherto unknown. He found three areas of iron bearing rocks. One, on the McDougall claim, 14 miles north of Paskaswa, has a wide band of somewhat impure magnetite running through hornblende schists, the ore body being 400 by 350 feet. Another on the same river is similar in appearance. It is expected that Mr. Bell's investigations will show the iron deposits in that district are more extensive than was hitherto known.

The old reduction works at Keewatin have been sold, and the water power will be utilized for a large flour mill. The stamps will be removed to another property belonging to the same company, namely, the Ottawa Milling and Reduction Company. The water power is considered one of the best on the continent.

Though mining operations in North-Western Ontario are generally speaking, rather dull at present, there is considerable activity in gold mining. In the Lake of the Woods region the Sultana has 20 stamps working. The shaft is down 700 feet, and is producing a high grade ore. Pellev Harvey, an expert assayer, formerly of Vancouver, has been at the Gold Rock mine, Manitobu, and as a result of his investigations the company has authorized the expenditure of a large sum in development. The Camp Bay Mining Company and the Traverse City Gold Reef Company are both active; the latter is sending its ore to the reduction works at Rat Portage. The Foley Mine, in the neighborhood of Fort Francis, is to be re-opened; an investigation by President Bowden and the Secretary has satisfied them that the ore will pay, and the shaft is to be pumped out. James V. Welch has commenced operations on the New Ontario gold mine, Fort Francis. The discovery of gold near Webbwood last year has given quite an impetus to operations in that district.

Supplementary letters patent have been granted to the Elgin Field Oil and Gas Developing Company, Ltd., of Dutton, Ont., authorizing an increase of its capital stock from \$49,000 to \$200,000.

The Atikokan Iron Co., Ltd., has been authorized to increase the number of its directors from three to five.

The New York and Ontario Gold Mining Co., Ltd., has increased the number of its directors from five to eleven, and has provided for the holding of special meetings of both shareholders and directors in the City of New York.

An unfortunate affair recently occurred at the Craigmont mine. Wm. Welch, an employee who had gone to make some repairs to the gasoline launch, was attacked by eight Swedish miners armed with knives and a hatchet, and seriously injured. His assailants were arrested, and so popular was Welch that the Swedes were with difficulty saved from being lynched. A report was circulated that Welch had died from his injuries, but this was unfounded, and he had the pleasure of reading a number of highly eulogistic obituaries of himself.

The Pittsburg Coal Company has selected a site and secured 35 acres of land for its coal handling plant at Fort William. It is on what is known as No. 2 Island, and has a frontage on both the Kaministiquia and McKeellar rivers. There will be storage for 1,000,000 tons, as this is a great distributing centre for coal. There will be a bridge to the Fort William side of the river.

Contracts have been let for a portion of the branch line of the Canadian Pacific Railway between Toronto and Sudbury, and the construction of the whole line is to be proceeded with at once. McKenzie & Mann will, they announce, also proceed with the James Bay road. The construction of these railways is of the greatest importance to the mining interests of Northern Ontario. When it is remembered that the

Sudbury district contributed in freights last year to the C.P.R. the large sum of \$1,600,000, the importance of having competing lines as well as new lines opening up mineral regions yet untouched must be evident. The present rush in railway building is said to be due largely to a desire to secure freights from the Hutton iron range.

The Corundum Refineries, Limited, has determined to erect a mill at Palmer Rapids, with a capacity of 100 tons a day. The company has secured 1,360 acres of corundum-bearing lands in the county of Renfrew, and expects to have their product on the market by next spring. Engineers are now at work developing. J. N. Scatcherd, of Buffalo, is president.

The Leamington Oil Company has struck oil in the No. 8 well, which has proved a veritable gusher. The oil, when the vein was struck, spurted over a 72 foot derrick. It flowed 125 barrels the first 12 hours. It is the best well yet struck in the district.

A good deal of development work is being carried on this season in a quiet way about North Bay in gold and copper ores, and some valuable deposits of iron are being opened up. Foley & Co. report a valuable discovery of hematite about 35 miles from North Bay. With a better market for copper, more active operations are expected next year.

Foley & Co., of North Bay, are developing a promising nickel deposit in the Sudbury district. It was discovered about a year ago in what is known as the Northern Nickel Range, and is only two miles distant from the main line of the Canadian Pacific Railway. Assays run from 1 to 7½ per cent., and give an average all through of about 4 per cent.

BRITISH COLUMBIA.

The Boundary mines give the following returns for the first six months of 1904:—

Total output from shipping returns	416,199 tons.
Output for June	68,076 tons.
Value of six months' output, on estimated basis of \$5 per ton	\$2,000,000

As the Granby Smelter was shut down several weeks, and as the Boundary Falls Smelter, which has been idle for six months, is about to be blown in, the total for the year 1904 is expected to reach 1,000,000 tons for the Boundary mines.

The Great Northern Railway's V.V. & E. branch is likely to be carrying ore out of the Phoenix Camp before many months, which will also help to increase the output.

