THE CANADIAN MINING JOURNAL

THE OFFICIAL ORGAN OF THE CANADIAN MINING INSTITUTE

VOL. XXIX. TORONTO and MONTREAL, April 1, 1908 No. 7

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"
Devoted to Mining, Metallurgy and Allied Industries in Canada
Published fortnightly by the
MINES PUBLISHING CO., LIMITED

Head Office - - Confederation Life Building, Toronto.
Branch Office Montreal, Halifax, Victoria, and London, Eng.

Editor:
J. C. MURRAY, B.A., B.Sc.

Business Manager:
J. J. HARPELL, B.A.

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for the issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

During the year ending with March 1st, 1908, 91,750 copies of THE CANADIAN MINING JOURNAL were printed and distributed, or an average of 3,822 per issue.

SPECIAL CONTRIBUTORS.

GEOLOGY: Dr. Frank D. Adams, McGill University; Dr. A. E. Barlow, late of Geological Survey of Canada; Professor Willett G. Miller, Provincial Geologist of Ontario; Dr. J. E. Woodman, Dalhousie University, Halifax, N.S.

CHEMISTRY: Dr. W. L. Goodwin, Director School of Mining, Kingston, Ontario; Milton Hersey, M.Sc., Official Analyst Province of Quebec.

MINERALOGY: Professor W. Nicol, School of Mining, Kingston, Ontario.

MINING: S. S. Fowler, M.E., Nelson, B. C.,; Frederick Keffer, M.E., Anaconda, B.C.; A. B. Willmott, M.E., Sault Ste. Marie, Ont.; J. C. Gwillim, M.E., School of Mining, Kingston, Ont.; J. Obalski, Inspector of Mines, Quebec; J. Bonsall Porter, M.E., McGill University; John E. Hardman, M.E., Montreal; Fritz Cirkel, M.E., Montreal; George W. Stuart, M.E., Truro, N.S.

METALLURGY: Hiram W. Hixon, M.E., Mond Nickel Company, Victoria Mines, Ontario; Stafford F. Kirkpatrick, School of Mining, Kingston, Ontario; A. P. Scott, Dominion Iron & Steel Company, Cape Breton.

COAL: Hon. Robert Drummond, Stellarton, N.S.

NATURAL OIL AND GAS: Eugene Coste, M.E., Toronto, Ont.

CEMENT: Manley Baker, M.A., School of Mining, Kingston, Ont.

CONTENTS

NOVA SCOTIA'S MINERAL OUTPUT.

The official returns of Nova Scotia's mineral output, given in full on another page of this issue, appeared early in March. The report of the Mines Department will be given fuller notice at a later date. Meanwhile it is timely to notice again the causes that led to the serious decrease in the output of coal. Whilst the Pictou and Inverness collieries increased their annual production by substantial amounts, the Springhill strike almost counterbalanced this gain.

In Cape Breton, owing to the Hub colliery fire, and the unusually late opening of the shipping season, the production was cut down by the serious amount of 175,-191 tons.

However, this diminution of output must be looked upon as purely fortuitous. It is hardly probable that the opening of navigation will be delayed again to such an extent as it was last spring. It is also to be hoped that labor troubles will become things of the past. The settlement effects between the Dominion Coal Company and its employees is a guarantee of peace so far as Nova Scotia's largest coal producer is concerned. Hence we may look forward with well-founded hope to a shipping season of unexampled activity.

The Provincial authorities had estimated that they would receive for the past year $725,000 in coal royalties. Events proved that this estimate, for the reasons adduced above, was excessive. In fact the actual amount received was $633,933, or $10,000 less than the revenue for 1906.

It is true, however, that the same causes that, had conditions been normal, would have brought about a large increase of tonnage last year, will again be operative this year. The St. Lawrence trade undoubtedly will be brisker during the approaching season. The local demand is growing heavier and the coast trade with the United States increases yearly. With an open spring and industrial peace Nova Scotia should therefore count upon a larger coal output this summer than in any preceding year.

Incidentally we notice in the Provincial Financial Returns the item of $14,851.17 for miners' relief funds. We mention this because it is our intention to discuss this item fully at a later date.

The tabulated statistics for the year ending September 30th, 1907, include several items, such as antimony ore, cement, bricks, copper, building stone, etc., not before specified in the annual returns.

BEGINNING A UNIVERSITY.

In presenting the University Bill before the British Columbia Legislature, the Hon. Dr. Young remarked that it was not the intention of the Government to decide immediately upon a site for the proposed buildings. The first efforts would be confined to establishing preparatory classes throughout the Province. By this means the germs of practical higher education will be implanted in a large number of young men and the best possible foundation laid for the University.

BRITISH AGITATION AGAINST THE EIGHT HOUR BILL.

Speaking before Mr. Herbert Gladstone, a representative of the British Iron Trade Association outlined the probable effects of the proposed shortening of the hours of labor. Conditions in South Staffordshire were principally referred to. At present the miners start to go down into the mines at 7 a.m. They are allowed a maximum of one hour for meals. Contract men seldom take more than half an hour. Between 7 a.m. and 4 p.m. the output for one gang of contract men is 22 tons or 40 tubs. If the day is reduced to 8 hours the output will be diminished by 9 tubs. The colliers go down in the owners' time and come up in their own time.

In addition to increasing the cost per ton of coal raised the effect upon the iron and steel industry would be marked. It is claimed that in the Tipton district 27 tons of water must be raised for every ton of coal. Decreasing the output by shortening the hours of labor will have the effect of increasing the relative amount of water pumped per ton of coal won to between 32 and 35 tons. This, it is stated, would be ruinous.

The collieries spoken of are owned and operated by manufacturers of iron and steel. Therefore their representative speaks with some degree of authority when he asserts that six shillings per ton will be added to the cost of manufacture of finished iron and steel.

In the foregoing paragraph is contained the essence of the whole matter. Labor unions, by complete organization, have attained a solidarity and, consequently, a political influence that gives their contentions tremendous weight. These contentions are so impressed upon the politicians and statesmen of the day that the claims of the employer are either overlooked or considered as the protests of class selfishness.

Time was when labor and capital were justly looked upon as the two eternal protagonists of our body politic. This conception to-day should be obsolete. The interests of both employers and labor are closely conjoined and are inextricably interwoven with those of every other class. Unreasonable concessions to either side may sometimes appear expedient, but will always be unprofitable and costly in the long run. In Great Britain the predominating tendency is to concede everything to the unions. In Canada, whilst by no means so pronounced, this tendency exists. Legislation, such as the Lemieux Act, is the best corrective that modern statesmanship has devised.

Canadian employers and employees should watch closely the trend of events in Great Britain.

THE HAMMER DRILL.

The air hammer drill is coming into prominence. Whilst it will not replace the reciprocating drill, yet its sphere of usefulness is larger than in commonly believed. The increasing number of types manufactured give it a wider application. Under certain conditions of shaft sinking the hammer drill is undeniably economical. For cutting hitches it is an essential if cheap work is to be obtained. But its limitations for drifting, stoping and cross-cutting have not yet been demonstrated.

In our Special Correspondence columns we give some valuable figures from an actual test.

THE PORT HOOD DISASTER REPORT.

The report upon the recent explosion in the Port Hood-Richmond Coal & Railway Company's colliery, handed in by a committee appointed by the Provincial Government, is not, in some important respects, in accord with the bulk of the evidence adduced. The report itself is reprinted in full in our news columns.

We have before us the evidence taken at Port Hood. Whilst we cannot now enter into a full discussion of this evidence, yet it appears to us that the facts, such as they are, point to an explosion of powder and not of gas. Our readers will have an opportunity later on of deciding the matter for themselves.

Meanwhile we cannot do beter than quote from the last letter of our Glace Bay correspondent, who refers as follows to the present system of coal mine inspection in Nova Scotia:

"There is one matter which is suggested by the eighth clause of Dr. Kendall's resolution, 'the enforcement of laws intended to lessen or prevent accidents,' and that is the personnel of the mines inspectorate of Nova Scotia. One of the facts that can be ascertained is that nothing will so tend to the prevention of accidents and the preservation of life and property as the existence of a vigilant and capable inspectorate. The men who compose the present force of inspectors are good men, we have no doubt, but they were not appointed by competitive examination, and we do not think that any of them are men with a college training.

"The Inspector of Mines should be a man of considerable scientific attainments and extensive knowledge of modern mining methods, in addition to having a thorough grasp of practical mining and all that appertains to it. He should be a man that can advise and direct in

case of emergency and danger, and a man whose advice could be sought and relied upon as proceeding out of a well trained experience added to scientific knowledge. No inspector should be appointed for political purposes, and 'we consider the time has arrived' when no man should be appointed to an inspectorship because of his political preferences, or as a reward of political loyalty. He should be appointed because his qualifications mark him out as fitted for such an onerous and responsible position. To-day when mines are at work in Nova Scotia with 1,500 persons below, in one mine, at one time, whose lives may be endangered by the ignorance or the stupidity of one man, we require inspectors who can enforce regulations, and explain why they enforce them. The Government of Nova Scotia should have a Chief Inspector of Mines, whose scientific and technical attainments should be beyond reproach. This man should appoint his assistants by rigid competitive provincial examination, such as would entirely eliminate the incompetent and raise the status of the inspectorate. Men of this calibre would need and could not be obtained without the payment of adequate salaries, but in return we would get adequate men, and it would open up an avenue of promotion for the young and ambitious mining students of the province. The Inspector of Mines should bear the same relation to the colliery manager that the colliery manager bears to his overmen, and the correspondingly more difficult than the colliery manager examination.

"As conditions are now, the managers and salaried officials of the coal corporations are man whose wide range of experience and technical knowledge, obtained by years of hard study, make them infinitely better able to advise the inspectors than the inspectors are to advise them, which is a reversal of the correct state of affairs. We think it will be found that most of the recent improvements in Cape Breton mining as regards safety —and they are many—have been carried out on the sole initiative of the officials of the coal corporations, who constitute the only body of mining experts in the province."

CONCENTRATION OF COBALT ORES.

We commend to the earnest attention of our readers an article appearing in this issue of THE CANADIAN MINING JOURNAL. The writer, Mr. G. H. Gillespie, has been afforded especial facilities for the study of the subject of Cobalt ore treatment. This article will be followed by others that will deal more fully with details.

Mr. Gillespie's point of view strikes us as being sane and clear. It is true that Cobalt ores present some peculiar difficulties. But most of these difficulties have been overcome in other camps. On the other hand Cobalt has exceptionally favorable conditions. Transportation is good. Labor is plentiful, and supplies are becoming cheaper.

Stress must be laid upon the fact that there is a strict limit both to the amount and to the varieties of ores that can be concentrated with commercial success. For instance, hand-sorting can in some cases be carried on to a much larger extent than now obtains. It is wasteful to put the whole run of mine through the mill. Again, with light stoping drills and narrower stopes the tenor of the ore may be considerably improved. Every pound of unnecessary waste rock handled means a multiplied waste of power, time and money.

We agree fully with the opinion that it is wise to begin with as simple an equipment as possible.

In most of the mines of Cobalt hand sorting of No. 1 ore plays a large part. So far as practicable then this ore should be separated in the initial stages, before and after crushing.

If a stamp mill is to be part of the equipment, the design and practice will be modified by several considerations. It is probable that heavy stamps, dropping between 90 and 110, twenty-mesh screens, low rapid discharge and a light feed will be the salient features developed as experience is gathered. Possibly concentrating tables and slime tables will meet all requirements after this, although it is likely that the average tailings will respond profitably to cyanidation.

We do not believe in a multiplicity of stages. Classifying can often be done most profitably in the mine and on the sorting tables. When classification becomes complicated, profits become correspondingly uncertain.

It is dangerous to dogmatize, however. Simplicity may be an unattainable ideal. But a tendency in the direction of that ideal is healthy.

THE PRICE OF SILVER.

In the year 1868 silver brought $1.326 per ounce. From that year until 1889 there was a slow thought constant recession in price, until in 1889 the figure of $0.935 was reached. Low water mark was touched in 1902, when $0.522 was the average price for the year. For 1907 the average was $0.653.

The world's output of silver in 1900 exceeded that of any previous or succeeding year — 173,591,364 ounces were then produced.

Since 1904 Canada's silver output has gone up in value from $2,075,000 to, roughly, $7,500,000.

A new safeguard for collieries is offered by the discovery of Profs. Elster and Geital that firedamp contains six or seven times as much radium emanation as the ordinary air of coal mines. An aluminum foil electroscope quickly shows the difference of electrical conductivity due to the emanation, and this simple apparatus becomes an effective and important means of detecting danger.

THE MECHANICAL EQUIPMENT OF THE OTTAWA MINT.

(A paper read before the Mechanical Section of the Canadian Society of Civil Engineers.)

BY A. H. W. CLEAVE.

The mechanical equipment of this branch of the Royal Mint was completed by the end of October last—the time occupied in the manufacture and installation of the necessary machinery having been just ten months.

Many machines in the Coining Department have been designed specially for the Ottawa Mint, and in these new devices have been adopted, which are not to found in other similar institutions. In addition to the machinery in that department, where the actual minting of money takes place, the following plants have also been installed:—

(1) The Electrical Plant, for power distribution, for lighting, etc.

(2) The Oil-fuel Plant, for storing and distributing the oil-fuel used throughout the various departments in the melting, annealing, and cupel furnaces, together with the fans and blowers for the same.

(3) The Die-making Plant, for sinking, turning, annealing and hardening the dies used for coinage purposes.

(4) The Plant for the Boiler House and the Machine, Smith's and Carpenter's Shops, in which all running repairs are effected and small tools made.

(5) The Plant for the Assay Department, where all the precious metals received into and issued from the Mint are analysed; and in which experimental research work will be conducted.

To give a full and complete description of all the mechanical devices which have been installed throughout the Mint would make this paper unduly long. Each of the plants enumerated above will therefore be briefly dealt with in turn, in the order given; and then the Coining Department, which contains types of machines probably less commonly known than the rest, will be described more at length.

ELECTRICAL PLANT.

Electrical Equipment.—The electricity used for power and lighting is supplied in the form of a two-phase, alternating current, and enters the building at a potential of 2,140 volts. It then passes through the transformers, of which there are three for power and three for light. In each case one is a spare, which can be put into circuit, on either phase, by operating the primary and secondary switches.

The transformers for power operate the motor of a motor-generator set. They are single phase, step down, oil insulated, self cooled, for a circuit of 60 cycles. The primaries are wound for a potential of 2,140 volts, and the secondaries for a potential of 500 volts. Their normal full rating is 100 kilowatts each.

The transformers for light operate the electric light system of the building. They are similar to the transformers for power, but the secondaries are wound for a potential of 107-214 volts; while their normal full rating is 15 kilowatts. The primaries and secondaries of each transformer are provided with binding posts, so that any one of them may be conected or disconnected without soldering to leads, or cutting wires.

The motor-generator set for transforming the current to operate the motors throughout the Mint consists of an alternating current motor and continuous current generator. The motor is of the two-phase, alternating current, induction type, operating from the transformers at a potential of 500 volts; its normal full rating being 225 H.P., at a speed of about 800 revolutions per minute. The generator is multi-polar, compound wound, continuous current, operating at a potential of 225 volts; its normal ful lrating being 150 kilowatts. The motor and generator are on one bed plate, and supplied with auto-starter for the motor, and field rheostat for the generator.

There are 32 compound wound, continuous current motors in use, ranging in power from 1 1-4 H. P. to 30 H. P., all operated at a potential of 220 volts.

The wiring for the motors is of the parallel two-wire system, the wires being carried in steel conduits.

The wiring for the lighting is of the interior conduit system; all the main circuits being of three wires, and the branch circuits of two wires.

There are 415, 3.5 watt, 16 C. P. 102-volt incandescent lamps, and 17 arc lamps. The latter are of the enclosed type for multiple circuits, adjusted for 7 amperes and 107 volts, alternating current.

The buildings are wired for electric clocks, bells and telephones, which are in use throughout the Mint.

OIL FUEL PLANT.

Oil Fuel Equipment.—The fuel used for melting and annealing purposes, and for the cupel furnaces in the Assay Department, is crude oil; its specific gravity being .850. The plant for storing, distributing and burning this fuel consists of:—Four storage tanks (each of 2,000 gallons capacity), two rotary pumps for distributing the oil throughout the buildings, three pressure blowers, four melting furnaces for crucibles holding 90 pounds each, one strip annealing furnace, one blank annealing furnace, one die hardening furnace, and three cupel furnaces and two small melting furnaces for the Assay Department. In melting and cupel furnaces an air blast is used in conjunction with the oil; while in the annealing furnaces and die hardening furnace dry steam is used, at a pressure of 60 pounds per square inch. The oil pumps are so arranged that the fuel is delivered to the furnace at constant pressure. All oil pumped, but not used, is returned through a spring-loaded valve to the storage tanks.

The tanks are supported on concrete bearers, one at either end, and one at the centre of each tank—so that the air may circulate freely around them. The piping for these tanks is so arranged that each one may be filled or emptied separately. Each tank is also fitted with a return pipe from the pumps, and a vent pipe through which all fumes rising from the oil are lead to the roof of the building. The air for the blast used in the melting furnaces is drawn from the tank room, so that the air round the tanks is constantly changed.

This fuel is found to be very economical, and excellent results have been obtained from all the furnaces. The heat can be regulated without difficulty, and, in the

melting furnaces, either nickel or aluminium may readily be melted.

Die Making Plant.

Die Department.—The machinery in this department consists of a die sinking press, two die turning lathes, and a die hardening furnace. The press and lathes are driven by a motor through an overhead shaft. In the die press the blow is given by a heavy fly wheel, 5 feet in diameter, which is keyed to a triple screw of 6 inches diameter. The fly wheel is actuated by two rapidly revolving discs, which can be brought into contact with its leather covered rim. One friction disc raises, and the other depresses the screw. The operator works the press by depressing a stirrup rod with his right foot. This action brings one of the friction discs into contact with the rim of the fly wheel, and thus the required blow is given to the die. On the operator withdrawing his foot, a balance weight raises the stirrup, the other friction disc comes into operation, and the screw is raised. After the blow has been delivered, the height to which the screw shall rise is regulated by a brake adjustment; and having reached that height, it remains there until the stirrup is again depressed. In this press a blow may be given varying from a few pounds to about forty tons.

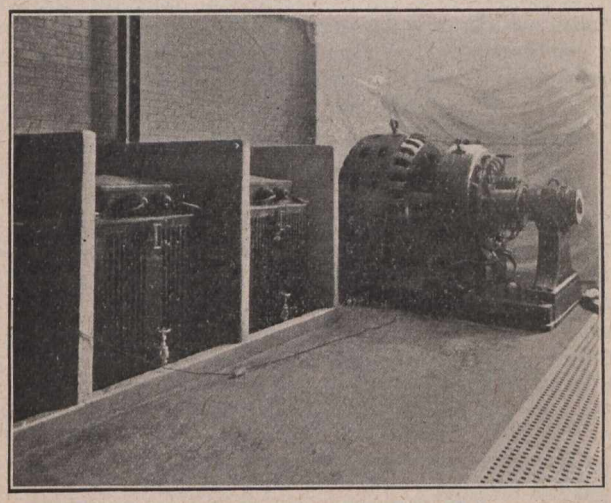


Fig. 1—Motor-generator set and power transformers.

Each coinage die requires three blows from the punch before the impression received is sufficiently sharp in all its details. After each of the first two blows the die is annealed in the die furnace. After the third blow it is turned to the correct size, and then hardened and tempered; after which it is ready for use in the coining press. It is usual for a pair of dies to strike about 80,000 pieces before they are unfitted for further use.

Machine Shop.

Repair Shops, etc.—In the machine shop the following tools have been installed:—

One 14-inch by 72-inch Norton roll grinding machine.

One Brown & Sharpe, No. 13, universal grinding machine.

One Brown & Sharpe, No. 2, milling machine.

One Bertram planing machine.

One Barnes 21-inch drilling machine.

One sensitive drill.

One 16-inch gap lathe.

One 14-inch, Pratt & Whitney lathe.

One shaping machine.

One polishing spindle.

In addition to the above, fitters' benches, grindstone, power hacksaw, etc., have been installed.

The roll grinder and the planer are driven by their own motors, while the other machines are grouped.