Concentration is the watchword in the Rossland Camp this year. A year ago there were no concentrators. Now Le Roi No. 2 has a 50 ton plant operating; War Eagle and Centre Star Companies have a 200 ton plant partly running, and in course of completion; White Bear Consolidated has a 70 ton plant partly completed; the Velvet Mine has a 50 ton plant nearly complete; Le Roi has a 20 ton experimental plant working. Following out their experiments in concentration, the Le Roi directorate has had F. W. Bradley, consulting engineer with John McKenzie, make a report on the proposition, and his recommendation is the erection of a 250 ton concentrator, and the increase of the capacity of the mine to 500 tons per day, shipping 250 tons and treating 250 at the proposed concentrator.

The operations of the Western Fuel Company, which owns the coal mines formerly worked at Nanaimo by the New Vancouver Coal Co., are to be very extensive, according to the plans of John L. Howard, of San Francisco, president of the owning company. Mr. Thomas L. Stockett, formerly with the Crow's Nest Pass Coal Company, has taken charge of the mines. At the present time the company is rebuilding the plant at the pithead which was burnt a few months ago. The new installation is to be the most extensive and complete plant for handling coal yet erected in British Columbia. From the mine to the hold of the colliery every step is to be automatic. While the new buildings are in process of erection the company is raising coal through the Protection Island shaft, which has been idle for some years. This shaft is on a small island in Nanaimo Harbor, and the workings are continuous under the harbor between the Protection Island shaft and the main shaft. The company is also developing a new property at Departure Bay, some five miles from the Nanaimo mine. President John L. Howard is credited with the statement that the Western Fuel Company, which is now raising about 22,000 tons of coal per month, expects to increase the output very soon, exceeding the former monthly tonnage of Nanaimo, which used to average 35,000 tons, and making it about 50,000 tons.

Lenora mine matters, which occupied some attention a few months ago in Victoria, where the stock is chiefly owned, appear to be at a standstill. The proposition that English capital should purchase the mine, together with a saw-mill and other holdings, has not been acceptable to all concerned.

Atlin, B.C., modest as its pretensions have always been in the placer mining world, is this season continuing to keep up its average; in a conservative way the camp is turning out a very remunerative return to practically all operators, even the big dredge installed by the British-American Dredging Company last year having satisfactory results.

A big nugget of gold, of which Atlin has yielded several from time to time, was found by Gus Anderson, a miner on No. 2 below Discovery a few days ago. While not so large as the Lambert nugget (valued at \$667), this new one is worth \$350. Anderson had not reached bed-rock.

A large body of self-fluxing sulphide ore has been opened on the McKinley claim, Franklyn Camp, East Fork of North Fork of Kettle River, 50 miles from Grand Forks in the Boundary District.

In a small way, the most successful mining operations on the coast have been carried on by the Marble Bay Mining Company at Van Anda. The Tacoma Steel Company, through Hy. Hewett, has since February, 1902, paid over \$110,000 or the purchase price of \$150,000 to J. J. Palmer, the former owner, every dollar of the money being taken out of the mine. The mine is copper, gold and silver, and the mineral is deposited in cones. Its success has been due largely to good management. A depth of 560 feet has been attained, which is a mere hole in the ground beside the Montana mines. The Golden Slipper, on the western portion of the island, owned by C. R. Miller, has been sold to Seattle parties for a good price. This is a developed prospect, the mineral is rich and the mine very promising.

B. C. Riblet, of Spokane, has left for the Britannia mines, Howe Sound, where he is installing a three-mile tramway at a contract price of \$72,000. He says the work will be carried on as rapidly as possible, and he expects to see it finished by the end of the year. It is the intention of the company to make the Britannia one of the biggest producers in the province. More than half a million dollars will, however, have been expended before that stage is reached. The working capacity of the tramway will be one hundred tons per hour. It is the intention to erect a concentrator at the coast end of the tramway, and to ship the concentrates across to the smelter at Crofton.

The smelters of Trail are daily handling 600 tons of gold-copper ore and 100 tons of silver-lead ore and concentrates, while the refinery turns out 11 tons of lead daily. How different a few years ago. Not a single ton of lead ore was smelted in this province seven years ago. Now not a ton is shipped out for that purpose. Ten years ago not a ton of copper ore was smelted in British Columbia. Last year 1,000,000 tons were mined and reduced by the smelters of Trail alone. Recently Mr. G. O. Buchanan, Administrator of the Dominion lead bounty, was at Nelson. He declared that up to June, the end of the fiscal year, \$183,000 had been earned by the lead-producers. Of this \$109,800 has already been paid out, and the balance of 40 per cent., or \$73,200, will be paid as soon as it is shown that the lead ore claimed for has been treated in Canadian smelters. The output of ore tonnage of what are known as the Boundary mines alone for the first six months of this year totals 416,023 tons, or nearly 70,000 tons a month, and it is likely to reach a round million for the year.

These smelters have an interesting history. The plant was started by Mr. F. A. Heinze nine years ago, but, as is well known, the C.P.R. made them what they are, securing control in 1898, and now operating the plant under the name of the Canadian Smelting Works.

According to Government reports the mineral products of British Columbia for the census year 1901 reached the value of \$14,679,700, or over \$4,000,000 greater than any other province in the Dominion, and nearly \$5,000,000 greater than the Territories, which include the Yukon. It has been proportionately greater every year. This will give some idea of her vast mineral wealth and activity. This July has been a record-breaking month even for Trail. Not only have the Canadian Smelting Works inaugurated a new industry in Canada by manufacturing the completed lead product at an estimated cost for new plant of \$100,000, but the biggest shipment of Canadian refined silver in the history of the country has been made this month. The shipment consists of 70,000 ounces, and is worth over \$40,000. It goes to China.