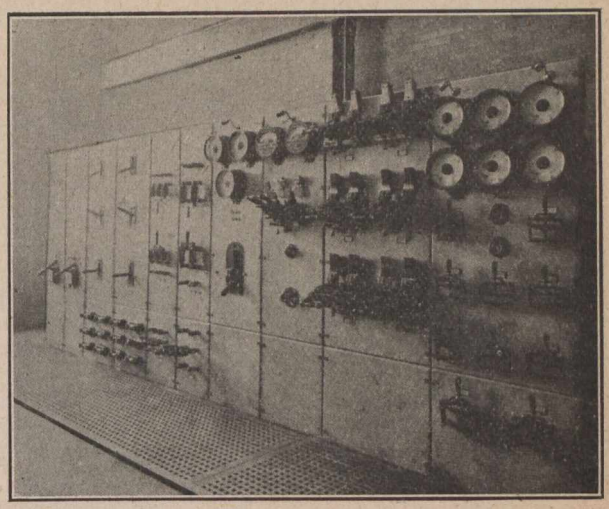


Fig. 2—Main switchboard in power room.

An elevator is situated in one corner of the shop, communicating with the smith's shop, which is in the basement next to the boiler room.

The smith's shop contains a Buffalo down draft forge, a Fairbanks' 100-pound power hammer, shearing machine, etc.

The boiler room is equipped with two marine type multitubular boilers, which are used for heating the Operative Department, by steam, during the cold weather; for supplying hot water throughout the buildings; and for supplying steam to the annealing and die furnaces, and to the drying apparatus. Hard coal is used in these boilers, and a pressure of 80 pounds per

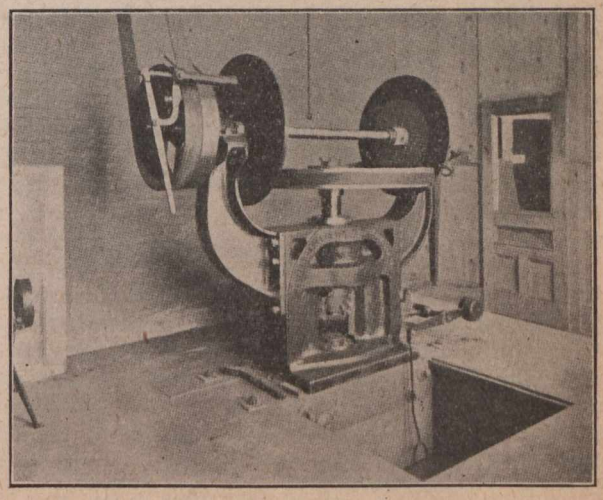


Fig. 3—Die-sinking press in Die Department.

square inch is maintained. The boilers are fitted with connections so that either, or both, may be used for any of the above services. The steam for heating the building, before entering that system, passes through a reducing valve, so that the pressure is reduced to 10 pounds per square inch. The returns from the heating

system are lead to a hot well, and are returned to the boilers by a duplex feed pump. The boilers may also be fed by means of a Pemberthy injector, or direct from the mains, in case of necessity, and when the steam pressure is below 40 pounds per square inch.

The carpenter's shop is in the basement, next to the smith's shop, and contains a variety saw, a 12-inch wood

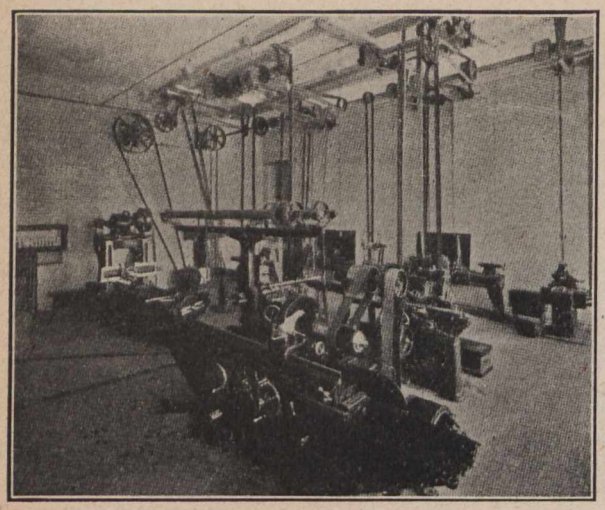


Fig. 4—Machine Shop.

turning lathe, and a carpenter's bench. The saw and the lathe are driven from an overhead shaft by a motor, which also drives the shafting for the blacksmith's shop.

ASSAYING PLANT.

The Assay Department.—This department is situated in the front building, and occupies three floors. In the basement the motors and blowers for the furnaces are installed, and here also are stored the acids, chemicals, etc. The furnace room is on the ground floor, and contains three cupel and two melting furnaces; all heated by oil fuel in conjunction with an air blast. The second floor is occupied by the laboratory and scale rooms.

In this department is an elevator, communicating with all three floors, which may be used either for passengers or for the conveyance of apparatus, acids, etc., to the various rooms. Additional communication between the three floors has also been provided, in the form of a spiral stairway. Fume chambers have been installed in the laboratory and furnace room, together with the necessary chemical and physical apparatus for assay and experimental work.

THE COINING DEPARTMENT.

For the purpose of describing the machines used in the actual processes of minting, it may perhaps prove interesting, and more intelligible, if the various operations through which the metals pass while being transformed from ingots into finished coins, are stated in order of sequence, and then are dealt with separately. A short description of each machine and the part it takes in the production of the coins will in each case be given.

The operations are as follows:—Melting, rolling, adjusting, cutting, marking, annealing, blanching and cleaning, coining, testing.

Melting.—The ingots (of a purity of 999 parts per 1,000, or over) are placed with the necessary alloy in the crucibles, and charged into the melting furnaces. There are four of these furnaces altogether, each one taking a No. 30-35 crucible (about 90-110 pounds of silver). Crude oil is used as fuel, in conjunction with an air blast. The oil (sp. gr. 32-34 B.) is delivered to the furnaces in very fine streams at a pressure of about 25 pounds per square inch, and is mixed with air from a low pressure blower (air blast about 10 ounces per square inch).

The flame does not play directly on the crucible, but first strikes a fire brick, and is then deflected so as to travel round the crucible, and then to the flue.

These furnaces are very clean, economical and easy of manipulation. It is usual, in the case of silver, and starting with a cold furnace, for the first round to be ready for pouring one and a half hours after lighting up. After the first round has been poured the furnaces have become thoroughly warmed up, and the subsequent rounds are ready for pouring one hour after charging in. It will thus be seen that in an ordinary working day of eight hours, metal can be poured six times from each furnace.

The flues are so arranged that the gases issuing from the furnaces enter a large condensing chamber, where they expand rapidly, and their velocity is reduced. In passing through these chambers the gases strike against baffle-plates (the course taken by them being in the form of the letter S placed on its side), by means of which their velocity is still further reduced. Any fine particles of metal which may be carried by them from the furnaces are deposited on the baffle-plates and sides of the chambers, and are thus prevented from being carried away through the chimney stack.

This treatment of the gases results in the saving of a considerable amount of metal, as is clearly shown in the annual report of the Director of the United States Mint. From this report it appears that, after six months' working, the value of the metals recovered from the condensing chambers attached to 13 furnaces, was no less than $12,900.00.

After the metal has been melted, it is poured into cast iron moulds, forming bars about 24 inches lon 1-2 inch thick, and varying in width fro 1 1-4 inches, according to the denomination of coin to be made. The

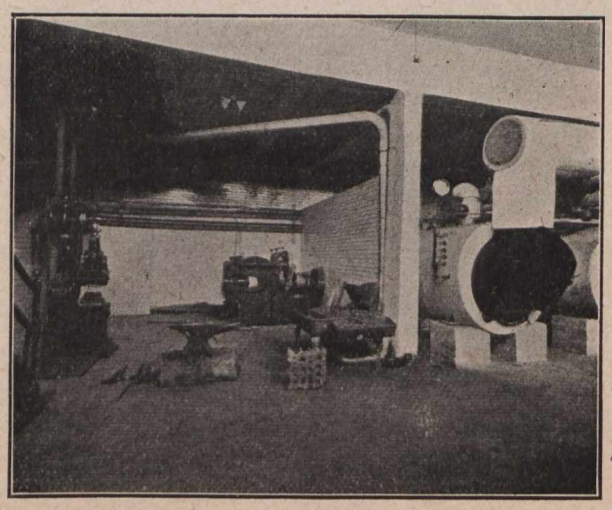


Fig. 5—Boiler House and Smith's Shop, showing two marine type high pressure boilers, power hammer, shearing machine and "Buffalo" down draught forge.

newly formed bars are removed from the moulds as soon as they have become solid, and plunged in a weak solution of sulphuric acid; after which they are washed and dried. They are then taken to the shearing machine and revolving files, where the spongy ends are removed,

and the rough edges trimmed. They are then ready for the rolilng mills.

The shearing machine is of the usual single ended pattern, such as used in machine shops, fitted with fast and loose pulleys, and driven from an overhead shaft.

There are two revolving files, each consisting of a headstock, with shaft, and single pulley between the bearings. On one end of the shaft, outside the bearing, is keyed a circular file of about 6 inches diameter and 6 inches long. These files are also driven from the same overhead shaft as the shearing machine, and revolve at 150 revolutions per minute. The bars from each crucible are kept separate from those from any other crucible, and are marked with distinctive letters and figures, so that their origin can be readily traced at any time. A small piece is cut from one end of the first and last bar from each crucible, and these pieces are forwarded to the Assay Department for testing purposes. The bars are not operated upon until the report from that department has been received, stating that they are within the legal remedy as to fineness. All bars which are above or below the legal standard are re-melted with the necessary amount of alloy, or fine metal, to bring them within the remedy.

All the worn out crucibles, covers, etc., are ground to a fine powder in a mortar mill; the powder being washed, so as to recover any metal that may have been taken up during the process of melting.

The powder is washed twice, after which it is sold by public tender, the tendering firms being allowed to take samples beforehand.

The mortar mill used for reducing the worn out crucibles, etc., is fitted with an under-driven revolving pan, five feet in diameter, has fast and loose pulleys, and is driven from an overhead shaft by a 5 H.P. motor. After the powder has been washed, it is dried in a steam-heated drying pan, 8 feet long, 4 feet wide, and 10 inches deep. It is then thrown into bins, where it is stored until sold.

(To be Continued.)

CONCENTRATING COBALT ORES.

G. H. GILLESPIE, M.E.

The problem of concentrating the ores of Cobalt is a complex one. It is, however, a problem that can hardly be considered entirely new. Every mining camp has its own peculiar features, which can only be worked out by experiment and by practical operation on a small scale. It is better, therefore, in adapting the principles of concentration to new ores to begin the practical application on a small scale and with a limited outlay of capital. The main aim, from the business point of view, in placing a concentrating mill in operation on a mine is, therefore, the treatment of low grade ores in a plant that is the most commercially efficient and that has been erected at the smallest initial outlay of capital.

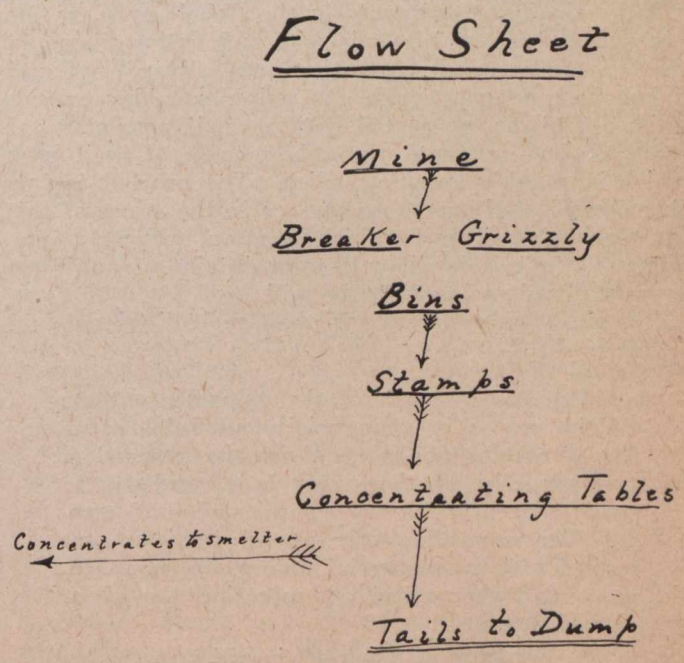
It must always be remembered that the capital outlay on a mill must be written off against the quantity of ore available for treatment during the lifetime of the mine. Therefore, the plant, which by large initial outlay of capital, gains in theoretical efficiency of extraction over a less costly plant, should that initial capital expenditure be out of proportion to the available tonnage, will in the end prove to be a much more costly plant both in respect of capital invested and in cost per ton of ore treated than one which simply aims at a commercial efficiency to begin with. In other words, the mill which at lowest first cost will give good results is more to be aimed at than the attainment of the utmost theoretical efficiency. As the plant increases in size with growth of tonnage the efficiency of extraction can be increased.

It is not advisable to make large capital expenditures to effect small savings per ton on a small installation. Such capital expenditures are, of course, requisite on large operations such as the 'Homestake'' mine where on a large tonnage treated a few cents per ton may make large profits in a year's operation. Large plants are the results of industrial evolution over a long period of years and on an assured tonnage. What is possible in practice on a large plant is, therefore, not often commercially advisable on a small plant.

The concentration of argentiferous ores is one of the oldest of all concentration problems. It was tackled a long time ago at two camps where conditions were similar to those existing at Cobalt. These mines were: The Peck mine, Bradshaw Mountains, Arizona, and Silver Islet, Lake Superior, Ontario.

The Peck mine ores were native silver, wire sheet and nugget, associated with chloride of silver, galena and zinc blende. The Silver Islet ores presented a general similarity to those of Cobalt.

The problem in each of these three cases stated is, generally speaking, similar; being the separation of the



silver along with associated sulphide and arsenide minerals from a siliceous or calcareous gangue.

Cobalt ores are native silver, flake sheet and massive, associated with nickel and cobalt arsenides as well as some of the complex sulph-arsenides of silver.

The methods which gave results in treatment of the Peck mine ores and of the Silver Islet ores should, therefore, so far as concentration is concerned, be ap-

plicable to the concentration of the Cobalt ores. The variation in practice would arise from the modernization of machinery during the past twenty or thirty years, and the application of such processes as the cyanide or hypo-sulphide to the mill tails. These processes for treatment of mill tails were not invented at the period the two camps mentioned were in operation.

The practice in the cases cited was for low grade ores.

The results obtained from this practice were exceedingly satisfactory.

In designing a concentration plant for the treatment of the ore of a camp, or preferably of a mine (as the ore found in individual mines in any camp may present points of divergence in type that would call for individual treatment and design), the points to be borne in mind are:—

(1) The plant must suit the ore, not the ore the plant.

(2) The plant should be for the treatment of the largest quantity of the lowest grade ore that can be commercially handled; that is, the mine must first be opened up on an extensive scale and the ore occurrence studied.

The general classification of the Cobalt ores up to the present may be given as:—

(1) No. 1—Shipping grade ore.

(2) No. 2—Screenings from picking tables, sometimes of shipping grade.

(3) Ore in greatest bulk too low grade to ship direct from the mine. This must either go to the mill for concentration or go to storage on the dumps.

The valuable constituents in the Cobalt ores are for high grade ore, smaltite, niccolite and native silver; in the low grade or concentrating ores, silver (leaf and flake) and in some cases the sulph-arsenides or sulphides of silver, associated with a small percentage of smaltite, but scattered through a mass of wall rock which is, roughly speaking, silica. The problem is further complicated by the occurrence in the mines of this impregnated wall rock, which is often extremely irregular, so that it is difficult to maintain any uniform average of values in ore to the mill.

The aim of concentration in the Cobalt district should therefore be:—

(1) Save as much of the valuable contents of the ore as is commercially advisable at as low a cost as possible. I use the expression, commercially, as there may be a tendency to make concentration too complicated, and costly. The more simple the process is made, consistent with a commercial saving, the more efficient and economical of operation the plant should prove.

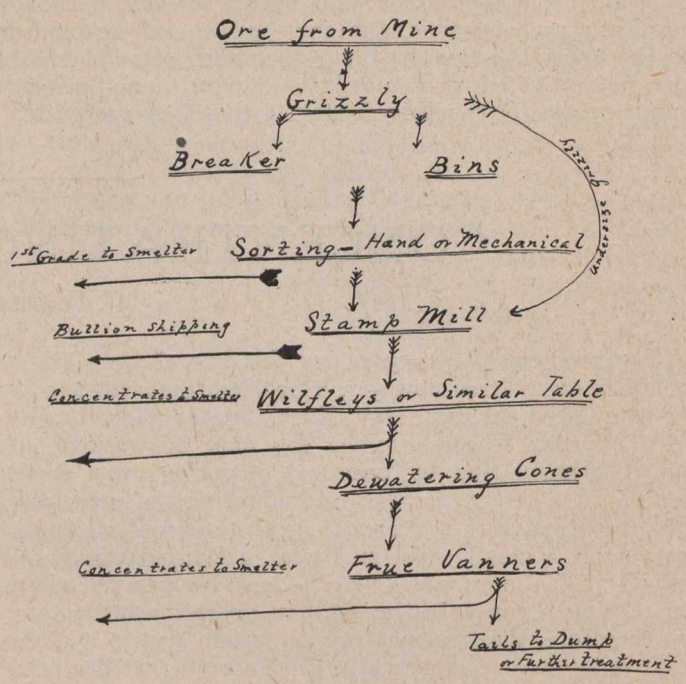
(2) Separate as much of the silica matrix as possible from the valuable ore to reduce freight and smelter charges.

(3) Even in the case of low grade ores it will be found that some of the native silver occurs in a massive form. The process to be installed should aim at the removal of this massive silver as early as possible in the progress of the ore through the mill and to collect as much as possible of this silver in the form of metallics; to be run into ingots for shipment as base bullion.

I would suggest as the result of experiment on the ores of this camp the following method of milling, and concentration, as one that would give good results both as to efficiency and economy of operation and installation.

Flow Sheet.

Method of Concentrating Cobalt Ores



The milling plant should, of course, be placed in the most suitable position to take the ore from the mine at the lowest possible cost.

The ore after delivery to the mill would go over a grizzly set to mesh of final breaker size; i.e., size to be fed to mill, say 1 inch ring oversize on grizzly; next through a rock breaker of standard type, preferably gyratory, set to 2 1-2 inch ring; thence over a picking belt or mechanical sorting device for removal of high grades; next through second breaker set to 1 inch ring; thence to stamp mill bins; next to Wilfleys, or similar tables; thence to dewatering cones; finishing on frue vanners; tails to dump or to final treatment.

The principal value in the ores of Cobalt calling for concentration is metallic silver. I advocate therefore, the preliminary sorting out of high grades before pulverizing for concentration; as experience in milling has taught me that it is exceedingly inadvisable to mix a small quantity of high grade with a large quantity of low grade highly siliceous ore, and then to attempt concentration of resultant mixture, which would be a tonnage presenting great variations in character and value. It will often be found that tails from a mill running on ore of variable grade will appear to give low results; i.e., high extraction. But if an attempt is made to examine ore from the viewpoint of actual loss, startling results may be found.

Let me state a case, that of a mill crushing 100 tons of ore per day of variable grade ore:—

> Two tons high grade, 3,000 ounces per ton.
> Ninety-eight tons low grade, 5 ounces per ton.
> Average value per ton of 65 ounces. Average tails from mill, 10 ounces per ton.

Now 98 tons had only 5 ounces per ton to start and 10 ounces per ton were lost. Therefore in a case of this kind no saving was made by treatment of 98 tons and as total loss was 100 tons by 10 ounces, or 1,000 ounces.

The loss in low grades, 98 + 5 = 490 ounces.

Therefore, 510 ounces must be directly traceable to loss on two tons of high grade or much more than enough to pay for preliminary sorting of high grades and to leave a good profit. It wil be noticed, also, that an average tailings loss of 10 ounces per ton on 100 tons of 65 ounces ore would mean an 85 per cent. extraction, which at first glance would appear to be quite respectable.

It may be that by stripping ore in mining (where possible) and sacking this ore underground will be a solution of the problem, and where high grade ore will not strip to admit of this sacking, breaking the stopes as narrow as possible, allowing the ore to come down mixed with as small a quantity of low grade or wall rock as practicable, sending this small quantity only over the picking tables, and allowing the large tonnage of known low grade to go past the picking table direct to mill without preliminary sorting, high grade ore such as found in this camp will stand a fair cost per ton for sorting. It must be borne in mind that anything saved by hand picking means 100 per cent. extraction, an extraction which no process of concentration will ever give.

The stamp mill has been successfully applied in many instances to the milling of ores containing native metallics.

The stamp mill as used in crushing ores for concentration may to many appear to be old-fashioned. It is really one of these old methods of crushing which has a wider and more general application than the more recent methods of rolls or roller mills.

The roll is a more specialized machine, good for certain purposes, but in my opinion not particularly suited for crushing the ores found in this camp and its application tends to complicate the practice and to increase the cost of installation.

The common objection to stamps, that of unequal crushing and sliming, can be largely overcome in crushing for concentration, by low discharge, double discharge, coarse mesh, or in other words quick discharge. Get pulp out of mortar boxes as soon as it has reached the desired mesh. The sliming tendency found in gold milling, where battery amalgamation is practised, is largely caused by the necessity of crushing at that rate at which gold will amalgamate in the mortar. Hence by high discharge and fine mesh, the pulp is held in the mortar longer than is really requisite for the simple operation of crushing.

The stamp mill presents an advantage over other methods of crushing as applied to these ores, in that, by what may be termed the jig action of stamp heads in the mortar boxes, the heavy particles of massive silver will tend to fall to the bottom of the mortar boxes, and have a secure lodgment among the dies, where such silver can readily be recovered and, by the scouring action of the stamps due to revolving motion of stamps, in such condition that it can be run into ingots after recovery for shipment as base bullion.

Jigging has, of course, wide application in the concentration of certain classes of ore. However, when the ore has undergone previous hand sorting to remove the high grades there can be no great need of the application of jigs to the ores left for concentration.

Jigging in my opinion is open to several objections in concentration of ore of this type where the principal values are found as metallics in a siliceous gangue.

(1) The occurrence of the silver in the wall rock, which constitutes the great bulk of the ore requiring concentration, is such that if we compare two particles of ore (say from 3-8 inch jig heads of equal mass), respectively, one particle of barren wall rock containing no values and the other piece of wall rock containing leaf or plate silver, then, since the silver is present in such minute quantity, the metallic contents of this class of ore cannot well be expressed in terms of percents. It must be expressed as merely ounces per ton. Further, the presence of this small amount of silver causes no marked difference in the specific gravities of the two particles. The jig being set to save particles of a much greater range of difference of specific gravities than would exist for the case stated, there is a decided tendency to throw out the valuable particle with the barren particle, both going to waste.

This is not a suppositious case, but will be found to be generally true of jigging as applied to this class of ore, and will be true for all meshes of jig product.

(2) As has been previously stated, one of the objects of concentration should be the cutting down of the silica contents of the shipping product. It is a difficult matter to do this, and to make an efficient saving by jigging. If saving is high, silica will be high, if silica is low, loss is high. Loss in jigging can of course be offset by regrinding tails from jigs in a stamp mill, chilian, ball, or other mill and reconcentrating over tables. But why complicate the process in this way? The same results can be obtained in the first stage of milling.

(3) In jigging, little or no silver can be saved in a state that admits of running into bars for shipment as base bullion.

With due attention to speed, drop, mesh discharge and other factors governing the crushing efficiency of the stamp mill, the resultant pulp will be in such a shape as to call for little or no classification.

The whole pulp after discharge from the mortars would go direct to the Wilfleys. Ample table capacity should be provided. In fact the provision of ample table capacity to prevent overloading is one of the most important factors in mill design.

The Wilfleys would make a high grade, low silica, concentrate to smelter; sands to follow on after dewatering to frues.

Any standard type of dewatering device would be suitable. It is necessary to remove excess water before feeding pulp to frues. Ample vanner capacity must be provided. Frues would give low grade, high silica concentrates to smelter. The feed of pulp, and water, and set of all tables is of course a most important matter. No table will give good results unless it is properly handled. The resultant tailings from frues could be sent over canvas or blankets. It is, however, more probable that, should tails carry commercial values, a finishing process, such as cyanide, will be found most applicable. It is not advisable to attempt to instal a finishing process until the grade and value of tails has been ascertained from actual practice.

Sampling for Mill Check.—Accurate and close mill check samples on mill tails in dealing with the ores of this camp is peculiarly necessary. This will be more marked in cases where ore has not been subjected to a preliminary hand or other sorting. It is an exceedingly difficult matter to get any accurate sample of heads to mill. The check must largely come from sampling resultant product and tailings. Accurate sampling devices are therefore requisite.

Should the sampling of tailings be done intermittently it would be difficult to get any accurate indication as to mill results.

The variation in the grade of the ore being very great, at one period low grade may be passing, then suddenly a change to high grade, and so on. A mill may give low average tails, but high tails on high grade ore with the same mill practice. In other words, losses expressed as percentages mean nothing unless the value of heads to mill is given.

> Eighty-five per cent. concentration on 20 oz. ore is good practice.
>
> Eighty-five per cent. concentration on 200 oz. ore is not good.

In the treatment of ores carrying native metallic values, one of the points which I wish to emphasize is: As the high grade silver ores of Cobalt contain values in cobalt, nickel and arsenic, these high grade ores can be handled by preliminary hand or other sorting.

Is it good practice to concentrate a bonanza ore? If mining methods make it necessary for high grades to go to concentrator, why not, where possible, change these mining methods? In gold milling practice ore of $100 per ton or upward is in most cases milled in a unit separate from those in which ore of $10 per ton is treated. It is recognized that greater care is required in the handling of high grade than in handling low grade ores. But this care cannot well be given when the high grade is mixed with a great mass of exceedingly low grade material. The impregnated wall rocks, the real concentrating ore of Cobalt, is really a milling rock complicated by the presence of a small percentage of arsenides. One does not jig a gold quartz. Why jig a siliceous ore, carrying exceedingly small percentages of ore separable by concentration?

The stamp mill with a follow-on process of concentration presents the following advantages:—

(1) Certainty of crushing efficiency.

(2) Saving of heavy metallics in mortars.

(3) Simplification of screening devices and classification; the doing away with elevators (always a source of trouble in a mill); handling all the ore through the mill by gravity, a great advantage in the handling of low grade ores; reduction in the number of stages of pulverization.

(4) The cutting out of values at early stages in the passage of ore through the mill.

(5) Cheapness of installation.

(6) Economical operation.

(7) Efficiency of concentration.

EQUIPMENT OF COBALT MINES—A DETAILED STATEMENT OF MACHINERY INSTALLED.

TOTAL HORSE-POWER AND COMPRESSORS

In the Mines of the Cobalt Camp.

Mine.	Boiler Horse-power Totals.	No. Compressors.	Cub.ft. free air per min.
1. Amalgamated	60	1	282
2. Argentite Mg. Co.	15	..	...
3. Airgoid	25	..	...
4. Alexandra	50	1	197
5. Bonanza Cobalt	25	..	...
6. Beaver Silver Cobalt	80	1	410
7. Big Chief	30	..	...
8. Buffalo Mines	220	1	1015
9. Casey Cobalt Silver Mfg.	80	1	285
10. Casey Mt. Development	25	..	...
11. Century Silver Mg. Co.	20	..	...
12. Cleveland Cobalt	315 (300 gas)	3	1332
13. Colonial	360	1	1297
14. Columbus Cobalt	85	1	300
15. Coniagas	240	1	1015
16. Cobalt Central	240	2	2065
17. Cobalt Consolidated	20	..	...
18. Cobalt Lake	230	1	1325
19. Cobalt Silver Queen	120	1	381
20. Cobalt Townsite	100	1	558

DRILLS

In the Mines of the Cobalt Camp.

		PERCUSSION.			AIR HAMMER.	
Mine.	Make.	Ingersoll.	Mac.	McKernon.	Rand.	Sullivan.
1. Amalgamated	Rand.	..	1	..	3	.. ..
2. Argentite Mg. Co.		..	..	..	1	.. ..
3. Airgoid		..	..	..	1	.. ..
4. Alexandra	Rand.	..	..	..	2	.. ..
5. Bonanza Cobalt		..	..	..	1	.. ..
6. Beaver Silver Cobalt	Rand.	..	..	..	4	.. ..
7. Big Chief		..	..	..	2	.. ..
8. Buffalo Mines	Rand.	..	..	..	12	.. ..
9. Casey Cobalt Silver Mfg.	Ingersoll-Serg.	..	..	..	4	.. ..
10. Casey Mt. Development		..	..	..	1	.. ..
11. Century Silver Mg. Co.		..	..	..	1	.. ..
12. Cleveland Cobalt	Ingersoll-Serg.	..	..	..	6	.. 2
13. Colonial	Rand.	..	..	..	8	.. ..
14. Columbus Cobalt	Gardner.	..	..	..	3	.. ..
15. Coniagas	Rand.	..	..	..	10	.. ..
16. Cobalt Central	Rand.	..	6	..	2	.. 5
17. Cobalt Consolidated		..	..	..	..	.. ..
18. Cobalt Lake	Rand.	..	8	..	1	.. ..
19. Cobalt Silver Queen	Ingersoll-Serg.	5	..	..	..	.. 2
20. Cobalt Townsite	Rand.	..	..	..	6	.. ..

TOTAL HORSE-POWER AND COMPRESSORS

In the Mines of the Cobalt Camp.

Mine.	Boiler Horse-power Totals.	No. Compressors.	Cub. ft. free air per min.
21. City of Cobalt	60	1	282
22. Coleman Developing	20	..	...
23. Canadian Consolidated	20	..	...
24. Derby-Edison	60	1	280
25. Drummond	100	1	285
26. Erie Mines	25	..	...
27. England's Premier	75	1	282
28. Foster Cobalt Mg. Co.	120	1	807
29. Gates	50	..	...
30. Green-Meehan	200	1	410
31. Hongsinger	20	..	...
32. Hunter Cobalt	20	..	...
33. Kelsey-Herbert	20	..	...
34. Kerr Lake	200	2	1619
35. King Edward	270	1	1015
36. La Rose	230	1	1710
37. Lawson	20	..	...
38. McKinley-Darragh	160	2	1296
39. Montreal Cobalt	25	..	...
40. Mutual	25	..	...
41. Mitchell	50	..	...
42. Nancy Helen	300 (250 gas)	1	410
43. Nipissing	908	2	3420
44. Nova Scotia	250	2	1992
45. North Cobalt Mg. Co.	70	1	300
46. O'Brien	300	2	2550
47. Progress	20	..	...
48. Pequot Mines	15	..	...
49. Peterson Lake	100	..	...
50. Pittsburg Cobalt	50	..	...
51. Provincial Mines	80	1	410
52. Ruby Silver Mg. Co.	25	..	...
53. Red Rock	60	1	197
54. Right of Way	225	1	925
55. Rochester	105	1	410
56. Rothchilds	85	1	282
57. Savage	70	1	410
58. Silver Bar	60	1	282
59. Silver Leaf	80	1	410
60. Sharpe Lake Mines, Ltd.	15	..	...
61. Silver Bird	50	..	...
62. Silver Cross	25	..	...
63. Smith & Flynn	20	..	...
64. Stella Mg. Co.	15	..	...
65. Strathcona Silver Mg. Co.	25	..	...
66. Taberner, W. W.	20	..	...
67. Thompson, A.	20	..	...
68. Temiskaming	120	1	558
69. Temiskaming & H. B.	120	1	1510
70. Trethewey	140	1	1015
71. Temiskaming Cobalt	15	..	...
72. United States	25	..	...
73. United Princess	25	..	...
74. United Fisher Epplet	60	1	282
75. University	125	1	485
76. Victoria	100	1	410
77. Wonderland	30	..	...
78. Wabi	60	1	282

DRILLS

In the Mines of the Cobalt Camp.

Mine.	Make.	PERCUSSION. Ingersoll.	Mac.	McKernon.	Rand.	AIR HAMMER. Sullivan.	
21. City of Cobalt	Rand.	..	..	..	3	..	..
22. Coleman Developing		1	..	..	..	..	..
23. Canadian Consolidated		..	..	..	1	..	..
24. Derby-Edison	McKernon.	1	..	2	..	..	..
25. Drummond	Ingersoll-Serg.	4	..	..	..	..	..
26. Erie Mines		..	..	..	..	..	..
27. England's Premier	Rand.	..	1	..	3	..	..
28. Foster Cobalt Mg. Co.	Ingersoll-Serg.	..	..	..	7	..	..
29. Gates		..	..	..	..	..	..
30. Green-Meehan	Rand.	..	4	..	..	..	..
31. Hongsinger		..	..	..	..	..	..
32. Hunter Cobalt		..	1	..	..	..	..
33. Kelsey-Herbert		..	..	..	2	..	..
34. Kerr Lake	Rand.	..	5	..	15	..	..
35. King Edward	Rand.	..	8	..	5	..	..
36. La Rose	Rand.	..	..	..	20	..	..
37. Lawson		..	..	..	..	..	..
38. McKinley-Darragh	Ingersoll-Serg.	..	..	..	9	..	..
39. Montreal Cobalt		..	..	..	1	..	..
40. Mutual		..	..	..	1	..	..
41. Mitchell		..	..	..	..	..	..
42. Nancy Helen	Rand.	..	1	..	3	..	..
43. Nipissing	Rand.	..	20	..	..	..	10
44. Nova Scotia	Rand.	12	..	..	..	1	..
45. North Cobalt Mg. Co.	McKernon.	..	..	3	1	..	..
46. O'Brien	Ingelsoll-Serg.	6	8	2	2	..	..
47. Progress		..	..	..	1	..	..
48. Pequot Mines		..	..	..	1	..	..
49. Peterson Lake		..	..	..	..	1	..
50. Pittsburg Cobalt		..	..	..	..	..	..
51. Provincial Mines	Rand.	..	3	..	..	..	..
52. Ruby Silver Mg. Co.		..	1	..	..	..	..
53. Red Rock	Rand.	..	..	..	3	..	..
54. Right of Way	Ingersoll-Serg.	4	..	..	1	..	2
55. Rochester	Rand.	..	..	..	4	..	..
56. Rothchilds	Rand.	..	..	..		..	..
57. Savage	Rand.	..	..	..	4	..	..
58. Silver Bar	Rand.	..	1	..	3	..	..
59. Silver Leaf	Rand.	3	..	..	1	..	..
60. Sharpe Lake Mines, Ltd.		..	..	..	1	..	..
61. Silver Bird		..	..	..	2	..	..
62. Silver Cross		..	..	..	1	..	..
63. Smith & Flynn		..	..	..	1	..	..
64. Stella Mg. Co.		..	1	..	1	..	..
65. Strathcona Silver Mg. Co.		..	..	..	1	..	..
66. Taberner, W. W.		..	..	..	1	..	..
67. Thompson, A.		..	..	..	1	..	..
68. Temiskaming	Sullivan.	..	1	..	5	..	..
69. Temiskaming & H. B.	Rand.	..	6	..	1	..	..
70. Trethewey	Rand.	2	2	..	2	..	..
71. Temiskaming Cobalt		..	..	..	..	..	..
72. United States		..	..	..	1	..	..
73. United Princess		1	..	..	..	..	..
74. United Fisher Epplet	Rand.	3	..	..	..	..	..
75. University	Ingersoll-Serg.	3	..	..	..	..	..
76. Victoria	Rand.	..	..	..	..	..	..
77. Wonderland		..	..	..	1	..	..
78. Wabi	Rand.	..	..	..	3	..	..

Note.—Air hammer drills as above are of followings makes: Murphy, 13; Waugn, 3; Hardseeg, 2; Sullivan, 2; Shaw, 1. Total, 21.

POSSIBILITIES IN THE ELECTRIC SMELTING OF IRON ORES.*

BY ALFRED STANSFIELD, D.Sc., Montreal.

(Ottawa Meeting, March, 1908.)

In view of the many recent attempts that have been made to employ electrical energy instead of fuel for the smelting of iron ores, it appears worth while to indicate, in a short paper, what can probably be accomplished in this direction, the manner in which the successful results can be obtained, and the advantages and drawbacks of the electrical process.

In ordinary metallurgy of iron the ore is smelted in a blast furnace with coke, producing pig iron. This is an alloy of iron with some 2 per cent. to 4 1-2 per cent. of carbon, 1-2 per cent to 4 per cent. of silicon and small quantities of other elements. It is decidedly more fusible than wrought iron or steel, and on this account is very suitable for foundry purposes. Bessemer steel and open hearth steel are made from pig iron by removing from it in the Bessemer converter, of the open hearth furnace, a considerable proportion of the carbon silicon, etc., which it contains, the product being nearly pure iron retaining a little carbon and some manganese.

Crucible steel is used for tools. It contains about 1 per cent. of carbon, and is made by adding the necessary amount of this element to pure varieties of iron or steel, and melting the material in crucibles so as to obtain a perfectly sound product.

Electrical energy has recently been employed to replace, in such operations, the heat which is ordinarily obtained by burning fuel. Electrical energy is somewhat expensive, and it was naturally employed at first for the production of the more valuable products, such as crucible steel, where the cost is of less importance. The electrical production of cast steel for tools and similar purposes may be accomplished in two ways—(1) by melting down pure varieties of iron and steel with suitable additions of carbon and other ingredients, just as in the crucible process, but using electrical energy for heating instead of coke or gas; (2) by melting a mixture of pig iron and scrap steel as in the open hearth process, and removing the impurities, such as sulphur and phosphorus so thoroughly by repeated washing with basic slags that a pure molten iron is at last obtained. This can then be recarburised and poured into moulds. Both of these methods are now employed commercially for the production of good qualities of tool steel. The larger sizes of electrical furnace that have already been constructed hold 5 or 10 tons, while the crucible will only hold about 80 pounds, and the high efficiency of the electrical method of heating more than compensates for the greater initial cost of electrical energy as compared with heat derived from fuel. The resulting steel is found to be even better than crucible steel, and can be produced at less cost. It is therefore, only a question of time until the crucible process shall be entirely replaced by the electrical process in all localities where electrical energy can be produced at a moderate figure.

Two forms of electrical furnace have been used for making cast steel:—(1) the Héroult steel furnace, which resembles an open hearth furnace, through the roof of which hang two large carbon electrodes. Electrical connections is made to these carbon electrodes and electric arcs are maintained between the lower end of each electrode and the molten slag in the furnace, thus producing the necessary heat. This form of furnace has been found to be very suitable for the second of the above processes, that is, the one in which pig iron and scrap steel are melted together and refined until pure enough to convert into cast steel.

An entirely different form of furnace has been devised in which no electrodes are required. This furnace consists of an annular shaped trough containing the steel. This ring of steel acts as the secondary of an electrical transformer. An alternating current is supplied to a primary winding, and the primary winding and the ring of steel both encircle an iron core, as in the ordinary transformer. The alternating current in the primary circuit induces a very large alternating current in the secondary circuit, that is, in the ring of steel, and in this way enough heat is produced to melt the steel. This type of furnace has been constructed lately in somewhat large sizes holding as much as 8 tons of steel and consuming 1,000 electrical h.p. It is apparently wel lsuited for the first mentioned process, that of metling down pure varities of iron and steel, just as in the crucible process.

The amount of energy needed in these furnaces amounts to about 800 or 900 K.W. hours per ton of steel, using cold stock, or 600 or 700 K.W. hours when the pig iron, which usually forms part of the charge, is supplied molten. This amount of electrical energy would cost more than the coal used in producing the same amount of steel in the open hearth furnace, but the resulting steel is far more valuable than the open hearth steel.

The above short account of the production of crucible steel in the electric furnace has been introduced, as this is the only commercial process for the production of iron or steel, which is at present in operation. The present paper deals rather, however, with the electrical smelting of iron ores.

In reducing iron ore to a metal, iron can be abtained in a relatively pure state, such as wrought iron, and this was the method adopted by the acient metallurgists in their small furnaces or hearths; but in the modern blast furnace, with its higher temperature, the coke which is needed for the production of heat carburises the resulting iron, producing nig iron. In the electric furnace, however, fuel is not used for the production of heat, since this is obtained electrically. Some carbonaceous material must be added to the charge in order to eliminate the oxygen of the ore yielding metallic iron, but the amount of this carbonaceous material can be regulated so as to yield either pure iron, steel or pig iron at will.