All the Kootenay papers report extensive forest fires. It is reported that in the vicinity of Fernie two million feet of logs have been destroyed. The damage is not confined to East Kootenay, but fires are also reported from the Slocan and the neighborhood of Kootenay Lake.

YUKON.

Mr. William Ogilvie's dredging company, the Ogilvie Dredging Company, operating on the Stewart River, is said to be saving \$100 per day in gold from a bar near Clear Creek, a tributary of the Stewart. The cost of operating is said to be \$50 per day. Mr. Ogilvie, whose son Morley has been north for some months at the dredge, was in Vancouver a week ago on his way from Dawson.

Dawson returns of gold for the Yukon for the period ending June 30th of this year total \$3,866,317.85, exceeding last year's returns for the same period, which were \$3,718,965.10.

There have been some returns from the new Aisek placers near White Horse, which would indicate that, though the season is early yet, very fair returns in gold will be realized. K. B. McLennan, a well-known Vancouver man, recently brought into White Horse from the creeks a hundred ounces of gold saved in a very short time from claims on Bullion Creek.

The "Yukon World," of Dawson, Y.T., under date 13th July, 1904, prints an account of the Aisek District from information received from Mining Inspector Burwash. The country embraced in this new district covers an area 50 by 150 miles. From Whitehorse (on the Yukon) it is 275 miles to Arch Creek over a very difficult trail, which reaches a height at one point estimated at 10,000 feet, and crosses extensive snowfields. The gold found is very coarse, i. e., only a particle running less than a grain in weight. In Mr. Burwash's words, as quoted by the paper:—It is essentially a poor man's district, as, with the exception of a very few localities, the ground is all shallow, with not a particle of muck to be seen, gravel reaching from the surface to bedrock, and averages from two to six feet deep. In one or two places it has been found to be fourteen feet to bedrock with gravel all the way

COAL NOTES.

Vessel owners expect a heavy coal traffic on the lakes this fall, and at rates that will make up for the losses due to the strike idleness this spring.

The Dominion Coal Co.'s output for July was 259,355 tons, compared with 331,090 tons in June. For the seven months to August 1st the production was 1,765,136 tons, as against 1,893,128 tons for the same period in 1903.

F. L. Wanklyn, vice-president of the Dominion Coal Co., is quoted as saying that within two years his company will be delivering between 1,500,000 and 2,000,000 tons of coal at Montreal, as against 1,000,000 tons or a little less during the season of 1904. This great increase in tonnage will be brought about by increased shipping facilities, including new and larger steamships, steel coal towers of about double the capacity of those now in use, additional docks, etc.

An official of the Dominion Coal Co. states that the recent acquisition by the Nova Scotia Steel & Coal Co. of extensive submarine coal areas in Cape Breton will in no way affect the future operations of his company. The submarine areas owned by the Dominion Coal Co. are some 17 miles in length, and have an average width of three miles, so that the coal resources of the company are practically unlimited.

James Ross, President of the Dominion Coal Co., states that during July his company shipped 60,000 tons more up the St. Lawrence River than in any other month since shipments were begun, and that the large tonnage in that direction will be maintained until the end of the season. The closing of some of the shafts was due to the strike at the plants of the Dominion Iron & Steel Co. and the consequent restriction of the fuel requirements of the company.

The mines at Coal Creek, B.C., are in operation most of the time, although compelled to suspend occasionally because of lack of cars. Some days the output runs as high as 1,800 tons, with the mines working on single shift.

At the annual meeting of the British Columbia Collieries Co., held at Victoria, B.C., G. W. Lovell was re-elected president. The company has secured large grants of Government land in the Similkameen district of British Columbia, which is very rich in coal and easy of development as soon as the region is made accessible by a railroad.

The extensive operations of the Canadian Pacific Railway Company's mining department in developing anthracite coal measures at the foot of Cascade Mountain in the National Park, Banff, deserve more than passing mention. Their extent may be briefly referred to by saying that over 300 men are now engaged at the mines at Bankhead, as it is called, and the work is only preliminary, opening the mine, running tunnels, building shops and mine works, erecting a town of model modern construction for the comfortable housing of the operatives and their families. The intention is to have at least 1,000 employees there in a year's time. The mine will supply to a large extent the needs of Manitoba and the Northwest in hard coal an unlimited market, and coking coal is also found at the same place. The mines are five miles from Banff Station, and a spur line has been run from the main line right to the mines. Mr. W. H. Aldridge, superintendent of all the C.P.R. Company's mining and smelting interests, is directing this new enterprise, and Mr. W. S. Ayres, mining and mechanical engineer, is resident engineer in charge of the construction and other works. It is expected that the mine will ship this year.

The Crow's Nest Pass Coal Company has leased from the C.P.R. the branch line from Fernie to Coal Creek, five miles. This branch was built to carry coal from the company's Coal Creek mines to the Fernie coke ovens. It was the intention of the Coal Company to build a parallel line to Coal Creek and extend to Morrisey to connect with the Great Northern Railway, but the extension is all that will now be built. The Coal Company was represented by Mr. G. G. S. Lindsay, of Toronto, in taking over the line. It will buy its own rolling stock, and commence operating the branch October 1st.

INDUSTRIAL NOTES.

The Canada Foundry Company have closed a contract with the Canadian Northern Railway for a bridge over the North Saskatchewan and northwest of Battleford, at what is known as the Second Crossing. It will consist of eleven spans, and the total length of the steel superstructure will approximately be 1,670 feet, not including the length of the approaches. The total weight of steel entering into the structure of this bridge will be approximately 3,500,000 pounds.

The A. Leschen & Sons Rope Co., of St. Louis, which has evolved from the modest beginning made by Adolph Leschen in 1857, are making very extensive sales. Their huge sky advertisement, visible by night as well as in the day time, is one of the first signs which is noticed by visitors to the World's Fair. This firm has recently reported the results of five and one-half years' continuous work of one of their patent flattened strand ropes, which has been in use on an elevator in St. Louis. After this length of service the original diameter of the rope is reported as having decreased by only 1-64th of an inch, a truly remarkable record.

The Wellman-Seaver-Morgan Company, of Cleveland, Ohio, are now the sole manufacturers of the well-known Sargent gas engine, which is made in any size from 100 h.p. as a minimum upwards. The Sargent engine is a double-acting tandem, and claims to get complete expansion of the burning charge; it also has the great merit of simplicity of mechanism, so that the usual multitude of valves and levers is happily conspicuous by its absence. The recognized standing of the Wellman-Seaver-Morgan Company and its enviable reputation for turning out good work should be a guarantee for users of the Sargent engine.

In June last the business, stock and goodwill of the late James Cooper, Montreal, were acquired by the new firm of F. H. Hopkins & Co., which will continue the business by furnishing railway contractors' and mining supplies.

The new firm have taken spacious offices in the new Imperial Bank Building, 236 St. James Street, Montreal, and have a large warehouse, 17 to 27 Normand Street, where a complete assortment of stock for customers' requirements is kept.

The members of the new firm are Mr. Frank H. Hopkins, for over twenty years associated with Mr. Cooper and the firm of Cooper, Fairman & Co.; Mr. J. J. Rosevear, who was financial manager for James Cooper, and Mr. R. A. C. McNally, who has been in charge of mining machinery in both the far west and the east for many years.

The firm has the agency for the Canadian market of Cammell steel rails, axles and ties; the J. H. Andrew Co.'s tool and dull steel; the Marion Steam Shovel Co.'s dredges, shovels, &c.; the Pittsburg water meter; the Ransome Concrete Mixer; the Dominion Wire Rope Company's ropes, cables, fittings, etc., and many other agencies.

The Dominion Coal Co. have placed an order this month with the Ottumwa Box Car Loader Co. for one of their loading machines. The demand for these labor-saving devices is rapidly increasing, as the coal is loaded with less breakage than in any other manner. A number of these Ottumwa loaders are already in use in the Cape Breton field, and give great satisfaction.

Digest of Recent Patents; Mining and Metallurgical.

UNITED STATES.

- July 26, 1904.
- 765,801.—Ore Washer and Separator. Samuel R. Wise, Whiteoaks, New Mex. An ore washer and separator comprising a longitudinally-inclined box or casing provided with a screen above a riffled bottom, said screen and bottom discharging at their upper ends, adjustable hangers supporting the box at the upper end, means at the lower end, supporting and imparting vertical and horizontal movement to the box, whereby material under treatment is tossed toward the upper end thereof, in combination with a water-distributing pan supported above, and adjustable independently of the box or casing.
- 765,998.—Ore Roasting Furnace. George H. Shellaberger, Dekalb, Ill., assignor to Apex Manufacturing Company, Kansas City, Mo., an Arizona Corporation. An ore-roasting furnace, the combination of a furnace-body provided with one or more extended ore-chambers, and an air-trunk extending through the length thereof contiguous to said ore-chambers, one or more communicating passages between said air-trunk and ore-chambers, a heat-generating furnace, an air-pipe extending through and heated in the combustion-chamber of said furnace, and communicating with said air-trunk of the furnace-body, and means for supplying air under pressure to said air-pipe.
- 766,156.—Ore-Roasting and Oxidizing Apparatus. Lyman H. Allen, Kansas City, Mo., assignor by direct and mesne assignments, of four-fifths to Ora A. Johnson, Charles E. Bye and William O. Bye, Kansas City, Mo., and Mary Elizabeth Stewart, Sonora, Cal. An apparatus for reducing ores comprising a rotary ore-retaining cylinder having flame-conducting openings at its forward end; a reducing-furnace, a flame-conducting cylinder leading from the furnace within the opening in said cylinder; means for drawing off the gases from the cylinder, and an open water-receptacle concentric with the inner side of the cylinder, and located at its forward end, adapted for the storage of the liquid to be vaporized, water-pipe leading within the flame-conducting opening of the cylinder and discharging downwardly within the open water-receptacle.
- 766,060.—Ore-Pulp Washer and Concentrator. Francis E. Parker, Kansas City, Mo. The combination, with the receptacle, for the concentration of metals from ore-pulp, having valved discharge-openings for the waste material, of suspensory devices for said receptacle, means for communicating an oscillatory movement to said receptacle, and a series of stud-shafts located at the limit of oscillation of said receptacle in pairs; horizontal guide-rollers on said shafts, arms extending radially from the side of said receptacle, and guide-pins on said arms contacting with said rollers, and controlling the curvilinear movement of said arms, and stationary pulp-agitating devices located above the receptacle and extending downwardly within the same and adapted to loosen the material at the discharge-openings in the receptacle.
- Aug. 2, 1904.
- 766,654.—Method of recovering Values from Ores by dissolving in Molten Baths. R'ph Baggaley, Pittsburg, Pa., and Charles M. Allen, Lolo, Mont.; said Allen assignor to said Baggaley. A method of producing matte, which consists in forming a molten bath of matte, blowing air thereunto, adding ore relatively high in silica, fluxing thereby the iron of the bath, and replenishing the bath with material relatively low in silica, and high in matte-making compounds.
- 766,279.—Process of Making Spelter. Oskar Nagel, Hamborn, Germany. An improved process for reducing zinc oxide ores, which consists in subjecting the material to the reducing effect of natural gas, the said gas being highly heated previous to entrance in the reducing-chamber, and in cooling the resulting zinc-vapors in an atmosphere of such gas.