Although this has been realized by the pioneers in the electric smelting of iron ores, certain difficulties in the operation have led them to smelt the ore for the production of pig iron instead of for the production of steel, although the difference in price of these materials would be sufficient to pay for all the electrical energy needed for the direct production of steel from iron ore,

*Journal of the Canadian Mining Institute. Part of Vol. XI.

and it is surprising that this more attractive proposition has not gained more attention from metallurgists.

A number of experiments have been made on the direct reduction of steel from iron ore in the electric furnace, but the most satisfactory work that has been accomplished relates to the production of pig iron from the ore, and this will be described first. This work has been carried out by Héroult, Keller and others. The furnaces they have adopted are similar to the one employed by Héroult recently in the experiments at Sault Ste. Marie. This consisted of a vertical shaft similar to a small blast furnace, in which hung a central carbon and served as the other electrode, the electric current passing between the hanging electrode and the molten metal in the crucible of the furnace. The ore, with fluxes and carbon sufficient for its chemical requirements, was fed in around the vertical electrode, and became heated and melted by the heat produced by the passage of the current. The electric current in this furnace produces enough heat to carry out the chemical reactions involved in the reduction of the ore to metal, and the fusion of the resulting pig iron and slag. The carbon is required for the reduction of iron oxide to metal and for the carburisation of the metal to form pig iron.

The Keller furnace is practically the same as the Héroult furnace, except that it consists of two shafts instead of one and that these two shafts are worked in conjunction with one another, the current entering through the vertical electrode in one shaft and leaving by the vertical electrode in the other shaft. A connecting trough or passage enables the electric current to flow form one part of the furnace to the other, and serves to collect the resulting pig iron and slag from both of the shafts. This has the advantage of using a higher voltage than the single shaft furance of Héroult. The results of operating furnaces of this class show a consumption of electrical energy of about 0.3 h.p. year, and about 800 or 900 pounds of coke or good charcoal per long ton of pig iron. Supposing that the general costs of operating this furnace and the blast furnace were equal, these figures would indicate that the electrical furnace would need to obtain energy at a cost per h.p. year of less than that of two tons of coke in order to compete with the blast furnace. Thus, if coke costs $3.00 a ton and electrical energy $5.00 per h.p. year, the cost would be about the same by the two processes, and with power at $12.00 per h.p. year, the electric furnace could not compete with the blast furnace unless the price of coke were as high as $7.00 per ton. In considering these figures it should be remembered that the heating power of one electrical h.p. year, is about the same as that of three-quarters of a ton of good coal or coke, assuming that the latter is completely burned. Looked at from this point of view, it will be obvious that even these small and admittedly imperfect electric furnaces are more economical, that is to say, they use the heat better than the large blst furnaces.

The electrical furnace possesses certain advantages over the blast furnace, which in some cases may over ride the high cost of electrical power. One is its ability to use without much trouble ores of a sandy or powdery character. This ability depends upon the absence of a blast in the electrical furnace. In the blast furnace powdery ores are liable to be blown out of the furnace by the blast, or it obstructs the passage of the blast through the furnace. In the electric furnace there is no blast introduced ,and these difficulties are less serious. Another advantage of the electric furnace is in regard to the smelting of titaniferous and other difficultly fusible ores. On the blast furnace these ores are liable to give trouble on account of the slag becoming pasty, but in the electric furnace it is possible to obtain a higher temperature and thus to overcome any difficulty of this kind. The high temperature which can be obtained in the electric furnace is advantageous in regard to the treatment of sulphurous ores. In the iron blast furnace, the sulphur contained in the coke or the ore is prevented from entering the pig iron by the present of lime and by maintaining strongly reducing conditions in the furnace; the lime then forms calciumsulphide, which passes into the slag. In the electric furnace it is possible to obtain higher temperatures, thus enabling a larger proprtion of lime to be used, and even more strongly reducing conditions to be obtained than in the blast furnace. Large amounts of sulphur can, therefore, be eliminated in the electric furnace, as has been shown in the experiments at Sault Ste. Marie.

Another point in favor of the lectric furnace is that it does not require, as the blast furnace does, a very high quality of coke for fuel. In the blast furnace a soft or powdery coke becomes crushed and obstructs the action of the furnace, and is less efficient than a harder variety; but in the electric furnace, where the coke or charcoal is needed merely as a chemical re-agent, any convenient form of carbon can be employed—coke, charcoal or small anthracite—and probably in improved furnaces even such fuel as peat, sawdust or soft coal could be utilized for reduction for reduction.

Looked at from a commercial point of view the electric furnace producing pig iron has many difficulties to overcome before it can compete successfully with the blast furnace. One very important difficulty is the small scale on which the electric furnace has so far been constructed. It will be seen from the account of the Héroult furnace that the height of the shaft of this furnace is limited by the length of the electrode, which is introduced into it. More recent furnaces have been designed by Dr. Haanel and by Mr. Turnbull, in which this difficulty has been overcome by a system of inclined or lateral shafts down which the ore passes, so that the electrode does not hang down the whole height of the ore column. Another weak point in the construction of the electric furnace is that no provision has been made for utilising the carbonaceous gases which escape at the top of the furnace. In the Turnbull furnace already referred to, it is proposed to utilise the gas by burning it in a rotating tube furnace down which the ore passes before it enters the electric furnace and is mixed with the charcoal. In this way the heat available in this gas will be utilized, and an economy in the working of the furnace may be expected.

In view of the importance of reducing the consumption of fuel and electrical energy to the lowest possible point, the writer has calculated what could be expected in this way if the gases arising from the reaction between the charcoal and the ore were used partly for the reduction of the ore and partly for preheating the ore. Such a result could be attained in a furnace consisting essentially of three parts. In the upper part the otherwise waste gases are burned by air introduced there and communicate their heat to the incoming ore to which the fluxes, but not the charcoal have been added. In the middle portion of the furnace the gases arising from the lowest portion, which may be considered to be wholly carbon monoxide, react on the heated ferric oxide, if that were the variety of ore to be treated, and reduces it to ferrous oxide. The charcoal is introduced in the lowest section of the furnace and completes the

reduction of the ore to metal. Electrical energy is introduced into this section of the furnace and serves to melt the resulting pig iron and slag, and to supply the heat necessary for the preceding chemical reactions. The details of the construction of such a furnace have not been worked out at present. In a furnace of this kind it can be calculated that one ton of pig iron can be obtained from an everage ore by the use of 0.2 h.p. years of electrical energy and about 600 to 800 pounds of coke or good charcoal. This includes a reasonable allowance for loss of heat. A further allowance should be made for irregularity in the use of the electrical power and, taking this into account, we may consider that one-quarter of a h.p. year and 600 to 800 pounds of coke or charcoal wuold be required for one long ton of pig iron from the ore.

Considering these figures, it will be seen that the use of 1-4 electrical h.p. year will save about 2-3 of a ton of coke, or that 1 electrical h.p. year should not cost more than 2 2-3 tons of coke, if the electrical furnace is to compete with the blast furnace. Thus, an electrical h.p. year, at $12.00 would correspond to coke at $4.50 a ton. The considerations previously mentioned in regard to the use of cheaper fuel and cheaper ore in the electric furnace would also apply in this case, and with improved design and construction thesize of the electric furnace may be increased so as to admit of a large and economical output of pig iron.

Electric smelting plants on a small commercial scale have been put up at Welland, Ontario and Baird, California. While very little has been heard of these, the writer understands that at Baird, considerable difficulties have ben met with in the operation of the furnace. No doubt these difficulties will ultimately be overcome. No attempt has been made at present to utilize the waste gases, but this point will be attended to later.

The direct reduction of steel from the ore has been carried out by Stassano and others, but no economical scheme for this purpose has ever been put into operation on a large scale. The Stassano furnace consists of a chamber, about one metre cube, lined with magnesite bricks. The ore, mixed with the necessary fluxes and charcoal for its reduction and made up into briquettes, is placed in this chamber, and is heated by an electric arc, which is maintained above the ore. In this furnace it is possible to reduce the ore to metal and to remove any impurities, such as sulphur and phosphorus, although Stassano did not actually demonstrate this as the ores he employed were very pure. The method of heating the ore is, however, uneconomical, and it was not to be expected that commercial results could be obtained. Stassano still experiments with his furnace, but no longer uses it for direct reduction of the ore.

Steel has also been obtained directly from the ore by Dr. Héroult in his electric steel furnace mentioned in the early part of this paper, but he found the process uneconomical and preferred to use pig and scrap as the materials for making steel in his furnace. Experiments in the laboratory have been made at different times with a view to the difect reduction of iron ore to steel. In this connection may be mentioned the experiments of Messrs. Brown and Lathe in the Metallurgical Laborratory, at McGill, which were described in the last number of the "Institute Journal." These experiments are being continued this year and the writer hopes to be able to communicate some interesting results at a later date.

In operation for the direct reduction of iron ore to steel the following difficulties should be borne in mind:—

1. The difficulty of eliminating sulphur, when this is present in the ore, the blast furnace producing pig iron being far more efficient in this particular than a steel furnace, such as the open hearth. It may possibly be necessary on this account, only to use ore that are relatively free from sulphur in the direct production of steel.

2. Another difficulty lies in the different conditions required for the reduction of the ore and the final refining treatment to which the resulting steel must be subjected. Thus the operation of making steel must always be intermittent in character, while the reduction of ore in the blast furnace is a continuous operation.

Until these and other difficulties have ben overcome, it is not likely that we shall have any successful producion of steel directly from iron ore on a commercial scale. Nevertheless, the high price of steel as compared with pig iron renders this proposition particularly attractive to the electro-metallurgist. At present the most satisfactory method appears to be that of reducing the ore to pig iron in one furnace, and turning this into steel in a separate furnace as in ordinary metallurgical practice.

MEERSCHAUM IN NEW MEXICO.

For more than a century meerschaum has been extensively used in the manufacture of pipes and cigar holders, the principal source of supply for the material being deposits in the plains of Asia Minor, about 120 miles southeast of Constantinople. These deposits are said to have been worked for other uses for more than a thousand years.

The German name meerschaum "sea foam" is paralleled in French by "écume de mer," which may be less beautifully translated "scum of the sea." The mineralogist will tell you it is sepiolite, a hydrous silicate of magnesia, but this designation will not diminish the smoker's enjoyment of his meerschaum pipe.

The ease with which meerschaum can be carved, its whiteness, and the fine polish it takes with wax render its especially suitable for elaborate carving and artistic treatment in the manufacture of pipes. These pipes are prized for the rich cream-brown or brown color that the bowls assume after being smoked a while. This color is caused by the permeation through the meerschaum of the mixture of the nicotine from the tobacco with the wax used in polishing the pipe. As long as there is absorbed wax in the meerschaum the color of the pipe will grow darker and with continued smoking will become nearly black. It is therefore necessary to "fix" the color of the pipe when the proper shade is reached. The method employed to accomplish this is in part a trade secret.

The manufacture of meerschaum into pipes is a thriving industry in parts of Germany and Russia, employing more than 3,000 workmen. It is said that the supply of meerschaum for this industry is becoming low, and the discovery of deposits of the mineral in New Mexico is therefore interesting.

Two deposits of meerschaum have been located in the upper Gila river valley, one about 23 miles east of north of Silver City, the other at a mine about 12 miles northwest of Silver City.

Mr. Douglas B. Sterrett, of the United States Geological Survey visited the mine in October, 1907, and

has prepared a report on the deposit there which has just been published by the Survey as a part of an advance chapter of Bulletin No. 340, "Contributions to Economic Geology, 1907." The deposit lies in the bottom and walls of the canyon of Bear Creek, occurring in veins, lenses, seams, and balls in limestone in both nodular and massive form. The nodular meerschaum thus far tested contains iron stains and particles of grit and is inferior to the meerschaum of Asia Minor. The more compact, massive material may perhaps be found free from stains and of better quality.

Mr. Sterrett's report sketches briefly the geological relations of the deposits, describes the mode of occurrence of the meerschaum, and presents the results of chemical and physical tests and analyses of the mineral.

The pamphlet containing the report may be had on application to the Director of the Survey, at Washington, D.C.

DESCRIPTION OF THE MONTANA-TONOPAH COMPANY'S MILL.

(Written for THE CANADIAN MINING JOURNAL.)

The ore from the mine is dumped into a steel ore bin at the head of the shaft and is drawn therefrom through an ore bin of the counterbalanced type into a No. 5 Gates styles "K" breaker. This crusher is set to crush all to pass a 2 inch ring. The product is delivered to a No. 5 "B" Gates continuous bucket elevator, which elevates and discharges same into a Gates 40 inch by 12 foot iron frame revolving screen without internal spiders and having 1 inch perforations. The product passing through the holes is delivered directly to the conveyor for transportation to the mill. The oversize which does not pass the hole is delivered by gravity to the two No. 3 style "D" Gates crushers. These crushers are of the special short head type for fine crushing and are set to make a product which will pass a 3-4 inch ring. The product of these crushers is also delivered to the conveyor above mentioned.

The ore now being all reduced to about 3-4 inch size, is conveyed by a travelling belt conveyor having a belt 14 inches wide to the mill building. This conveyor is about 194 feet long and travels up an incline of about 40 feet in this distance. At the entrance to the mill building this conveyor discharges the ore on to another conveyor of the same size and type, but operating in a horizontal plane at an angle of 30 degrees from the line of the other and it is about 91 feet long. This conveyor is provided with an automatic tripper or distributor, which travels along the length of the ore bins in back of the batteries, delivering the ore automatically into the bins the entire length.

At the point where the ore is discharged from the first conveyor on to the second there is installed a Cole automatic sampling device to take a sample of the crushed ore. This is very ingenious and about the best devised sampler that is made for ore discharged from a belt conveyor. Mr. D. Cole, assistant manager of the Cananea Cons. C. Co., made the first design and installation of this sampler at their mills, and it has proved a great success. The arrangement is such that a cutter or sample scoop is made to pass through the ore stream and take a sample across the full width of the belt during its passage. The frequency of the sampler can be arranged for in the driving mechanism.

The crushed ore is drawn from the bins back of the batteries through ore bin gates into the automatic feeders, which are of the suspended or hanging type, which can be moved back from the mortars when necessary thus giving a large working space for making the usual repairs. There are eight bin gates and feeders, one for each battery.

There are forty stamps, weighing about 1,050 pounds each. They are arranged in eight batteries of five stamps each in a mortar and each battery is driven by a belt and tightener from the countershaft. The batteries are made right and left hand, set in three-post frames. The mortars are of the narrow rapid crushing, quick discharge type, and the principal battery parts are steel to insure maximum wearing life. The ore is crushed through 12-mesh screens on the mortars.

The pulp from each five stamp battery is delivered to a 24 inch cone classifier or sizer, which makes two products. The spigot, or coarse product, of each is delivered to a Wilfley concentrating table, of which there are eight in all, and the overflow from each cone is delivered to the two Dorr classifiers. The tailings from the Wilfley tables are also delivered to the Dorr classifiers by belt and bucket elevators, which are made necessary on account of the contour. In the Dorr classifiers a separation of the sand and slimes is made mechanically. It is aimed to crush all the pulp to one hundred mesh and finer in the tube mills, and these classifiers separate that part of the pulp which is already crushed to this size and it is delivered to the thickening cones for concentration on vanners, as later mentioned. The coarse sand product from the Dorr classifiers is delivered into two 5 foot by 22 foot Gates trunnion type wet grinding spur gear driven tube mills. These mills are provided with silex flint brick linings 4 inches thick, and the initial charge of pebbles for each mill is 10 tons. The sands are all ground to 150 mesh or finer in these mills and each mill discharges its product into a classifying cone 4 feet diameter. These cones are for the purpose of separating any sands from the product which might have passed through the mill without being reground fine enough, and the sands are elevated back to the Dorr classifiers to be again fed to the tube mills. The finished product is delivered to spiral sand pumps, by which it is elevated to 2 large settling or pulp thickening cones, where with the excess of water removed it is sent to the cyanide plant. The thickened pulp from the bottom discharge is delivered to 16 standard frue vanning machines or concentrators having endless rubber belts 6 feet wide. These concentrators remove and collect any fine sulphides after regrinding, in addition to that saved by the Wilfley tables. This concentrate pro-

duct is collected and dried, after which it is shipped to the smelters.

The tailings from the vanners and the overflow from the settling cones are delivered to any one of three dewatering tanks in the cyanide plant. These tanks are provided with filters through which the water is drawn off and flows to a final settling box to collect any slimes carried in suspension, after which it is delivered to a water sump tank to be pumped back for re-use in the mill.

The thickened and dewatered pulp from the settling tanks is drawn off from the bottom discharge through a pipe line connected to the suction of a centrifugal pump. This pipe line is arranged so that the contents of any tank can be drawn off and a cyanide solution pipe is connected up with same to introduce solution if desired. The pulp is delivered by the pump into the agitator tanks. There are six agitators of the Hendryx type for treatment of the pulp, this number being required on account of the predominating value being silver and requiring about 24 hours to bring same into solution. After the required period of agitation the pulp is drawn from these tanks by a centrifugal pump and delivered into the pulp storage tank. This tank is provided with a stirring gear which keeps the pulp in gentle agitation to prevent same settling. From this tank the charges are drawn into the filter tanks as required.

The filter system used for removing the solution from the pulp is the Butters Vacuum System, consisting of two filter boxes, each containing 72 filter leaves. A charge of pulp is delivered to the filter box and after removing the solution by a vacuum applied to the filter leaves and following with the necessary washes, the pulp is discharged through the bottom from the filter leaves, and is sluiced out to waste. The solution is collected in a small storage tank and is pumped through a clarifying filter press into anyone of three precipitating tanks.

Precipitation is effected by means of zinc dust introduced in the form of an emulsion and with agitation by compressed air until the cycle is completed. The contents of the precipitating tanks are pumped up to the refining plant and the precipitate is collected by passing the material through filter presses where the precipitate is collected on the filters in cakes and the solution is delivered to the storage tanks for re-standardizing and used again. The cakes collected are dried and shipped to the refineries for reduction to bullion.

The mill is driven throughout by electric motors, and these motors are distributed so as to give unit drives to the various departments. The current used is bought commercially and is 60 cycle, 3 phase, 440 volts, transformed down from 6,600 volts and distributed from the main switchboard to the various motors located at the different points in the separate buildings. The motors are of the Allis-Chalmers standard induction type, and this company furnished all the electric equipment, including transformers, switchboards, etc.

The plant is arranged in separate buildings to conform to the contour of the country and also for protection against fire.

The elevators and pumps for handling slimes, solutions and water are installed in duplicate to insure against stopping of the entire plant when making necessary repairs to these machines.

The capacity of the mill is rated at 200 tons per day, and the crushing plant is capable of handling double this capacity in a single shift if necessary. A remarkable feature of this plant is the short time consumed in building it and placing it in successful operation. As soon as power was available for operating the entire mill after its erection, it was placed in daily operation and handled the rated tonnage practically from the start. The details had been worked out so completely in every point that the entire plant was a success commercially, metallurgically and mechanically from the start.

The plant was designed by the Allis-Chalmers Company under the able direction of Mr. F. L. Bosqui, consulting engineer for the Montana-Tonopah Mining Company, to whom full credit is due for its immediate success.

THE ASSAY OF SILVER ORES.

W. K. McNEILL.*

The writer has been asked to follow up his former article by another dealing with the silver assay in detail.

The pyro-chemical method for silver and gold has been found necessary owing to the fact that the metals are found diseminated through the rock or gangue in such relatively small quantities that the ordinary gravimetric method is out of the question, both on account of the large quantity of ore that would have to be operated on, and because of the time consumed in such an operation.

The processes of the silver assay consist in (a) roasting; (b) crucible fusion and scorification; (c) cupellation.

The first is to remove any sulphides which the ores contain, but it must be remembered that in the ores such as those of Cobalt, if they contain smaltite or niccolite, they cannot be subjected to this process. By a series of careful experiments, it has been found that in the volatilization of the arsenic there is a great silver loss. This process, then, can be entirely omitted in the characteristic Cobalt ores.