766,718.—Ore-Concentrator. Howard E. Marsh, New York, N.Y., assignor by mesne assignments, to Jarvis, Simmons & Company, Incorporated, New York, N.Y., a Corporation. The combination with a drum open at both ends, and having a reduced portion and feeding mechanism upon the drum; of a suction-fan in one of said ends, a magnetic disk in the opposite end of the drum, baffle-plates interposed between said fan and disk, and an outlet between said fan and plates, said outlet being adapted to receive particles from the reduced end of the drum.

766,626.—Gold-Saving Apparatus. Edward S. Kelley, St. Joseph, Mich., assignor of one-half to Willis W. Cooper, Kenosha, Wis., Henry S. Cooper, executor of said Willis W. Cooper, deceased. A gold-saving apparatus in combination with a sluice-box; a conveyor fitting closely to the inner wall thereof; means for rotating said conveyor to carry earth and water positively and with comparative slowness through said sluice-box, to prevent current in or agitation of the fluid mass; a bottom trough extending longitudinally of said sluice-box; amalgamated partitions in said trough; and a pocket having an inlet-opening near the discharge-opening of said sluice-box, into which inlet-opening gold particles fall by gravitation.

12,254.—Roasting-Furnace. Lewis T. Wright, Keswick, Cal. The combination with a series of floors, of a central hollow shaft, hollow arms carried thereon over the respective floors, an open-bottomed pipe inserted in said shaft, an intermediate pipe in said shaft into which the first pipe discharges, open-ended pipes leading from the intermediate pipe into the hollow arms, and feed and exhaust pipes connected to the first pipe and hollow shaft.

Aug. 9, 1904.

767,179.—Furnace for Melting Metals or other purposes. Carl Spiegel, St. Petersburg, Russia. A melting-furnace, the combination of a fire-plate provided with a naphtha-supply means and with hemispheric projections, said plate being provided with perforations extending through said projections, and upwardly flaring at their upper end, and said projections being on the upper face of the plate, with an air-supply chamber secured to and under said plate and in communication with said perforations.

767,365.—Amalgamator. William E. Vandenberg, Chicago, Ill. An amalgamator comprising a fixed conduit for the pulp, a mercury-trough in the conduit, spherical bodies revoluble in the mercury in the trough, and rings spaced from and extending around the spheres, also revoluble in the trough, and disposed with relation to the spheres and in planes substantially parallel with the current of the pulp.

767,276.—Dry-Sand Amalgamator. Frederick J. Hoyt, Redlands, Cal. The combination with an amalgamated mercury-floated rotary sphere, of a pipe, and nozzle thereto, to discharge on said sphere, an air-reservoir, an air-compressor and an air-engine, connected to operate.

766,880.—Gas Producer. Jerome R. George, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts. The combination with a heating-chamber provided with an opening in its top for the admission of coal, of a coal-reservoir located above and over said opening, and having an opening in its bottom for the delivery of coal, a rotating coal-distributor between said reservoir and the producer-chamber, said distributor consisting of a hopper-shaped spout with its upper or admission end concentric with its axis of rotation and of greater area than its lower or delivery end, which is eccentric to said axis of rotation, with the inclined side of said hopper-shaped spout at an angle to a vertical plane whereon coal will flow freely by force of gravity alone.

767,105.—Magnetic Separator. Myron Dings, Milwaukee, Wis. The combination of an electromagnet having a substantially vertical axis; a cup-shaped lower pole-piece partially inclosing the magnetic winding; an upper pole-piece covering the magnet and protecting marginally therefrom; a non-magnetic ring of less diameter than the upper pole-piece, but connected to the latter and arranged to cover the upper edge of the lower pole-piece; and a conical distributing shield covering the upper pole-piece except at its marginal edges.

Aug. 16.

767,840.—Regenerative Gas Reheating-Furnace. Frederick Siemens, Dresden, Germany. A regenerative gas reheating-furnace having primary and secondary chambers in communication with each other for the passage of billets, blooms or the like from the primary to the secondary chamber, means whereby a gas-flame is directed across one of said chambers above the bed thereof and between the ends of said bed, said flame being of a gradually-increasing temperature from one end of said bed to the other, and means for heating the other furnace-chamber.