Crucible Fusion.—Weight of ore, one-quarter to two or more assay-tons, depending on the supposed richness of the ore.

The ore is previously ground to a very fine powder, and the metallics removed and assayed separately, as they cannot be so mixed with the powder as to make a homogeneous sample. To the weighed portion of ore is now added a charge of standard flux, litharge, silica, assayers prefer to use as a reducing agent sulphide of and some reducing agent, such as argols or charcoal. Many iron, but this does not give as good results as the argols; although, if the ore is pyritic, the amount of reducing agent may be decreased, so as to utilize the pyrite and give the desirable size of lead button (15 to 25 grams).

A great many assayers invariably dispense with roasting, and estimate the reducing power of the ore. They then add enough reducing agent to give the required weight of lead and if the ore is very rich in reducing agents enough nitre is added to neutralize the excess.

---

*Manager Canadian Laboratories, Toronto, Ont.

But generally the assayer depends on his own appraisal of the ore, estimating the general composition and making up a flux that will be fusible at redness to a mobile slag. If the ore is silicous, containing quartz or silicates, then add iron soda carbonate to the standard. If the ore is more basic, then add silica, and if decidedly basic then the charge can be mainly litharge and silica.

A few points are worth noticing here:—

(1) The litharge should be tested for silver.

(2) If the charge "boils," owing to an excess of silicates, it should be put into a very hot muffle at first.

(3) Nails should be added to combine with any refractory pyrite.

(4) The charge should be thoroughly mixed.

Scorification.—In this process, used altogether for cobalt and nickel bearing ores and metallics, the charge of one-tenth assay-ton is mixed with ten to fifteen times its own weight of test lead free from silver, and thoroughly mixed, and a small quantity of borax glass added. If, as stated before, a small film of litharge is placed over the charge in the scorifier, it will improve the operation. The assay should be placed in a hot muffle. The causes of "bumping" have been previously mentioned. If slag becomes too viscid it can be remedied by the addition of some glass slag saved from crucible work.

Cupellation.—This operation depends on the facts that lead is easily oxidized by air, and that the precious metals resist oxidization even at a high temperature, although silver will steadily oxidize in the muffle during cupellation if the temperature becomes too high.

The cupel is made of "bone ash," or "cement." Experiments on these two substances show that bone ash is slightly more rapid than cement, and that it will at ordinary cupelling heat absorb the last traces of lead better. But cement, on the other hand, will absorb as well if, during the last stages, the temperature of the furnace is increased. They also have the advantage of being cheap and durable.

The process for the "scales" or metallics is outlined in all text-books.

In all silver assaying a great many duplicates should be run if any exact results are to be obtained. It is also advisable to correct for volatilization. For exact work, also, the combination of wet and dry methods is perhaps better, the ore being dissolved in the usual way and the silver precipitated as a chloride. The residue from solution is carefully assayed for silver as well as the precipitated silver chloride. This item was omitted by a writer in the *Engineering and Mining Journal,* hence accurate comparisons could not be obtained.

A splendid device for even cupelling in a furnace, when the heat is uneven, is the "cooler," an iron plate which can be held over the cupels and withdrawn when the temperature lowers. By this method all the assays can be "feathered."

SALT RESOURCES OF SUSSEX, NEW BRUNSWICK.

Present indications point to a scientific and systematic development of the salt resources of Sussex, King's County, and the vinicity. From Havelock to Salina, or Salt Springs, the entire series of valleys are abundant in salt springs varying in density of brine. A boring of some seventy feet was made several years ago (no log of boring has been kept), and the brine overflow from this boring tests one hundred per cent. more than the surface brine that had been used for nearly a hundred years, during which salt had been made from these springs, and in some instances the product has been found to be particularly pure, having been used largely for dairy purposes. Up to the present only the most primitive methods have been employed in making salt, the brine having been boiled in the ordinary cast iron pots, thus entailing a very large waste of fuel. The principal operations seem to have been carried on at Plumeseep, on what is known as the old Kendrick property, where, in all, seven springs have been located. Most of these have been tested and show an average strength of twenty per cent. The origin of the springs is a mystery, and with a view to solving it an English concern has been organized with a capital of £50,000, and there is every prospect of heavy development being carried on within the coming year.

Dr. R. W. Ellis, of the Geological Survey, visited the springs last summer, and as a result of an examination was very favorably impressed with their possibilities and recommended that boring be begun to test the origin of the flows. This will be carried out in the near future and it is fully expected that large secondary deposits will be discovered.

It may be of interest to note here that the waters flow close to a fresh water stream, and travellers are frequently surprised on finding it saltier than sea water.

It is the intention of the parent concern, which controls the Kendrick property, to send over one of its directors, who will make a fuller examination of the situation, and, in the event of a favorable report from him, it is probable that next summer a large sum of money will be expended in the vicinity. Other parties are interested in the location of salt deposits, and the right to bore will be acquired. Should a salt bed be located, there is a very strong possibility, it is believed, of building up an industry that will hold an important position in the development of the trade of the province.

The concern organized to carry on the manufacture of salt is known as the New Brunswick Canadian Salt Company, Limited, with its head offices in London. The Canadian solicitor is Walter H. Trueman, of St. John, and Harold D. Buchanan is resident manager.

Considerable has already been accomplished in the establishment of the plant. The installation of two large vats, into which the brine flows to be reduced to a proper saturation, and the placing of the boilers for the reduction of the salt to crystalline form, have been done with a view to the use of every particle of heat. The system, which is a new one, provides for the passage of all flame used under the boilers through tubes extending back under the evaporating vats. Thus the heat produced does double duty, and, to a large extent, solves the problem of cheap fuel, the most important factor in salt manufacturing. The intention is to install

about thirty additional vats and boilers, should the company's experience in its later development work prove satisfactory. This will give a capacity of many barrels daily. Favorable reports have been received, but until the diamond drills are sent below, the real test will not be known.

If salt beds are discovered it will be almost a guarantee of immense areas of salt located in the province.

The large salt beds of Michigan, where most of the salt consumed in the neighboring republic is manufactured, extend for hundreds of miles and are practically inexhaustible. The Canadian beds at Goderich are also of great extent, being controlled largely by the Canadian Pacific Railway. On both sides of the border the same methods are employed to bring the salt to the surface. After the holes are sunk they are piped and then water is forced down and pumped up after it has been properly saturated with brine. These solutions are very dense and produce a painful sensation when brought in contact with the tongue.

Everything of course depends on what is known as the secondary deposit of salt. If the brine comes from the bowels of the earth, it is impossible to reduce it with anything like a proper margin. As the waters of the spring rise, they come into contact with the surface drainage and thus are reduced in saturation and can only be brought back to their original strength by the use of fuel. The condition is equally true of the flows from the initial and secondary deposits, but where the latter are encountered the modern methods of pumping overcome this difficulty and gives a brine with sufficient saturation to enable the operator to place it in the vats at once.

One cannot overestimate the importance of a discovery of secondary salt, with the great Maritime Province markets at hand. Transportation would be reduced to a minimum and the price of fuel very low at the point referred to.

After years of experiment, something is proposed which will either shatter the most sanguine hopes, or gives to Sussex and its vicinity industries that will mean a large annual distribution of money in wages. At present the suggestion of the existence of salt beds is regarded with optimism, and if they do there is big money in store for the fortunate finder.

Should no boring be done (which is very unlikely), a good profit can still be made with the company's new system of evaporation. Compared with the old pot and pan method, at least eight times the quantity of salt could be produced with the same amount of fuel, and it is claimed that the old method was a paying proposition.

WORLD'S GREATEST GOLD PRODUCER.— RECORD WORKING COSTS.

(Special to Canadian Mining Journal.)

The Robinson gold mine of the Rand, which achieved the wonderful record of producing £1,290,461 in gold and distributing £660,000 in dividends during 1907, has further distinguished itself by a reduction of working costs to a level below the most optimistic anticipations of a few years ago. During the recent period of financial distress, when yields and dividends have been steadily rising and the support of European investors as steadily weakening, there has been a call, one may say, a clamor, for cost reduction upon the Rand which has necessitated the sternest reorganization of methods. Wages have been reduced and in every department of work, technical and clerical, a standard of economy instituted before unknown. The demand for higher efficiency has been satisfied by modifications of metallurgical system of an order that is revolutionary for the Rand. By means of tube mills for regrinding the coarse mill products, stamp duties have been raised to 8 and 9 tons per diem and the gold recovery to 96 per cent. These figures are, of course, high above the field's average, but gradually the less efficient mines are being brought into line and the whole aspect of Rand metallurgical performances reflects the great industrial importance of the reform.

The tendencies of underground economy are yet difficult to foretell. Chinese labor is being rapidly repatriated; Kaffirs are now offering themselves for work in unwonted abundance. But the cloud of future uncertainties, owing to the variability of the native supply and the prospects of Government legislation extending to the systems of labor allocation underground, still hangs heavily upon the industrial horizon.

With a monthly total of ore milled of 1,350,000 tons, the Rand cannot speedily reflect changes of a current expenditure. The reduction has been slow. The average for the field has been gradually reduced to under 20 shillings per ton milled, which represents only 85 per cent. of the rock hoisted, owing to "waste" elimination at the head gears. Before the war, an average of 24 shillings per ton was recorded. Many companies, however, are now operating for 17, 16 and 15 shillings per ton, with a fair allowance for development charges.

The record was attained by the Robinson mine in December, 1907, when the total working expenditure touched 14s. 1.18d. per ton milled. I have been favored by Messrs. Eckstein & Company's Central Administration with a detailed analysis of expenditure, which stands as follows:—

(210 stamps ran 28.75 days, crushing 40,000 tons.)

	Cost per ton. s.	d.
Mining—		
General		7.22
Stoping	4	6.95
Timbering		3.81
Shovelling and tramming	1	4.73
Winding		9.39
Pumping		2.61
	7	10.71
Reduction—		
General		0.72
Ore sorting		3.09
Ore crushing		2.56
Ore transport		3.13
Stamp milling	1	3.68
Tube milling		4.31
Cyaniding pulp	1	2.15
Discharging residues		7.22
	4	2.86
General expenses—		
Mine		11.00
Head office		5.17
Development		7.44
Total working expenditure	14	1.18

The rock hoisted and delivered to the sorting station during the month totalled 48,460 tons, of which 8,560 (17.664 per cent.) were sorted out. The number of whites in the employ of the company was 319, and of natives 3,019; there were also 94 Cape boys and Indians.

Although the Robinson heads the list of gold producers, its crushing capacity is far below that of its nearest competitor, the Simmer and Jack. This mine, belonging to a different group, crushed, with its battery of 320 heads, 736,930 tons during 1907 for a yield of £1,187,634.

Small batteries no longer form part of the Rand's industrial designs. The joint Simmer East-Knights Deep mill is of 400 head capacity, that of the Crown Deep-Robinson Central Deep 300, and that of the Robinson Deep also 300 heads; all these with duties of 6, 7 and 8 tons per stamp per day.

A new mill is being erected for the Simmer Deep-Jupiter, of 300 stamps, which will be built mostly of steel and will employ stamps of 1,670 pounds weight, with mortar box allowance for an increase to 1,800 pounds. The sands and slimes vats to serve this plant will be no less than 50 feet and 70 feet respectively in diameter.

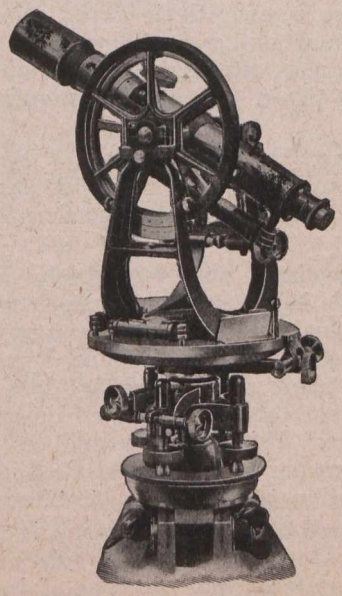
From such figures as the above can be learned the true significance of the Rand's modern policy of "large scale operations."

RALPH STOKES.

Johannesburg, February 20th, 1908.

A NEW THEODOLITE.

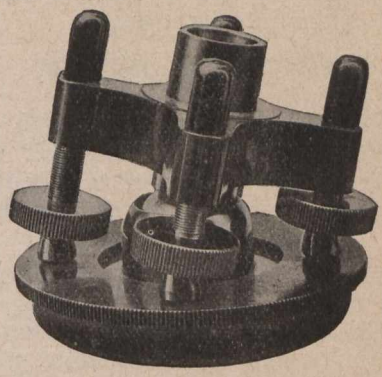
We show below an illustration of an improved theodolite recently placed on the market by Wm. Ainsworth & Sons, the well-known instrument makers, of Denver, Colorado.



The instrument is designated as their Type BU, and has ten inch twenty-five power telescope with one and one-fourth inch objective, five inch full vertical circle, guard and vernier reading to one minute, thirty seconds telescope level, stadial and gradienter five inch limb with verniers reading to one minute at 30 degrees angle with telescope.

The construction of the standard is such that it admits of placing a two and one-half inch compass in the centre, which answers very well for checking courses; most surveys now being made from a meridian established by solar observation; and for rigidity and permanence of alignment the U standard is far in advance of the usual construction.

All clamp and tangents are of the gib type, which when properly constructed are superior to the split clamps formerly used, in that they do not carry the instrument off the line when clamping. The convenience of our limb and lower clamp and tangent screws can be appreciated from the illustration.



The principal parts are made of the hardest bronze alloys to limit gages and interchangeable to the highest degree; the makers guaranteeing that any of the parts excepting the limb, vernier plate and centre can be interchanged with other of their instruments of the same size without throwing the instrument out of collimation to exceed fifteen seconds.

One of the advantages resulting from the use of gages is shown by the leveling head, which cannot be cramped in any position, and whereas usually when leveling up an instrument it is necessary to loosen all four of the screws to prevent cramping, this is not the case where all parts are made accurately to gages and carefully inspected after each operation and before assembling. The cramping of the leveling head increase tenfold the wear on the leveling screws and on lighter construction occasionally cramps the centre, this being the greatest objection to the four screw or American type of leveling head by engineers.

Another of the excellent features of this instrument is the telescope construction, wherein accurate limit gages also play a very important part. The main telescope tube is finished inside and out by lapping, as is also the outside of the draw tube to within .0001 inch of standard dimensions. The inside of the objective head, the outside and inside of the lens cell and the periphery

of the objective are all of uniform diameter, true and accurate to within these limits. The makers guarantee these as well as other parts of the same size instrument to interchange with a resultant error in collimation of not to exceed the above amount.

EXCHANGES.

The Iron and Coal Trades Review, March 6th.—Commenting upon the mineral production of the United Kingdom in 1907, the *Review* has this to say: "During 1906 the upward movement of the market was slow and limited. It is true that in 1907 the continued and extraordinary expansion of trade had its effects upon prices, and coal became much dearer; but it must be remembered that the industries of the country generally had enjoyed a long term of unusual prosperity before the coal trade began to enter into its own."

Bulletin of the Imperial Institute, Vol. V., No. 4.—A highly instructive summary of the occurrences and uses of tantalum appears in this number of the *Bulletin.*

Metallic tantalum has come into prominence through the discovery of its suitability for the preparation of filaments for incandescent lamps. The commonest ores of tantalum are tantalite and columbite, which consist of tantalates and niobates of iron and managenes in varying proportions. Tantalite contains 84 per cent. of tantalum pentoxide, whilst columbite contains but little tantalum and is mainly composed of niobic pentoxide, a practically worthless and often detrimental constituent.

Tantalite is black in color, has a composition formulated thus (Fe, Mn) Ta_2O_6, in which manganese frequently replaces the iron, and tin, zirconium or niobic oxide takes the place of the tantalum. Streak is black, hardness 5 to 6.5, and specific gravity 6.5 to 7.3. It crystallizes in the orthohombic system.

There are many other tantalum-bearing minerals; but they are not of commercial importance.

Tantalum minerals are found principally in the eastern part of the United States; in the tin-bearing districts of the Northern Territory of South Australia; and in West Australia. The American minerals range from 18.20 per cent. to 78.20 per cent. tantalic pentoxide. South Australian samples show 41.70 per cent. and 55.52 per cent.; West Australian, 50.57 per cent. to 80.61 per cent.

The ores are bought on a basis of at least 60 per cent. of tantalic pentoxide. Niobium oxide should not exceed 3 per cent. Chromium should be entirely absent. The price is stated to be about 4s. 6d. per kilogram of ore.

Tantalum is extracted from its ores by means of conversion into the alkali fluoride, which is then acted upon by metallic sodium.

The pure metal melts at 2200 degrees C. Its hardness is 10 and its specific gravity 16.5 to 16.6. Although ordinarily ductile, under hammering it becomes extremely hard.

Its principal uses are its application as an incandescent filament and as an alloy. It has been proposed to use it in place of platinum for laboratory purposes. Since it is attacked by hydrofluoric acid and by fused alkali and since it oxidizes when heated in air its usefulness would be limited. However, it has the advantage of being unattacked by aqua regia.

The Journal of the Chemical, Metallurgical and Mining Society of South Africa, January, 1908.—Mr. W. A. Caldecott, B.A. F.C.S., has an article on Mexican silver ore treatment in this number of our South African contemporary. "Some Features of Silver Ore Treatment in Mexico" is the title of the paper. Part I., which appears in this issue, takes up "Works Practice."

Cheap power and the replacement of the old patio process by cyanide treatment have made the remarkable advance in Mexican silver ore treatment methods possible. Power is being transmitted as far as 170 miles and supplied at a cost of 30s. per horse-power per month, considerably less, the author notes, than the average cost of electric power on the Rand.

The patio process, invented at Pachuca by Bartolome de Medina in 1557, although still in operation, is mainly of historic interest. Cyanide leaching preceded by a chloridizing roast is also a thing of the past, as also is hyposulphite lixiviation.

Mexican unskilled labor is cheap, costing about 1s. 6d. per day; but its cheapness is offset by its irregularity. In the city of Mexico there is an electrolytic refinery for gold and silver bullion. The metric system is generally used in dealing with Mexican silver ores. Cyanide consumption is expressed in kilograms per metric ton of 1,000 kgm., or 2,204 lbs.; and silver or gold is reported in grams per metric ton.

Mexican silver ore is usualy a hard, flinty, quartz containing little extraneous base metal mineral. Silver occurs mostly as silver sulphide, associated at times with a little arsenic or antimony. Silver chloride and native silver are comparatively rare. A small but important amount of gold is found with the silver. As a rule the gold is more readily extracted by cyanide treatment than the silver, and thus it requires no special attention.

Fine grinding, cyanide treatment, decantation followed by mechanical filtering and zinc shaving precipitation are the essential features of modern Mexican practice.

The uniform dissemination of finely divided silver-bearing minerals in the ore render finer crushing necessary than is usual on the Rand. Stamps followed by tube mills represent the most advanced practice; but at a Guanajuato plant stamp milling alone with slotted screens equivalent to 45 meshes per linear inch, serves to slime the ore. This, however, reduces the duty per stamp to 2.7 tons per 24 hours. At Pachuca, stamps are followed by chilian mills crushing to 80 mesh.

The Mexico mill of El Oro Company is equipped with forty stamps and six 4 ft. x 20 ft. tube mills. The 16-mesh battery product from 200 tons of hard, flinty ore per day is reduced to a product, 90 per cent. of which passes a 200-mesh screen. Developments at this plant will go far towards determining whether making 50 per cent. to 75 per cent. slimes and corresponding quantities of hard and tough fine sands, or sliming all the ore is the most economical method. This hinges on the actual cost of all-sliming.

Trials are now proceeding in stamp milling without battery screening but with a high slot discharge on the lines of the old German schubersatz.

Amalgamated copper plates are not generally used in Mexican plants, but following the stamps and sometimes the regrinding appliances as well, Wilfley or other concentrators are employed. The concentrates are usually shipped to a smelter, together with a certain amount of hand-picked ore.

Sand is commonly separated in vats from the pulp, leaving the battery by Butters distributors, and long sand treatment is usual. The slow rate of solution of the cyanide renders lengthy agitation and aeration necessary in slime treatment.