767,926.—Ore-Concentrator. Christoffer A. Christensen, Oretown, Oregon, U.S.A. An ore-concentrator, consisting of a diamond-shaped table having riffles formed across the same, said table provided with a rise or upward incline along one side, and up which the ends of said riffles extend, troughs upon said rise or upward incline provided with lateral outlets facing the lowest portions or bottoms of the riffles, means for supplying water to said troughs, a receiving-trough disposed beneath the upwardly-inclined ends of the riffles a hopper at the upper side of the trough and opposite end from the said rise or upward incline, and means for imparting vibratory jarring motion to the table.

ENGLISH PATENT.

Crucible Furnaces. M. Harvey, Walsall. A portable furnace containing a crucible is fixed in an outer casing, which forms a blast chamber, so that the contents can be poured without removing the crucible. The outer casing is provided with tunnels, and is mounted on a carriage. Means are provided for leading the blast into the furnace, for charging the fuel, for tilting the whole, and a spout for pouring.

NEW COMPANIES.

ONTARIO.

The Alpena Oil and Gas Co., Ltd. Incorporated 27th July, 1904. Capital, \$100,000.

The Goderich Cement Brick Co., Ltd. Incorporated 29th July, 1904. Capital, \$40,000.

The Canadian Cement Brick Co., Ltd., Incorporated 15th June, 1904. Capital, \$150,000.

Silver King Gold and Copper Co., Ltd. Incorporated 30th June, 1904. Capital, \$2,000,000. Provisional directors:—Harvey Lawson Holmes, William Herain Merrill and George Wellington Morris. Head office: Toronto, Ont.

Canadian Ore Concentration Co., Ltd. Incorporated under the laws of Great Britain. Attorney, Robert Charles Donald, of Toronto.

Domintion Cement Brick Co., Ltd. Capital, \$50,000.

The Empire Salt Co., Ltd. Capital, \$50,000. Head office, Sarnia, Ont. Provisional Directors:—Jas. J. Carter, Chas. H. Rogers, Jas. H. Kittermaster, David Milne and Alex. S. Burnham.

The Canadian Michigan Gold Mines, Ltd. Capital, \$1,000,000. Head office, Sault Ste. Marie. Provisional Directors:—Wm. Coyne, Chas. A. Brown, of Sault Ste. Marie, Ont.; John B. Spellman, Webbwood; Elmer S. B. Sutton, Otto Supe, Sault Ste. Marie, Mich., and H. Asmus, Buffalo, N.Y.

The Ontario Crude Oil Co., Ltd. Capital, \$300,000. Head office, Toronto. Directors:—John W. Stokes, Sarnia; W. D. Earney, James Kynoch, A. M. Miller, Erastus Miller, Toronto.

The Silver King Gold and Copper Co., Ltd. Capital, \$2,000,000. Head office, Toronto. Directors:—Rev'd H. L. Holmes, W. F. P. ... Falls, N.Y.; Wm. H. Merrill, G. W. Morris, Buffalo, N.Y.; Howard Denison, Toronto.

BRITISH COLUMBIA.

Flathead Valley Oil Lands Development Co., Ltd. Incorporated 7th July. Capital, \$250,000, divided into one million shares of 25 cents each.

Fundee Gold Mine Co., Ltd. Incorporated 25th July, 1904. Capital, \$600,000.

The Elk River Coal and Oil Co., Ltd. Incorporated 12th July, 1904. Capital, \$25,000.

The Eva Gold Mines Co., Ltd. Incorporated 22nd July, 1904. Capital, \$500,000.

Ross & Howard Ironworks Co., Ltd. Incorporated 23rd July, 1904. Capital, \$250,000.

The Georgia Rock Co., Ltd. Incorporated 27th June, 1904. Capital, \$10,000.

The Green City Mining and Improvement Co., Ltd. Incorporated 26th July, 1904. Capital, \$100,000, divided into two hundred shares of \$500 each.

Consolidated Spruce Creek Placers Co., Ltd. Head office, Seattle, Wash., U.S.A.; head office in B.C., Victoria, attorney, Frank Weir. Capital, \$30,000.

HEMATITE IRON

HEMATITE IRON MINE IN HASTINGS COUNTY TO lease on royalty. Also about 1,000 tons already mined for sale. Will deal with principals only. For particulars apply to

MRS. T. C. WALLBRIDGE, C. M. WALLBRIDGE,
20 Madison Ave., or, Madoc,
Toronto, Ont. Out.

FOR SALE

ONE NEW MORGAN-GARDNER ELECTRIC LOCOMOTIVE; weight 12 tons; built for 44" gauge track; motors wound for 220 volts. Locomotive has never run a single day. Immediate delivery can be made. Price \$1400 00. Address Box "1," Columbus, Ohio.



PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at \$2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required

to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19 an ounce, and on smelted Gold valued at \$18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licences to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department 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.

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

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

THE HON. A. DRYSDALE,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

PROVINCE OF QUEBEC

The attention of Miners and Capitalists in the United States
and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate,
Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

**The Mining Law gives absolute security to Title, and has been
specially framed for the encouragement of Mining.**

Mining concessions are divided into three classes :—

1. In unsurveyed territory (a) the first class contains 400 acres, (b) the second, 200 acres, and (c) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (a) as a mining concession by purchase, or (b) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are \$5 and \$10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, \$2 and \$4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals, and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than \$500 if mining for the superior metals ; and not less than \$200 if for inferior metals. In default, cancellation of sale of mining lands.