In addition to the use of strong solution in slime treatment a good deal of lead acetate is added, varying from 4 ounces to 12 ounces per ton of dry slimes. The strong solutions used and the considerable weight of silver to be precipitated cause the employment of coarse zinc shavings, for which lead-coating is not needed, as the zinc-silver couple soon formed yields a high precipitating efficiency. For smelting the silver, often amounting to one ton per month at individual plants, crude oil furnaces are employed.

The cyanide consumption ranges from two to four pounds per ton of ore and the percentage recovery of silver from 70 to 90 per cent. A higher recovery of gold is made.

Ore treatment charges run from $1.95 to $3.00 per ton of ore.

PERSONAL AND GENERAL.

Mr. James Ross, president of the Dominion Coal Company, is at Atlantic City.

Mr. E. P. Earle, president of the Nipissing Mines Company, was in Ottawa recently.

Mr. W. A. Carlyle has completed his examination of Le Roi mine and is now returning to London, England, to report to the directors of the company.

Sir William Armstrong has been investigating the Sudbury nickel deposits to ascertain their value as a source of supply for the armor of war vessels.

Mr. E. C. Wood, of Spokane, is in Kamloops. Mr. Wood will resume his practice as a mining and civil engineer. He was formerly a resident of this city.

Mr. John Hayes Hammond, the noted mining engineer, who has been ill in San Francisco for some months, has now fully regained his health and will shortly return to the East.

Lieutenant-Governor Dunsmuir of British Columbia is negotiating with British capitalists for the sale of his Vancouver Island coal mines and other business interests, with a view of residing in England.

Boston capitalists have acquired from Mr. James Amess, of Vancouver, a dredging concession in the Fraser river near Lillooet and organized a close corporation to operate it under the title of the Boston Gold Mining Company.

Dr. Victor S. Clark, who has been traveling through Canada making a special investigation for the Washington Department of Commerce and Labor as to the workings of the Lemieux Industrial Disputes Act, was in Cobalt about the middle of last month.

Mr. B. A. C. Craig left Toronto on the 23rd March for Saskatchewan. He will be absent for some weeks. Mr. A. Crawford Craig is in Saskatchewan now. His brother will join him there. The two Messrs. Craigs are interested in the mineral deposits of the new province.

Prof. J. J. Thomson, of Cambridge, Eng., has been nominated by the Council of the British Asociation for the Advancement of Science as president of the meeting to be held at Winnipeg next year. He took his degree of D.Sc. from Dublin, Victoria and Columbia Universities and is a Ph.D. of Cracow. He became an F.R.S. in 1884 and is known as the author of several standard scientific works.

WATER IN GRANITE.

The very general belief that wells sunk in granite will get no water appears not unreasonable when we consider that granite is the hardest of rocks and that its surface outcrops are as a rule so free from pores or crevices through which water might circulate that the expectation of finding water by drilling would seem absurd. Within the last few years, however, the many succesful wells drilled in crystalline rocks have effectively proved the erroneous character of the old opinion.

The crystalline rocks, such as granites, gneisses, schists etc., like the sedimentary shales, limestones, and sandstones, carry water in their pores—the microscopic spaces between the grains of solid mineral matter; but while the sedimentary rocks may absorb several per cent of their volume in water—sandstones about 15 per cent, limestones 5 per cent, and shales 4 per cent—granites and other crystalline rocks rarely absorb water to more than one-half of 1 per cent of their volume, and the water in such rocks moves through the pores so slowly that it can never escape fast enough to be of value in wells. Fortunately, however, the crystalline rocks are traversed in various directions by many joints and crevices. An investigation of these joints shows two principal systems, one of which is nearly vertical and the other horizontal. The vertical joints, which may be hundreds of feet in length, while not at all regularly spaced, are usually 10 to 20 feet apart, trend in all directions, and may be inclined to the vertical at any angle up to 30 degrees. The distance between the horizontal or sheet joints, which approximately parallel the surface, varies from a few inches near the surface to many feet at a depth of several hundred feet below.

The nearly vertical joints serve as channels for the admission of water from the surface, while the sheet joints form reservoirs for its storage. As most of the joints are rather narrow, the amount of contained water is likely to be moderate, and the yield of wells in granite is seldom more than 10 gallons a minute, though some exceptional wells, pumped by steam, have yielded as much as 30 gallons a minute. Out of 72 successful wells in southern Maine only 2 yielded more than 50 gallons a minute.

The extreme irregularity of the joint systems makes the success of any well in granite a matter of chance. Of two wells drilled within 50 feet of each other, one may be a failure, the other a marked success. Records collected in southern Maine indicate that about 87 per cent of the wells drilled in granite supply water enough for ordinary domestic uses.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Glace Bay, 18th March, 1908.

Glace Bay is happy. Votes of thanks and congratulatory addresses have fallen around like "leaves on Vallambroso," and even on Friday, the thirteenth, the citizens of our smoky towns managed to smile. The Board of Conciliation made their award on the 12th of March, and it was accepted and signed by the representatives of the men and the general manager of the Coal Company on the following day. Although at no time during the negotiations between the Coal Company and their men was there any real fear of a strike, yet everybody is relieved at the removal of the incubus of uncertainty that has been with us since the end of November last. As stated in previous correspondence, the members of the Board were Prof. Adam Shortt, of Kingston University, Ontario, chairman; Dr. A. S. Kendall, M.P.P., men's representative, and J. Dix Fraser, of New Glasgow, the company's representative. The work of the Board commenced on Monday the 2nd, and it sat every day without intermission from 10 to 5 until the 10th. Professor Shortt proved an ideal chairman. The way in which he went to the heart of things evoked the admiration of all who were present at the sittings of the Board. His quick appreciation of fine technical points was remarkable. He quickly divested any disputed point of its haziness and laid the issue fair and square before the witnesses. Very evidently the professor has had considerable experience in work of this kind. Every little while he would treat the audience in the Council Chamber to a little dissertation on general principles, which he would proceed forthwith to apply with unerring directness to the particular point that then happened to be under consideration. It was soon seen that he could not be trifled with, and that it was impossible to lead him astray very far. Prof. Shortt carefully avoided any personal issue, and once or twice when signs of a little friction manifested themselves he made it very plain that such questions were entirely out of his province, and that all he was there for was to make as fair a settlement of wages as could be archieved. He was consistently courteous and impartially tactful, and possesses the happy knack of appearing to be deeply interested in every bit of evidence given.

The men presented their evidence in a very capable manner and in an eminently fair manner also. Their case was conducted by the Grand Secretary, John Moffatt; the Grand Master, Stephen B. MacNeil, and the Grand Outside Watch of the P. W. A., Sylvanus Nicholson, and these gentlemen proved themselves entirely worthy of the confidence reposed in them by the members of the P. W. A. Mr. Nicholson in particular proved himself to have quite extraordinary staying powers as a cross-examiner, and altogether the case of the men was presented with great ability.

The award of the Board confirmed the main features of Schedule No. 1 put into effect by the company on the 6th of January, with certain concessions to the men that mean an aggregate increase of about $70,000 per annum over the wages paid under the three years' contract. These increases are as follows: An increase to men in machine narrow work, to cover the increase to loaders and the increase in the price of powder. A scale of rates for mining coal in pillars graded according to the weight of the cover, which are an increase over the pillar rates under Schedule No. 1. The laboring rate remains at $1.52 according to Schedule 1, but an increase of two per cent. is given over Schedule 1 rates to boys, drivers and landing tenders, and to mine mechanics and shiftmen getting over $1.70 per day, bringing up the rate of skilled shift labor to $1.75 per day. The clauses relating to cross-cuts in pillars, and to wedging coal in pillars where the presence of gas rendered it unsafe to use powder which appeared in Schedule 1 were modified and simplified, as their former reading was a little ambiguous. The price of powder and house coal remains as under Schedule 1.

All agree that the award of the Board was a very fair one, and it will be seen that the differences between the men and the company were very small after all. The graded rates for pillar getting, while distinctly more favorable to the men, yet bear out the company's former contention as to the greater ease of mining pillars under deep cover compared with mining pillars under light cover. The settlement of the pillar cross cut question removes a constant source of friction and the uniform price for powder puts the sale of explosives on a more business-like footing than before.

The men and the company have agreed to the continuance of the rates of the award until 31st December, 1909, and we are therefore assured of at least two years of industrial quiet, which cannot but be of great benefit to every one concerned.

We think the P. W. A. are to be congratulated on their getting, and the Coal Company, on their ability to give, an increase of wages at the present time, when retrenchment and financial failure are of daily occurrence. We venture to think the miners of Glace Bay are about the only people on this continent who will get an increase of wages this year, unless all financial signs fail. We have no doubt, however, that the Coal Company will feel that freedom from labor troubles and the prospect of an uninterrupted two years of steady development are well purchased at the cost of the extra wages they are going to pay.

The Lemieux Act has certainly proved its worth as a means to conciliation, and once again we see that in many cases the differences between employer and employee are but slight, and more or less easily adjusted if an impartial tribunal, or rather a peacemaker, is available to bring them together. Men and masters are naturally more or less suspicious of each other and always seem to find it difficult to treat absolutely openly with each other. Whether we say the Lexieux Act is to be thanked or whether it is Professor Shortt that we owe our thanks to, we also think the easy settlement was largely due to the fact that there really was not much to fight in the Coal Company's Schedule 1, that it was very fair and very just.

An interesting visitor to the meetings was Dr. Clarke, a representative from President Roosevelt, who is interested in legislation for the States of a similar character to our Canadian Act. We think they need it.

We see that the Springhill lodges of the P. W. A. and one of the Cape Breton Lodges, namely, Olive Lodge of No. 3 Colliery of the Dominion Coal Company, have announced their intention to secede from the P. W. A. and join themselves to the United Mine Workers of America. "Whom the gods destroy, they first make made." Why should a Canadian labor organization wish to join hands with the union of men who belong to another nation, who live under laws other than their own. We think the condition of miners in Canada is quite as happy as that of the miners in the States. We wonder whether the men of Springhill ever have tried to realize what the Canadian nation is going to be some day? The miners of the States have evidently realized that, or why should they send their emissaries here to enlist Canadian in their forces? The ambassadors of John Mitchell are not consumed with anxiety for the welfare of Cape Breton or Nova Scotia. What they wish to do is to have a hold on the chief Canadian coal field, so that whenever they wish to force the hands of the coal operators in the States, they will be safe from Cape Breton coal imports to relieve the situation in their disfavor. The relations between the P. W. A. and the coal operators of Cape Breton have been almost patriarchal in their mildness. What other labor union in the world has its dues stopped thorugh the colliery office? Some men are of the opinion that friendliness cannot exist between an organization of men and their employers,

and that capital and labor are necessarily and always antagonistic. They have a suspicion that mild relations mean weakness on their part, and that nothing is ever obtained without a show of hostility and a fight now and then. We venture to assert that they are woefully mistaken. Organization is as necessary to labor as it is to capital. If labor does not organize, it will suffer, and so will capital. But these organizations are not of necessity antagonistic, as a matter of fact it is trite to say that their interests are one and the same. Quite what benefit would ensue to the miners of Cape Breton if they threw over the P. W. A. and joined the U. M. W. A. we find it difficult to see. They might certainly pull somebody else's chestnuts out of the firt, but whose fingers would be burnt? We rather think the vote passed at Olive Lodge was a snap vote and did not represent the true feeling of the men there or anywhere else in Cape Breton. After the splendid fight put up by the Grand Officers of the P. W. A. before the Concilation Board we should think the men at Olive who listened to the smooth tongued orator from the States will feel rather ashamed of themselves. From what we have seen of the men of Cape Breton they do not need to go to the States for leaders, for they are quite capable of leading themselves. As a race the native miners of this Island are the equal of any miners anywhere. Their physique and their intelligence is above the ordinary, and their pawkiness and wise caution do not belie their Scots ancestry. We speak advisedly when we say that coal mining in Cape Breton is even *yet* only in its initial stages, and we think the Island can produce men with brawn enough to win the coal, and brains enough to see that they get paid for it.

The coal washery of the Dominion Coal Company, situated on the Sydney & Louisburg Railway near Port Morien, was completely destroyed by fire on the night of Sunday the 8th of March. The fire when first noticed by the watchman was only small, but owing to the dry and dusty nature of the surroundings it spread with great rapidity. The boiler house was speedily involved and the fires were drawn. This rendered the fire pump useless, and the firemen, who had speedily responded from Glace Bay, could not do much to check the flames. The loss is between $70,000 and $80,000, and is fully covered by insurance. The washer was an old one, of the Robinson-Ramsey type, and was used entierly for washing slack to supply the New England Gas & Coke Company, at Everett, Mass. The Gas Company will probably arrange to take dry coal unwashed for the present at any rate. The Coal Company will probably replace the Washery with a more modern plant, but the location is still undecided.

DOMINION COAL OUTPUTS FROM MARCH 1st to 14th, 1908.

No. 1	22,276
No. 2	32,317
No. 3	14,440
No. 4	20,303
No. 5	23,962
No. 6	10,375
No. 7	3,515
No. 8	7,333
No. 9	15,402
No. 10	6,057
	155,980

ONTARIO.

COBALT:—

Queen Alexandra.—This property, which is situated on the east shore of Cross Lake, has been sold to some Toledo, Ohio, people, represented by Mr. Mowery.

Silver Leaf.—The shaft is down 100 feet. The vein is from 6 to 13 inches in width in the bottom. It is very high grade ore. About 16 sacks of ore are filled daily.

Kerr Lake Crown Reserve.—The showing here cintinues as rich as ever. It is the intention of the management to contiue the cut until two carloads of ore are ready for shipment, and then start sinking a shaft. Their No. 1 ore will run over ten thousand ounces to the ton.

North Cobalt Mine.—Work has been discontinued here for the present.

Silver Queen.—The annual meeting of the shareholders will be held on May 1st. It is likely that a payment of annual dividend will be announced.

McKinley-Darragh.—Three cars of low grade ore have been shippeds so far, this month. This ore, which will run about 200 ounces, goes to the Pennsylvania Smelting Company.

O'Brien Mine.—There are 120 men at work here. No. 1 shaft is down 325 feet; No. 2, 90 feet and No. 6, 150 feet.

Provincial.—This mine has joined the list of shippers and sent out fifty thousand pounds of ore t oDeloro, last week.

LORRAINE TOWNSHIP:—

Silver King Mine.—The annual meeting of the Silver King Mining Company was held in Haileybury on the 17th inst. Twelve men are at work on the property owned by this company.

The Haileybury Silver Mining Company.—The shaft on the property owned by this company is down 40 feet. A boiler, hoist and pump are being installed. 15 tons of ore have been sacked.

Mr. Pete Farrar, of New Liskeard, has bought two diamond drill outfits an dis sending one in to the Larder Lake district and one to Abitibi.

Hydraulic Compressed Air Company.—25 men are at work here. Two shafts are being sunk, one 11 feet in diameter and one 21 feet in diameter. The former is now down 60 feet and the latter 20 feet. They are to be sunk 430 and 340 feet, respectively. A 13-drill Sullivan air compressor, driven by water power, supplies air for the machine drills.

Montreal River.—Mr. Chas. Gifford has purchased a steam plant, consisting of boiler, hoist and pump and has sent them up to his property on the Montreal River. His property is looking very well. This is the first steam plant to go into this district.

The shipments from Cobalt, for the week ending March 14th, were the heaviest in the camp's history, amounting to 870,720 pounds.

The following were the shippers:—

	Pounds.
O'Brien, to Deloro	125,280
La Rose, to Denver, Col.	197,400
Mckinley-Darragh, to Carnegia, Pa.	189,660
Cobalt Central, to Copper Cliff	49,700
Nipissing, to Copper Cliff	63,000
Watts, to New York	52,730
Buffalo, to Denver, Col.	42,740
Right of Way, to Deloro	60,210
Provincial, to Deloro	50,000
J. Rowland, to Toronto (experimental)	40,000

A Cobalt correspondent has very kindly sent us the following account of a drill trial in that camp. It is worth careful persual.

"I yesterday witnessed an interesting test of a new Sullivan Air Hammer Drill, of which I though you would like a note:—

Drilling Test at Right of Way Mine, Cobalt, Ont.

17th of March.

"Drill used, Sullivan D.21, Air Hammer type.

"The hole was a dry back hole, in a drift, at a slope of about 75, and wes in hard conglomerate rock all the way. Drill was set up on a tie in the track.

"Time taken to set up after connections were made, was 20 seconds. The time consumed from the starting of drilling till the test was completed, was 18 minutes.

"The length of hole drilled, was 5 feet 4 1-2 inches.

"Five pieces of dril lsteel were used and the time for each was as follows:—

	Minutes.	Minutes.
1st drill	0—4	4
2nd drill	4—7	3
3rd drill	7—11	4
4th drill	11—15	4
5th drill	15—18	3
		18

"Time consumed in changing drills is included in above and was from 15—20 seconds for each change.

"The cuttings feel from the hole in a steady stream and the air in the vicinity of the drill was not nearly so dusty as would have been the case with an ordinary percussion drill."

GENERAL MINING NEWS

NOVA SCOTIA.

Sydney Mines.—The Nova Scotia Steel & Coal Company has notified its employees that, unless the steel market improves, a reduction of 10 per cent. in the wages of all employees receiving more than $1.50 per day will go into effect on May 1st.

Port Hood.—That the Port Hood explosion was due to gross neglect on the part of persons unspecified is the finding of the committee, Messrs. Moffatt, Moss and Scully, appointed by the Local Government to investigate into the disaster. The committee's report reads as follows:—

Hon. Christopher Chisholm,

Commissioner of Public Works and Mines,

Halifax, N.S.

Dear Sir,—

Having received authority through Attorney-General W. T. Pipes, we went to Port Hood on Monday, February 10th, or three days after the explosion. In company with Deputy Inspector Nicholson and Manager McLennan, we entered the mine on the following morning, going down the main slope to No. 3 landing. After travelling to No. 3 level north to the face, we returned and went into No. 4 slant, passing No. 3 balance on No. 3 level south. The mine is well aired and well timbered, the levels being clean and in good condition.

On our way into No. 3 level, we noticed a thin skin of ice at the landing where the ventilation was in full play. The face of No. 3 elvel is said to be 1,800 feet from the main slope. On passing through the level door we were met by unmistakable evidence of a gas or coal dust explosion. A heavy smell filled the level from the door to the face, and for those of us who has experience in mine explosions there was no doubt as to what had taken place, although there was nothing in the appearance of that part of the level to indicate an explosion.

Nearing No. 3 slant, however, we noticed debris scattered over the roadway, and were informed by the manager that for some distance outside of No. 3 slant the road had been cleaned up to permit of the easy running of a tram, which conveyed the dead bodies to the bottom, and to take back material to restore the ventilation. Between No. 3 slant and No. 3 balance we passed over two small falls of roof rock, and noted that nearly all the timber and material which had been lying alongside the level had been moved out of position and tossed about in all shapes, most of it close to the low side of the rib.

All the stopings but one between No. 4 slant and No. 3 slant had been blown out downwards, but were replaced by brattice. On reaching No. 3 balance we went up to the face a distance of 150 feet and made a close examination of everything there. At the foot of the back balance numbers of hand picks were strewn around, and farther up parts of stemming gear were seen lying in the middle of the place. Passing through the upper crosscut, we went down it. There were no signs of disturbances in these places, except on the bottom at the level; even the sight strings were not burnt. Going in towards No. 4 slant, we passed the place where the five men on the high level were found dead.

The position of the bodies as they were found was explained to us by the manager. Inside of No. 3 balance stood an empty box on the track, while tools, timber and other material were strewn promescuously around. No. 4 slant is 28 feet from the face of the upper and 46 feet from the face of the lower level. The bottom of the slant was filled up within three feet of the roof with coal and other materials, tools, such as shovels and picks, being partly buried. Some of the picks were fastened by the rope with which the miner generally carries his piece and powder cans, showing that these men were only going in to work, and were just on the way there when the explosion occurred, as five of the bodies were picked up at this spot. Inside of the slant towards the face of the level two booms were down, having been blown down by the force of the explosion. The bottom of the lower level at the foot of the slant was considerably torn and disturbed. Leaving the south side, we again entered No. 3 north level, and travelled the inside balance, making an examination of the bords. These were found in very good condition, the roof well timbered, free ventilation, and no gas.