(b) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, \$2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in surveyed territory, \$5 for every 100 acres, and (2) in unsurveyed territory, \$5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of \$5 and an annual rental of \$1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUÉBEC, P.Q.

Ontario's

Mining

Lands.

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite; copper in sulphide and native form; gold, mostly in free milling quartz; silver, native and sulphides; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1903 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe.

The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc., apply to

HONORABLE E. J. DAVIS,

Commissioner of Crown Lands,

or

THOS. W. GIBSON,

Director Bureau of Mines,

Toronto, Ontario.



Dominion of Canada.

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at \$10 per acre for soft coal and \$20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of \$7.50 per annum for an individual, and from \$50 to \$100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is \$5.

At least \$100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When \$500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at \$1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee \$5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, \$10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds \$10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental \$100 per mile for first year and \$10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, \$10. Royalty at the rate of two and one-half per cent. on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of \$2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least \$200.

A certificate that work has been done must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

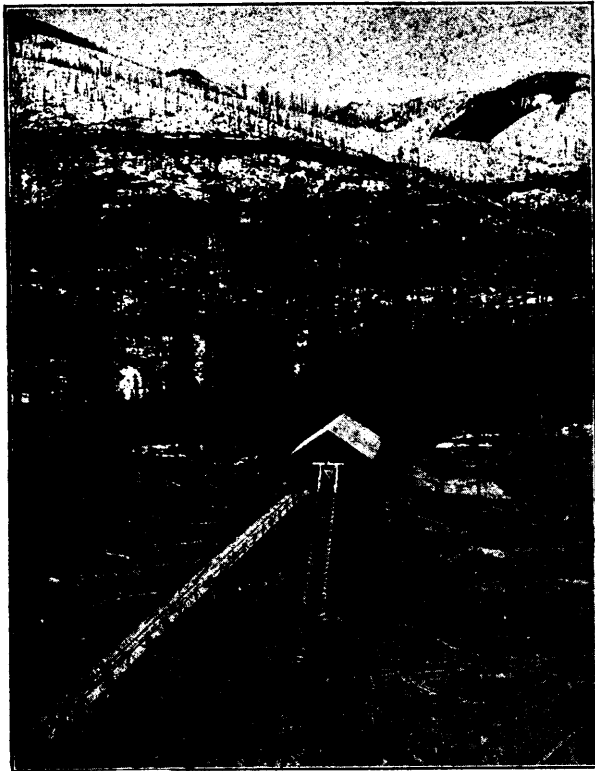
PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North-west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of \$1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,

OTTAWA, February, 1904.

JAMES A. SMART,
Deputy of the Minister of the Interior.



ONE MAN can handle **1600 TONS**
per day with a

Riblet Patent

Automatic Aerial Tramway

You can figure the cost per ton.

**More Riblet Tramways are now being installed
than of all the other systems combined.**

Write for Description and Prices.

B. C. RIBLET, ENGR.,
Spokane, Wash., U.S.A. Nelson, B.C., Canada



A Thing to Remember!

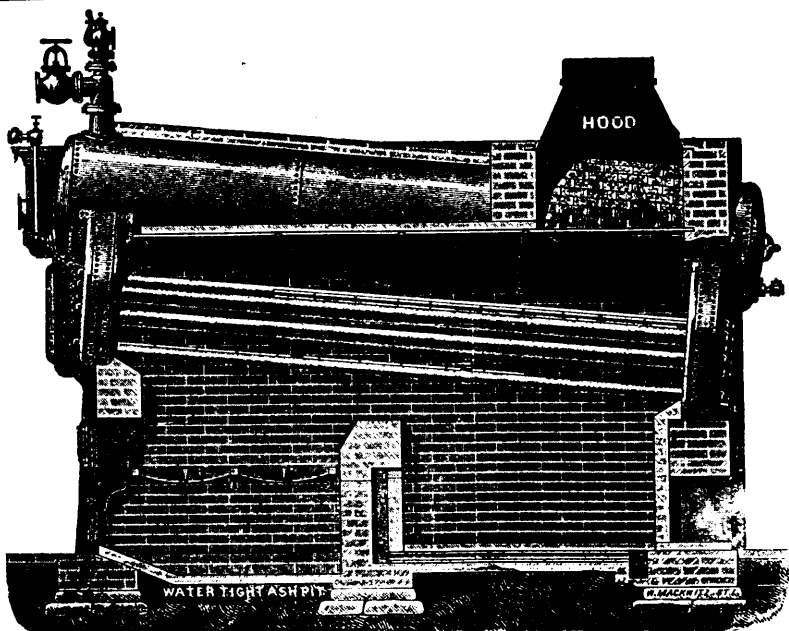
The water can often be got out
and the job finished by means of

Trade **The Pulsometer** Mark
Steam Pump

whilst you would be collecting the
necessary tackle for ordinary pumps.

The Pulsometer Engineering Co. Ltd., Reading, England.

CANADIAN REPRESENTATIVES **PEACOCK BROTHERS** CANADA LIFE BUILDING Montreal



HEINE SAFETY BOILER

MANUFACTURED BY

The Canadian Heine Safety Boiler Co.
TORONTO, ONT.