Not being satisfied with the thoroughness of the investigation of the first day, we requested the manager to go into the mine with us on the following morning, which he did. We went into No. 3 balance, south carefully noting things as we proceeded. Nearing the back head, boots were found which had been blown out towards the slope a distance of forty feet. A full can of powder was found on the high side, the can seeming to be in fair condition, and but little injured by the explosion. A miner's jumper and a vest with a watch in the pocket was also picked up. The watch had stopped at 8.45. To ascertain whether it had been stopped by the sudden concussion of the explosion, we wound it up, giving twenty half turns of the stem. From this we gathered but little information as to the exact time the explosion had occurred, for it was evident the watch had run down. It was undamaged, as it started to go as soon as wound up. We again examined No. 3 back head and balance, went into the faces of the

upper and lower level, turned and travelled out the lower level to No. 3 slant. This level was in much better condition than the upper level, being free from falls of rock, although debris was scattered along it out to the slant. So far as we could gather from the condition of the mine, the explosion was not a violent one.

The nature of the explosion is undoubtedly one of gas. It occurred in the back head and balance, from which it scattered in all directions, the most of its force having been exerted along the upper level for a distance of 400 feet, and in No. 4 slant extending out the lower level a distance of 400 feet. The reasons for our conclusions are:—

1st.—That the heavy smell in that section of the mine is that usually caused by an explosion of gas or gas and coal dust combined.

2nd.—That the dust of the mine is too heavy to be suspended in the air (and if there were sufficient quantity of it as there is not) by the concussion of a blown out or a heavy shock. Evidence is wanting that a shot was fired at all.

3rd.—That no coking substance was found on the props or roadways as is usually found after coal dust explosions.

4th.—That there was no other element present to cause such an explosion as occurred there.

5th.—There is evidence showing that gas in quantity had been found in the balance.

That it occurred in the back head and balance seems more plausible and reasonable than to say it occurred in the lower level, because if any door was left open by which the air could take a short circuit it was No. 3 slant door. If this door had been left open naturally the air was cut off from the levels. There was gas in the balance and in the back head. If all four places, the upper and lower levels, the balance and back head, were full of gas set off in the lower levels it would certainly have reached the other three places, causing a tremendous explosion.

But as the effect of the explosion does not point to great violence, this theory must be discarded. It is more reasonable, however, to suppose that gas could have gathered in the balance and back head, owing to the knocking down of the brattice on the level between these places, and that this gas was the cause of explosion, the quantity being much less than from the four places combined, and there is evidence to show that the brattice between the balance and back balance was down.

As to how the explosion occurred, whether set off by a naked light, fired by powder from a can or shot, no one will ever be able to tell, as all in that section of the mine were killed.

In presenting this report we thank the Department for extending the authority which enabled us to fully investigate the cause of the explosion, and obtain information which may lead to prevention of similar disasters in the future.

JOHN MOFFATT,
JOS. MOSS,
THOS. SCULLY.

ANNAPOLIS.—Messrs. J. J. Drummond, Selkirk, and Strong visited Annapolis recently for the purpose of selecting a site for an ore shipping pier for handling the Nictaux and Torbrook iron ore.

NEW BRUNSWICK.

If present indications are correct, the Northwest Miramichi will be the scene of an iron mining industry giving employment to a large number of men.

Messrs. James Robinson, Millerton; John Ferguson and W. E. Fish, Newcastle, and F. M. Tweedie and R. A. Lawlor, Chatham, are seeking incorporation as the New Brunswick Iron Mines Company, Limited, with a capital of $49,500. The chief place of business will be at Newcastle, but the company are seeking power to engage in mining, etc., in all parts of the province. It is generally understood, however, that the company has been organized with a view to the development of the rich iron ore deposits on the Northwest Miramichi, which are said to be equally as valuable as the Gloucester mine now being developed.

Mr. Ferguson, of Newcastle, has for several years been trying to bring the valuable property to the attention of capitalists, and the opening of the Gloucester mine, which adjoins the property held by the new company, has at length directed the attention of interested parties to the north shore.

It is stated also that the development of the property referred to will be carried forward on a large scale.

T. M. Burns, ex-M.P.P. of Bathurst, who was in St. John recently, stated that the work of the Gloucester iron deposits was still in progress. A surveying party of the Londonderry Iron Company were on the ground making surveys, he added, and the Intercolonial engineers who had been looking over the ground preparatory to building spur lines from the main line to tap the iron fields have completed their work. It is the intention of the promotors to begin mining as soon as possible in the spring, and there is no indication that they will change their intention.

There has been a good demand for the stock of the St. John Iron Company since the Dominion Iron & Steel Company entered upon the development of the Lepreaux iron deposits, but those who can afford to hold on to their stock refuse to sell.

The operations at present are limited to borings with the object of making a thorough testing of the deposit. It is hoped that by the early part of June that there will be about a hundred men at work. The Dominion Iron & Steel Company are confident as to the value of the property and will, it is expected, expend a great deal of money on its development during the approaching summer.

The plaster quarries of the Albert Manufacturing Company of Hillsboro' have closed down for a couple of months, owing to the dullness of the American markets, incident to election year. About 300 men will be temporarily out of employment. The management hope to resume operations in May.

ALBERTA.

LETHBRIDGE.

It has been rumored for some time past that F. H. Sherman, president of District 18 U. M. W. of A., will run for the Provincial Parliament in the Pincher Creek district at the next election.

The report has, however, been officially denied by Mr. Sherman in the Fernie *District Ledger*.

The *Ledger* states there is no Labor party in Alberta, as the labor unions have declared for Socialism, and that at present active measures are being taken to organize the Socialistic party in many of the industrial centres.

FRANK.

The following resolution was passed by the Frank local union No. 1263 of the United Mine Workers of America:—

"That, whereas three hundred miners and mine laborers have been idle since December 31, 1907, owing to the closing down of the Canadian American Coal & Coke Company's mines at Frank, Alta., thus cutting off the only means of support for ourselves, our wives and families, and whereas we have utterly failed to

obtain employment and are in consequence forced to depend on charity, owing to our wages being insufficient for us to save money to keep our families in times of depression;

"Therefore be it resolved that we make an appeal to the Provincial Government of the province to open up some public work for the purpose of providing us with an opportunity of earning an honest living for ourselves and families, and be it further resolved that copies of this resolution be sent to the Prime Minister of the province, to Mr. J. Marcellus, our local member, and to the press.

"(Signed) Geo. Nichol, Secretary."

BLAIRMORE.

The third meeting of the joint committee of the Western Coal Operators' Association was held at Blairmore on March 10 and 11. The following gentlemen represented the Western Coal Operators: Mr. Hurd, general manager of the Crow's Nest Pass Coal Company; Mr. Stockett, general manager of Bankhead Mines, Limited; Mr. H. W. McNeil superintendent McNeill Company, Canmore. Representing District 18, U. M. W. of A.: A. J. MacDonald, Blairmore, Alta; W. Graham, Coleman, Alta.; W. Davis, Michel, B.C.

The following decisions were arrived at: In the matter of the claim that the lampmen at Michel be paid $2.62½ per day, and in the matter of the lampmen at Coal Creek.

The joint committee of the Western Coal Operators' Association and District 18 of the United Mine Workers of America have decided that Michel lampmen be paid $2.62½ per day, and the Coal Creek lampmen be left to the management of the company to deal with.

Lewis Stockett, President.

A. J. McDonald, Secretary.

In the matter of the International Coal & Coke Company, in respect to proposed new work at the Coleman mine, the joint committee of the Western Coal Operators' Association and District 18 of the United Mine Workers of America is of the opinion that the agreement under which we are working specifically provides that new work must be in actual operation before any contract price is established for the same and until such price is established all men shall be paid the day wage scale, and that therefore the International Coal & Coke Company be advised to estalish the new work before bringing the question of new prices for the same before this committee.

Lewis Stockett, President.

J. A. McDonald, Secretary.

STRATHCONA.

Although work has been going on smoothly in the Strathcona mine since a dispute was settled some time ago under the Lemieux Act, friction has again arisen.

Owing to the low price of coal the company met the men and asked for a reduction in the mining price. The men would not grant this reduction, so the Strathcona Coal Company shut the mine down, paid off the men and did not open again till they got a small force of non-union men to start work on the reduced rate. The miners claim the Company has broken the agreement entered into some time ago, and have been distributing hand bills setting out their grievances. The bills circulated by the miners read as follows:—

NOTICE TO MINERS, MINE LABORERS AND OTHERS.

We request you to keep away from the Strathcona mine for the following reasons:—

In December last the United Mine Workers of America signed an agreement with the Strathcona Coal Company before the investigation board appointed by the Dominion Government, which agreement went into force on the 23rd December, 1907.

The company now refuses to abide by its contract and insists upon a reduction in wages from 33 1-2 cents to 28 cents, and threatens further to reduce wages to 25 cents per car for mining coal.

Furthermore, they refuse to pay the District scale for any work whatsoever and have failed to pay us our wages at all for near two months.

We now refuse to work until the company keeps its agreement with us. Kindly keep away from the Strathcona Coal Company's mine pending the settlement of this dispute.

By order of District 18 United Mine Workers of America.

EDMONTON.

Several important amendments were made to the coal mines regulations during the recent session of the Provincial Parliament.

One of these amendments was to the effect that no boy under 16 years of age shall be employed in any mine underground, but making exception for boys already employed underground although not 16 years of age. No boy under 12 years of age shall be employed at any mine above ground, and boys under 16 years who are employed above ground must be able to read and write and have a knowledge of elementary arithmetic.

The section of the Act relating to the distance between shafts or outlets has been amended so that such shafts or outlets must not at any point be nearer to each other than 100 feet. This amendment is in accordance with the recommendation of the recent Royal Commission on the coal mining industry in the province.

The section relating to the qualifications required for mine managers has been amended so that a candidate for a mine manager's certificate must have at least five years' practical experience in a mine and be at least twenty-three years of age. Candidates possessing a degree or diploma in scientific or mining training only requires three years' practical experience, however. Candidates for pit boss and fire boss certificates must have three years' practical experience in a mine and be twenty-three years of age.

The section relating to the appointment of check-weighers is amended by making it compulsory for the owners of the mine to withhold from the wages of the miners employing this check-weigher a pro rata amount sufficient to meet the wages due the check-weigher.

Owners of coal mines are required to make certain returns to the Minister of Public Works before the 21st day of January in each year. Such returns are required to show the amount of coal mined during the previous year and the number of men employed at the mines.

The Act is amended so that after each visit to a mine the Inspector of Mines must post a synopsis of his report in some conspicuous place near the mine.

In mines in which gas has been found within the previous 12 months then a fire boss appointed for the purpose must examine the mine with a safety lamp immediately before the commencement of work in each shift, and must make a written report on the condition of the mine before men are allowed to enter.

It is also made illegal where safety lamps are used for anyone to unlock a safety lamp or to have matches or any smoking material whatsoever in his possession in the mine, and where safety lamps are used in a mine open lights may not be used between the place where the safety lamps are used and the main return airways.

With regard to blasting in a mine, the owner of the mine must provide some non-inflammable material such as clay for the men

to stem their shot holes with. It is illegal to use in any one shot any two classes of grades or qualities of explosives.

In mines in which safety lamps are required to be used no person but a shot-lighter holding a certificate under the Act may fire shots. It is the duty of this shot-lighter before firing any shot to examine the shot hole and see that the right quantity and quality of explosive is used, and also to see that there is no gas present.

If inflammable gas has been found in a mine the shot shall not be fired till the gas is removed or unless the explosive employed in firing the shot is so used with water or other contrivance as to prevent it inflaming gas or is of such a nature that it cannot inflame gas.

If the place where the shot is to be fired is dry and dusty then the shot shall not be fired unless the place of firing and all contiguous accessible places within a radius of twenty yards are in a wet state from watering or unless some safety explosive is used.

Explosives are not to be thawed underground, but the owner of every mine must provide a suitable thawing apparatus on the surface at each mine.

An important amendment is to the effect that a suitable supply of timber shall be constantly kept in each working place as near the face as practicable and in no case further away than the nearest cross-cut to the working face or other convenient place in the vicinity thereof.

The owner of a mine when more than 20 men are employed is required to furnish a washroom for the men.

When a committee of the men employed in the mine make an examination of such mine as they are allowed to do by law, then, so one of the amendments reads, should such committee report the existence, or apprehended existence of any danger, it is the duty of the owner of the mine to send a copy of the committee's report to the inspector of the district.

The books, such as fire boss report books, etc., required to be kept at a mine, must be furnished by the mine owner and by an amendment any person employed in the mine can examine these report books, or anyone having the written authority of anyone employed in the mine can examine the said report books.

The above are the chief amendments to the Coal Mines Act, and ought to prove beneficial to the welfare of employer and employee alike.

The amendments dealing with blasting in gaseous or in dusty mines are certainly of great importance, and if rigidly enforced will go a long way to prevent explosions.

SASKATCHEWAN.

TAYLORTON.

The dispute which has been going on for some time past between the employees of the Manitoba & Saskatchewan Coal Company at Bienfait and the company reached a climax when the employees, 50 in number, asked the Labor Department at Ottawa for a board of investigation to be convened to enquire into the hours of work and rate of wages. The employees, who are members of the United Mine Workers of America, have nominated F. H. Sherman as their representative on the board. The date of the investigation is not yet fixed.

SASKATOON.

The work at Eagle Lake which has been undertaken by the Government of the Province, to prove the coal deposits in that district, has only been a partial success. While coal was undoubtedly found, yet the seam was thin and was split in two by a clay band. Considerable difficulty was also experienced in mining the coal, as the roof was a soft clay which made timbering very difficult. On the whole the property did not come up to expectations, but work is still going ahead and better conditions may yet be found.

ONTARIO.

COBALT.—The Little Nipissing will soon become a shipper.

In the past five months, under the management of Superintendent Houston, the Right of Way has done 800 feet of cross-cutting and drifting and 150 feet of sinking. Four drills are working.

On the Drummond mine thirty-six men are working. Three drills are on double shift. At the Jacobs ninety-two are employed and between nine and ten drills are kept in commission. The old No. 3 shaft is down 300 feet.

DESERONTO.—The furnace of the Deseronto Iron Company is temporarily closed on account of transportation difficulties.

BRITISH COLUMBIA.

VANCOUVER.—On the Fraser river, near Lillooet, a dredging concession of three and one-half miles has been acquired by American interests. A dredge, to cost about $75,000, will be built this summer.

TRAIL.—The shipment to Hong Kong during the second week of March of 140,000 ounces of silver from the Consolidated Mining & Smelting Company's plant at Trail brings the shipments of silver from this plant for the past six months to over one million ounces. Nearly half of this has gone to the Canadian mint at Ottawa. All gold from this plant is now shipped to the assay office at Seattle and from there to the various branch mints of the United States. So soon as the Canadian mint is ready for gold, the Trail smelter and refinery is able to supply it, so that the output of the Canadian mint will be almost entirely from the Trail plant. Between fifty and sixty tons of lead are produced daily, most of which is shipped to the Orient. The company is ready to blow in the largest copper furnace in Canada, and a new crusher has been added, which crushes and samples the full tonnage in one instead of three eight-hour shifts. It is estimated that the sales of copper throughout the United States were sixty million pounds during the past three weeks, and that approximately every pound of copper above ground has been sold. The present price of copper represents only about the average cost of production. Lake coppe ris quoted at 12 1-4 cents and 12 5-8 cents, and electrolytic at 12 1-4 cents and 12 3-8 cents. Lake copper is copper which does not require refining, and is supposed, also, to be of superior quality. Electrolytic copper, as is known, is the general copper refined by electrolytic methods. It will be interesting to note the cost of producing copper in various localities. At Lake Superior it costs 9 1-2 cents a pound; at Butte, 10 1-2 cents; at Bisbee, Ariz., the cost is only 8 1-2 cents; while at Globe, Clifton and Morenci, Ariz., it costs 12 cents. At Cananea, Mexico, 13 cents is the cost of production.

NELSON.—Work has been resumed in the Queen Victoria mine. J. P. Swedeberg is in charge. Mr. Swedeberg owns the property.

VICTORIA.—Mr. H. C. Brewster (Alberni) has introduced a bill into the Provincial Legislature which is designed to protect miners employed on properties operated by other than the owner. Speculators often bond mining properties from owners and commence operations for the limited period specified in the bond. As the miners have always two weeks' pay coming to them, the operator, if unsuccessful in floating a company, often disappears and leaves the men unpaid. In these cases there is no one to be held responsible. Mr. Brewster's bill aims at removing this abuse. It proposes to force the operator to deposit in a bank a sum sufficient to meet the wage requirements. Failure on the part of the operator to comply with this should be sufficient warn-

ing to the workmen. The provision reads as follows: "Whenever any operator shall employ any miner in or about a mine, such operator shall, within ten days from the time he first begins to operate or work such mine cause to be posted up in a conspicuous place at such mine, where it may be seen and read by the miners, a certificate signed by the manager of a branch within British Columbia of some chartered Canadian bank, certifying that such bank holds or becomes responsible for a specified sum of money, to be used so far as necessary to pay the wages of miners employed at the mine by the operator; such certificate may be replaced or supplemented from time to time by another. Each certificate shall be posted up as aforesaid at the mine within fifteen days of its date, and the specified sum therein mentioned shall not be less than will at any time thereafter pay all the wages then owing miners for work at the mine, and that may be earned by the miners then working there until the next regular monthly or other pay day, and for and during another month after such pay day." The liability of the bank, the operator, and the workmen, is fully defined and the form of the bank certificate is provided. It is further provided that any miner may in writing relinquish his rights under this Act. He may also after fifteen days' notice in writing resume those rights. It is made unlawful for an operator to incur a greater liability in wages to the miners than the sum mentioned in the bank's certificate.

ROSSLAND.—The mines of the south belt of Rossland are enjoying a modest boom. Sunset No. 2 and Homestake are to be worked under lease.

A. B. Perry and G. G. Wilson have leased the O. K. mine and mill. Mining will be begun at once. The mine is on the south slope of the O. K. Mountain, two and a half miles west of Rossland and a quarter of a mile from the Red Mountain railway loop. The mill is a ten-stamp one.

CRANBROOK.—The Sullivan smelter at Marysville and the Kimberly mines have closed down indefinitely. Operating difficulties and not financial strengency caused the cessation of work.

ROSSLAND.

The Rossland mines are shipping from 5,600 to 5,800 tons of ore per week and up to the 17th of March had shipped 61,571 tons for the year. The shaft at the Centre Star will be deepened a couple of hundred feet in the near future. This would give them a depth on the dip of the ledge of 2,400 feet. The workings of the big mines here should soon pierce and cross the permanent water line, and it is hoped that when this is done the long looked for zone of second enrichment will be discovered. The lessees of the Blue Bird have installed a small drilling plant, and the mine is looking better every day. The Canadian Goldfields Syndicate has leased the Sunset to some local miners. The O. K. mine, a pockety, free gold property, to the west of the camp, has also been leased. Mr. W. A. Carlyle has finished his examination of the Le Roi mine and is now en route to London, where he will make his report. The smelter at trail has just completed the installation of the largest copper furnace in the Dominion. It has a capacity of 500 tons per day of ore and flux. The Trail refinery has shipped another 140,000 ounces of fine silver to Hong Kong. It is suggested here that arrangements may be made to treat some of the Cobalt low grade ore at British Columbia smelters. Some of our mining men seem to think the idea feasible, if proper freight rates could be obtained, as the ore would no doubt be valuable as a flux.

BOUNDARY.

While the Granby is occupying a lone position on the Boundary shipping list, still, it is giving a good account of itself and is making new records weekly and then surpassing even the new ones. During the last week they shipped nearly 25,000 tons of ore to the Grand Forks smelter, taxing the capacity of that plant to its limit. The Phoenix mines shipped 80,155 tons of ore to the smelter during February, which was 6,000 tons more than they handled in January. One good feature of the situation is a plentiful supply of coke, cars, labor, etc. It takes four giant machines to crush the 33,000 tons of ore that is sent out daily, one of which, with a receiving capacity of 42 inches by 30 inches, is capable of crushing 150 tons per hour, if need be. On Friday, the 13th, the company exceeded all previous daily records and forwarded 4,005 tons down the hill. Up to the 14th of March the total for the year was 194,187 tons shipped by Granby.

While the Granby smelter is the third largest in the world, it is to be further enlarged, and by next fall will have a capacity of 4,500 tons per day. The blast furnaces, convertor plant, convertor building and blowing engine plant will be augmented and the additions will cost about $2,000 before they are all made. The machinery is now on order and is to be delivered before July 1st. In part it will consist of two Connersville blowers of 30,000 feet capacity each, four 150 Canadian Westinghouse motors to drive them, and a 500 Nordberg blowing engine, of a capacity of 10,000 cubic feet free air per minute to 15 pounds pressure.

Some additions will be made to the smelting plant of the Dominion Copper Company before work is resumed. The new machinery which has just arrived at the British Columbia Copper Company's Mother Lode mine is being installed and will be all ready to start up when the time comes to go back to work. A Spokane enterprise will expend $10,000 on a dredge to work on Granite Creek. They claim they can work the ground to bedrock and make it pay. These grounds were worked profitably in the early days of 1886-7. The Sally mine at West Fork has shipped another car of ore to Trail smelter. Comments have been made on the selling in New York of Dominion Copper 6 per cent. bonds at $45. At this price the returns are 13 per cent. The company has several hundred thousand dollars in the treasury. The New York office of the Granby Company have decided to pass the quarterly dividend, and as a consequence the shareholders here are not likely to receive any more cheques until copper climbs a little. Only 768,000 pounds of copper were shipped into the States this year in January, whereas 2,410,116 were sent over the line in the same month during 1907.

SLOCAN—E. KOOTENAY.

Nothing new has developed in the closing down of the Sullivan mine and smelter in consequence of the recalcitrant zinc in the ore and other troubles. The minority shareholders are holding a meeting in Spokane March 19th for the purpose of discussing the best means of protecting their interests should the mortgagees take action. A strike of good ore is reported from the Flint mine. The ore in the Granite, near Nelson, is improving with depth. Diamond drilling is in progress at the St. Eugene mine, Moyie. Their pay roll for February amounted to $35,000.

CROW'S NEST.

The International, Alberta, Galbraith, Royal and Crow's Nest Pass coal mines continue to operate steadily. The Crow's Nest Pass Coal Company mined 9,81931 tons of coal in 1907, as against 213,295 tons in 1906, showing a material increase in production. The pay roll at their mines averages $185,236 per month.

COAST, ETC.

The Monarch mine at Field continues to work. While this company is working under difficulties, still they state the proposition is paying its way. While no great rush is expected into the Findlay river country, good reports are received by men coming out of there, and they state that it is a rich section. It is generally conceded that it is a little early yet, though, to go into that district. The best route is via Hazelton, and that is the trail most used at the present time. Boston capitalists are going to expend a large sum for a gold dredging plant to be used on the Fraser river near Lillooet this season. The sand and gravel

in that particular vicinity is difficult to treat and several companies have failed in their attempts, but this concern is satisfied that they can solve the problem with an up-to-date machine.

General conditions throughout British Columbia are looking very sunny when everything is taken into consideration. While several of the big mines, both metal and coal, are closed down, a slight advance in the price of copper will mean the resumption of work and no doubt early summer will see the situation considerably changed unless other troubles crop up. Considerable money will be spent for railway work in this country, including the big contract for the Western end of the Grand Trunk Pacific, which should help to a great extent.

MINING NEWS OF THE WORLD.

GREAT BRITAIN.

Twenty-six miners lost their lives by the breaking out of fire in the Hemstead colliery, near Birmingham, on March 4th. Great efforts were made to rescue them, the work being continued for several days. The rescue apparatus, which was put to a practical test for the first time, proved ineffective, and one of the rescue party was sucocated by the fumes.

The Glamorgan colliery has been purchased by the Cambrian Colliery Company for £240,000. This is believed to be a preliminary step in the direction of a large combination of enterprises in connection with the coal export trade.

RUSSIA.

The quantity of copper smelted in the Ural district in 1907 was much in excess of the output of any preceding year. It amounted to 434,918 poods of metallic copper as against 260,788 poods in 1906.

Attention is being directed to the Altai asbestos deposits, which have been found to be of fine quality. The principal source of supply at present is in the Urals, but it is claimed that owing to more favorable topographical conditions the first cost of the product in the Altai district will be 50 per cent. less than at the Ural mines.

GERMANY.

A German zinc syndicate was organized at a recent meeting of owners of zinc works, which aims at the regulation of production, sales and prices for the next three years. It includes all the German producers with one exception.

Official statistics give the total production of coal in 1907 at 143,222,886 tons.

FRANCE.

The total production in mineral combustibles for 1907 was 36,930,250 tons, of which 764,861 tons was lignite. The increase over 1906 was 2,733,865 tons.

AUSTRALASIA.

The coal industry of Queensland, Australia, has received a stimulus owing to the operators having obtained a contract for 60,000 tons for the United States navy at Manila.

Explorations by the State Mines Department in the Powlett River district, Victoria, have resulted in the discovery of a seam of good coal four feet thick at a depth of 495 feet. Two other seams each one foot nine inches thick were pierced at lower levels. It is believed that the Powlett River district is much more extensiv than has hitherto been supposed.

Owing to the high price of tin there is great activity in tin dredging in the Emmaville district, New South Wales. Four dredging plants are in successful operation, and one company is preparing to spend £100,000 in development.

In Ballarat, Victoria, a company has been organized headed by the Mayor, and has taken up 200 acres of land in the heart of the city to prospect some of the quartz lodes.

SOUTH AFRICA.

Owing to the slump in the demand for diamonds, it has been decided to close down the Du Toits Pan diamond mine, Cape Colony, which is part of the De Beers property, on April 24th, until the market improves.

The outlook for the mining industry in Rhodesia is promising except for the scarcity of native labor. The gold output of Southern Rhodesia for January was 50,521 ounces. There are 175 gold producing mines, of which 129 produced fine gold during the month. The total January output of minerals was valued at £201,508.

The proposed new gold law of the Transvaal places considerable limitations on prospecting and the holding of claims which are not worked. The mining community are strongly opposed to some of its provisions.

UNITED STATES.

The commission appointed in Oklahoma to consider the question of the purchase by the State of 440,000 acres of coal and asphalt lands, has recommended their acquisition at a price not exceeding $10,000,000—to be raised by an issue of State bonds.

The Washoe smelter of the Amalgamated Copper Company at Anaconda, Montana, is again in operation, and it is anticipated that it will very shortly be turning out copper at its normal capacity of over 15,000,000 pounds per month. When fully in operation it will resume the purchase of custom ore, which will mean the resumption of work in several important companies in the Butte district.

In the Juneaw mining dsitrict, Alaska, there has been a steady advance in gold mining development. At the Treadwell group on Douglas Island the use of oil instead of coal has been introduced for the steam plant, materially reducing the cost of power.

HAITI.

Valuable gold placer districts have been discovered, one of the most important of which is situated in the southern portion of the island near Jacmel. Concessions have been secured from the Government by parties who are undertaking to develop the properties.

MEXICO.

Stockholders of the Douglas Copper Company have secured control of the Ryall and Mix concessions, Sonora, covering about 1,500,000 acres, which will be developed by the Mexican Exploration & Mining Company, capitalized at $5,000,000.

Three new smelters have recently been put into commission in Chihuahua, and are operating satisfactorily. Two of these plants are entirely new and the third has new machinery and improvements.

PERU.

Great preparations are being made by the Cerro de Pasco Copper Company, recently incorporated with a capitalization of $60,000,000, to develope the copper mining industry. The promoters of the enterprise are Mr. J. B. Haggin and other New York financiers, who have for some time been extensively engaged in this field. The export of refined copper from Peru twelve years ago was only 1,007,228 pounds, but since the Americans began work at Cerro de Pasco it was greatly increased, the shipments to the United States last year being 20,152,000 pounds.

STATISTICS AND RETURNS.

NOVA SCOTIA'S MINERAL OUTPUT.

Fiscal Year Ended Sept. 30th, 1907.

Nova Scotia's coal output in the fiscal year, 1907, was 125,945 tons less than in 1906, the amounts raised in each year being 5,866,605 and 5,730,660 tons respectively, according to the figures contained in the report of the Mines Department laid on the table of the House recently. Only in two counties, Inverness and Pictou, was more coal raised in 1907 than in the previous year. Inverness' figures were 345,391 tons, compared with 234,906, a gain of 110,941 tons. Pictou county produced 731,921 tons, 61,485 tons more than in 1906. In Cape Breton the output was 175,191 tons behind 1906, owing to the fire in the Hug colliery, while Cumberland county, owing to the strike in Springhill, went 130,526 tons behind the 1906 figures, only producing 508,202 tons.

Returns of Coal Sold.

The returns of coal sold during the year 1907 show, compared with the returns of 1906, as follows:—

	1906.	1907.
Nova Scotia	1,962,206	1,842,419
New Brunswick	434,882	427,128
Newfoundland	149,506	146,502
Prince Edward Island	76,809	77,493
Quebec	1,739,308	1,709,493
West Indies	.....	2,598
United States	769,775	616,312
Mexico	.....	7,591
Other countries	62,104	12,483
Bunker	.....	204,572
Total	5,194,590	5,046,690

The mineral output of the province for the year ended September 30th, 1907, was:—

Coal raised, gross tons	5,730,660
Pig iron, gross tons	293,436
Coke made, net tons	493,102
Iron ore, gross tons	562,746
Lime stone, net tons	458,601
Gypsum, gross tons	332,345
Gold, ounces	15,006
Bricks	25,000,000
Building stone, net tons	63,861
Cement, barrels	58,762
Antimony ore, net tons	1,403
Manganese ore, gross tons	495
Copper ore, net tons	2,471
Drain pipe, feet	300,000
Grindstones, net tons	350
Copper, pounds	12,320
Moulding sand, net tons	190
Barytes, net tons	.....

COBALT ORE STATEMENT.

For the Week Ending March 14th, 1908.

O'Brien Mine—March 7th, to Doloro Mining Company, Doloro, Ontario, 63,000; March 12th, 62,280 pounds. Total, 125,280 pounds.

La Rose Mines—March 7th, to La Rose Mines, Denver Col., 40,000 pounds; March 7th, 57,400 pounds; March 10th, 40,000 pounds; March 13th, 60,000 pounds. Total, 197,400 pounds.

McKinley-Darragh-Savage Mines—March 13th, to Pennsylvania Smelting Company, Carnegia, Pa., 62,460 pounds; March 13th, 64,200 pounds; March 13th, 63,000 pounds. Total, 189,660 pounds.

Cobalt Central Mining Company—March 7th, to Canadian Copper Company, Copper Cliff, Ont., 49,700 pounds.

Nipissing Mines Company—March 7th, to Nipissing Mines Company, New York, 63,000 pounds.

Watts Mine—March 11th, to American Smelting & Refining Company, Denver, Col., 52,730 pounds.

Buffalo Mines—March 11th, to Canadian Copper Company, Copper Cliff, Ont., 42,740 pounds.

Right of Way Mining Company—March 12th, to Doloro Mining & Reduction Company, Deloro, Ont., 60,210 pounds.

Provincial Mine—March 13th, to Deloro Mining & Reduction Company, Deloro, Ont., 50,000 pounds.

J. Rowland—March 14th, to Cowan, Toronto, Ont., 40,000 pounds.

Totals—870,720 pounds.

RAND OUTPUT SMALLER.

Official announcement is made that the production of gold at the Rand for January reached a total of 541,930 fine ounces, against 560,329 fine ounces in January, and 493,542 fine ounces in February a year ago. Last month's figures, based on the market value of $21.25 per ounce, represented $11,516,012, against $11,906,991 in January, and $10,497,767 in February, 1907.

The following tables gives the output by months (in fine ounces) for a series of years:—

	1908.	1907.	1906.	1905.
January	560,329	537,638	428,638	369,258
February	541,930	493.542	407,668	363,811
March	.....	538,497	443,723	399,833
April	.....	537,019	439,243	399,166
May	.....	524,477	461,202	416,395
June	.....	507,559	475,975	412,317
July	.....	532,711	491,793	419,595
August	.....	555,037	509,115	428,581
September	.....	538,034	505,111	416,487
October	.....	553,553	540,600	415,527
November	.....	549,801	533,373	424,757
December	.....	583,526	550,167	431,594
Total	1,102,259	6,551,662	5,786,617	4,897,221

BRITISH COLUMBIA ORE SHIPMENTS.

Week ending March 7th and year to date:—

Boundary shipments—	Week.	Year.
Granby	23,663	169,630
Crescent	28	28
Other mines		411
Total	23,691	170,069
Rossland shipments—		
Centre Star	3,042	32,420
Le Roie	1,634	15,300
Le Roie No. 2	854	6,351
Evening Star	79	334
Total	5,606	54,405
Slocan-Kootenay shipments—		
St. Eugene	593	5,070
Whitewater	90	156
Whitewater, milled	280	2,660
Queen, milled	185	1,655
Poorman, milled	250	1,600
North Star	76	656
Arlington, Erle	44	605
Vancouver	20	394
Ferguson	96	370
Richmond	51	365
Standard	21	337
Emerald	27	316
Ruth	41	241
Rambler-Cariboo	45	213
Nugget	22	191
Kootenay Belle, milled	25	125
Gallagher	25	25
Wellington	8	8
Grant	1	1
Other mines		8,967
Total	1,900	24,955

The total shipments for the past week were 31,197 and for the year to date 249,429 tons.

NOVA SCOTIA STEEL COMPANY'S COAL SHIPMENTS.

The coal shipments of Nova Scotia Steel & Coal Company for February and the two months are as follows:—

Shipments February, 1908	41,230
Shipments February, 1907	25,245
Increase February, 1908	15,985
Shipments 2 months, 1907	55,974
Shipments 2 months, 1908	88,980
Increase 2 months, 1908	33,006

During the month of February the Nipissing Mines produced approximately $102,000 worth of ore and shipped ore to the smelters that month of a value of $54,000.

The output of the Crow's Nest Pass Coal Company's collieries for this week was 21,140 tons; daily average 3,523 tons. The week in the past four years compares as follows:—1908, total, 21,140 tons, daily average 3,523 tons; 1907, total 20,105 tons, daily average 3,351 tons; 1906, total 18,523 tons, daily average 3,087 tons; 1905, total 11,997 tons, daily average 1,999 tons.

OUTPUT OF COAL AND OTHER MINERALS IN THE UNITED KINGDOM IN 1907.

COAL.

The Home Office Mining Department has issued its annual preliminary return, showing the quantities of coal and other minerals raised in the United Kingdom in 1907, together with statistics as to the persons employed. The output of coal from mines under the Coal Mines Regulation Act, which was 251,050,809 tons in 1906, was 267,828,276 in 1907, showing an increase of 16,777,467 tons. The increase in the twelve inspection districts respectively were as follows:—

	Tons.
East Scotland	1,660,482
West Scotland	439,697
Newcastle	764,906
Durham	1,154,128
York and Lincoln	2,624,036
Manchester and Ireland	502,803
Liverpool and North Wales	1,151,229
Midland	3,947,465
Stafford	1,301,148
Cardiff	862,744
Swansea	1,101,687
Southern	1,267,142
Total increase	16,777,467

The number of persons employed at mines under the Coal Mines Regulation Act was 940,618, an increase of 58,273. The increase in the output of coal is at the rate of 6.68 per cent., and the increase in the number of persons employed at mines under the Coal Mines Regulation Act is at the rate of 6.60 per cent. The output of coal by counties was as follows:—

England.

	Tons.
Cheshire	381,654
Cumberland	2,253,790
Derby	18,083,016
Devon	.....
Durham	40,264,871
Gloucester and Kent	1,683,083
Lancaster	26,183,274
Leicester	2,816,885
Lincoln	.....
Monmouth	13,195,688
Northampton	.....
Northumberland	13,722,029
Nottingham	11,728,886
Shropshire	862,173
Somerset	1,158,529
Stafford	14,605,706
Warwick	4,553,766
Westmoreland	1,146
Worcester	715,789
Yorkshire	35,173,561
Total	187,383,846

Wales.

Brecon	622,728
Carmarthen	1,972,353
Denbigh	2,742,788
Flint	726,882
Glamorgan	34,137,733
Pembroke	49,694
Total	40,252,178

Scotland.

Argyle and Dumfries	245,624
Ayr	4,073,320
Clackbannan	419,959
Dumbarton	493,508
Edinburgh	2,344,792
Fife	8,530,043
Haddington	1,069,733
Kinross	132,130
Lanark	17,968,298
Linlithgow	1,805,335
Peebles	875
Renfrew	38,072
Stirling	2,965,088
Sutherland	5,771
Total	40,092,548

Ireland.

Antrim	4,813
Kilkenny	65,366
Leitrim	1,400
Queen's County	2,686
Roscommon	13,945
Sligo	1,064
Tipperary	9,341
Tyrone	1,089
Total	99,704
Gross total	267,828,276
Total in preceding year	251,050,809

IRONSTONE.

To the total output of 8,236,118 tons of ironstone, shown in the above table, the principal contributing districts were as follows:—Cleveland, 6,230,987 tons; Staffordshire, 1,036,239 tons; and Scotland, 700,148 tons. These figures do not include the quantities work on the West Coast, in Lincolnshire, Warwickshire, and one or two other districts, neither do they include the output from quarries.

MINERAL PRODUCTION UNDER METALLIFEROUS MINES REGULATION ACTS.

The following table shows the output of various minerals under the Metalliferous Mines Regulation Acts, during 1907, as compared with 1906:—

Description of Mineral.	Total in 1907. Tons.	Total in 1906. Tons.
Arsenic	1,473	1,699
Arsenical pyrites	697	640
Barytes	30,343	27,827
Bauxite	7,537	6,654
Chalk	1,765	2,902
Chert and flint	5,372	4,912
Clay and shale	114,525	118,521
Copper ore and copper precipitate	6,759	7,758
Fluorspar	40,229	36,280
Gold ore	12,987	17,384
Gypsum	195,266	196,143
Igneous rocks	69,871	72,722
Iron ore	1,803,063	1,824,415
Iron pyrites	2,800	3,798
Lead ore	31,215	30,226
Limestone	470,263	765,718
Manganese ore	16,098	22,762
Ochre, umber, etc	4,789	4,415
Oil shale	210	409
Rock salt	243,345	230,558
Sand	23,580	12,642
Sandstone	b156,324	168,077
Silver ore	4	1
Slate	116,570	126,699
Tin ore (dressed)	6,087	6,276
Uranium ore	71	11
Wolfram	312	263
Zinc ore	19,945	22,824
Total	c3,381,491	3,712,436
Number of persons employed:—		
Underground	18,559	17,818
Above ground	13,008	12,413
Total	31,567	30,231

a Including 8,363 tons of calc spar.
b Including 11,864 tons of ganister.
c In addition to this quantity 80 tons of mixed ores (containing arsenic, copper, tin and wolfram) were obtained.

MINERALS.

The output of various minerals under the Coal Mines Regulation Acts, and the number of persons employed in their production, are shown in the following table:—

Description of Mineral.	Total in 1907. Tons.	Total in 1906. Tons.
Barytes	10,297	7,199
Clay and shale, other than fireclay and oil shale	320,889	252,275
Coal	267,828,276	251,050,809
Fireclay	2,890,197	2,971,173
Igneous rocks	146	424
Iron pyrites	7,394	7,342
Ironstone	8,236,118	8,209,880
Limestone	22,366	32,816
Oil shale	2,675,779	2,546,113
Petroleum	.....	10
Sandstone (including Ganister)	*128,103	126,675
Total	282,119,565	265,204,716
Number of persons employed:—		
Underground	757,887	709,545
Above ground	182,731	172,800
	940,618	882,345

*The quantity of ganister obtained was 120,103 tons.

Company Reports.

Nipissing declared its regular quarterly dividend of 3 per cent., or 15 cents a share, payable on April 20th. Books close March 27th and re-open April 23rd. The financial statement of the company as of March 14t his approximately as follows: Cash and silver bullion on hand, $457,000; accounts receivable, $134,000; ore in transit and at smelter, $175,000; total $896,000, less dividend of 3 per cent., payable April 20th, $180,000; balance, $716,000. It is stated that financial condition of the company and conditions at the mines continue to show improvement. It is expected that by April 20th the company will have earned nearly the $180,000 required to pay the dividend declared.