THE HEINE SAFETY BOILER—Made in units
of 100 to 500 h.p., and can be set in batteries of any
number. Suitable for Mines, Pulp Mills, Water and Electric
Installations, and large plants generally. The best and most
economical boiler made.

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CLYDE PATENT WIRE ROPE WORKS
Rutherglen, Glasgow, Scotland

MANUFACTURERS OF

WIRE ROPES for Collieries, Mines, Aerial Tramways

Transmission of Power, Logging and general Hauling and Hoisting Purposes.
Wire specially selected for own exclusive use.
We have made many records with our Winding, Haulage and Crane Ropes.

Illustration of Winding
Rope, 240 fms. long x
3 1/2 circ. Galvanized
Special Improved
Patent Steel, Com-
pound Make, supplied



to Kenneil Collieries
Bo'ness, Scot., which
gave a record life of 6
years and 2 months.
Shewing condition
when taken off.

TELEGRAMS—"Ropery Rutherglen." A B O, A I and Lieber's Codes used.

AGENTS IN CANADA:

Wm. Stairs, Son & Morrow, Ltd., Halifax, N.S.
W. H. Thorne & Co., Ltd., Saint John, N.B.

Drummond, McCall & Co., Montreal.
John Burns, Vancouver, B.C.

DRUMMOND, MCGALL & CO.

IRON, STEEL AND GENERAL METAL MERCHANTS

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Beams, Channels, Angles and other Structural Material.
Steel Plates—Tank, Boiler and Firebox Quality.
Cold Rolled Steel Shafting.
Mild Steel Bars—all diameters.
Wire Rope. Snow Steam Pumps. Tool Steel.

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CANADA IRON FURNACE COMPANY, LIMITED

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MIDLAND, ONT.

GENERAL OFFICES

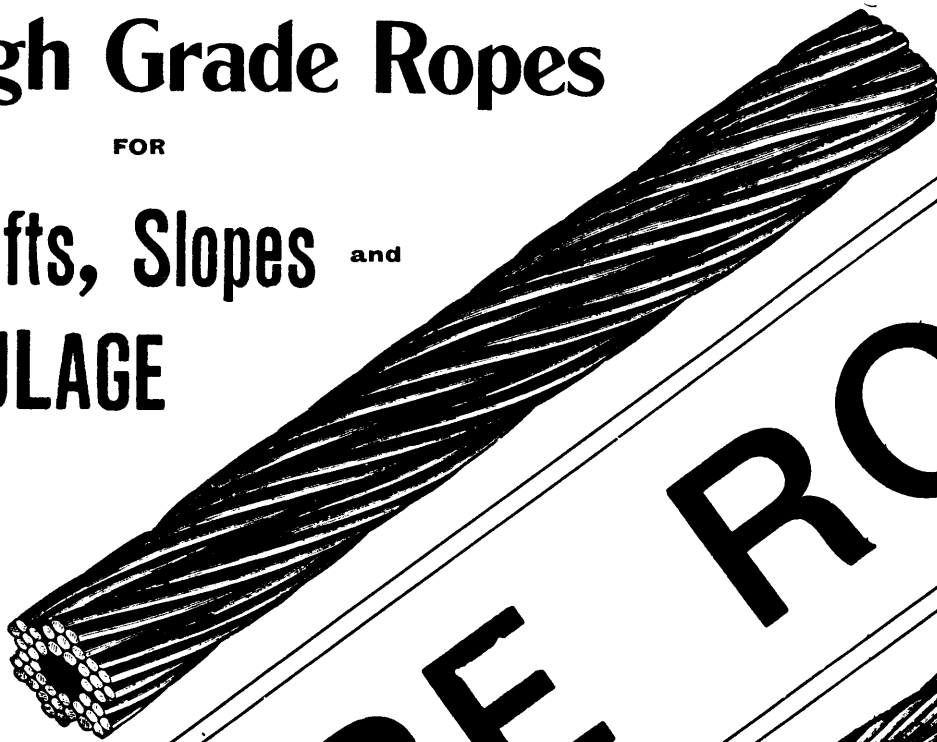
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Geo. E. Drummond, Managing Director and Treasurer.

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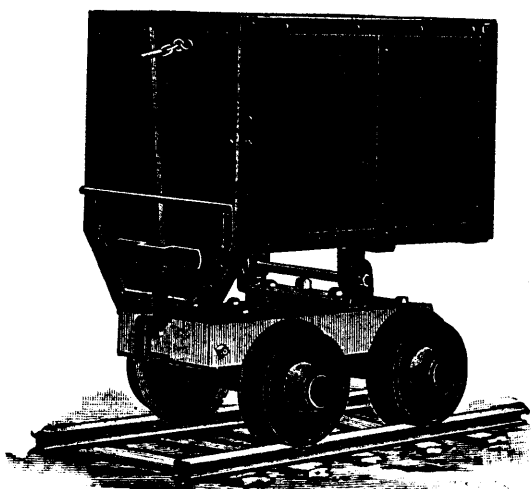
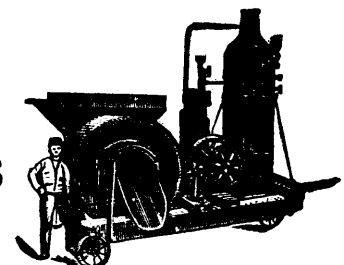
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