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COPPER

In his presidential address before the Institution of Mining and Metallurgy at the recent annual meeting, Prof. W. Gowland paid particular attention to the advances in copper smelting in late years. After pointing out that Great Britain, which, during the first half of last century, was the chief producer of copper in the world, gradually lost that position, owing first to the discovery of important deposits in Chili, later in the United States, and to the decreases in the output of the Cornish mines, the speaker proceeded to say that the present enormous output of the metal would have been quite impossible with the old methods, furnaces and appliances, some of which still survive in Continental Europe and in Great Britain. The extraordinary development of the copper industry is due chiefly to the remarkable increase in the size and capacity of furnaces; the application of the Bessemer process to copper mattes; the introduction of pyritic smelting; the general reduction in the costs of production; and last, but not least, the removal of the chief producing centres from the old world to the new. In Prof. Gowland's opinion advances as great, or perhaps greater, then those of the last fifty years will be made before the end of the next half century, probably, in part, in the following directions:—

(*a*) The extended application of producer gas as fuel in copper reverberatory furnaces. This would, he felt sure, be found to be specially efficatious with large furnaces, such as those of the Anaconda Company. Gas could be admitted at several points in their sides, and so secure a uniformly high temperature throughout their length.

(*b*) The introduction of the tilting furnace of the open-hearth steel manufacturer into the copper refinery. A movement in this direction has already been made at the Tacoma Refinery, Puget Sound, but oil and not gas is used as fuel.

(*c*) The extended adaptation of the Bessemer converter to the treatment of poor copper matte, etc. Even now, with a basic lining and the addition of silicious ores of value to the charge, a certain amount of success has been attained in this direction, but this is only an earnest of what may ultimately be reached.

(*d*) The roasting of cupriferous pyritic ores in cast iron vessels with a blast and additions of silica or lime.

(*e*) The utilization of the sulphur dioxide from the poor gases from calcining and roasting plants for the manufacture of sulphuric acid by a "contact" process.

(*f*) Lastly, but by no means least, the electric smelting of copper where water power for generating electricity can be obtained at small cost. This process at present, however, has not passed out of the experimental stage.

THE WESTERN COAL STRIKE

A satisfactory settlement has been reached at last. On May 6th Deputy Minister of Labor Mr. W. L. Mackenzie King announced in an official telegram to his Department in Ottawa, that, as a result of concilation proceedings, an agreement had been signed and the miners would resume work on the morrow.

By the terms of the agreement the men receive a five per cent. increase in wages and an eight-hour day from bank to bank. Other substantial concessions are made. It is agreed that if, in case of dispute, the difficulty is not settled by the first camp board, there shall be an immediate appeal to a board of arbitrators, whose chairman shall be named by the Minister of Labor. The agreement stands for two years, and provision is made for a meeting of operators and representatives of the union, sixty days before its expiry, for the purpose of arranging a renewal of the agreement.

If during this protracted struggle the men had remained at work, pending the action of the Board of Conciliation, they would have deserved in full measure public sympathy and support. In stopping work they took a step that entailed heavy loss to the industries depending upon a regular supply of fuel. For this they have no excuse. It is fatuous to affirm that this was done without the sanction of the Executive of the United Mine Workers. The stoppage of work was the result of concerted action by the members of the union, and this the public must remember, should disputes arise at any future time.

Mr. Mackenzie King appears to have performed his delicate task with skill and tact. The peculiar difficulties of the situation tested the new Labor Act very thoroughly. That a settlement has been reached peacefully reflects credit upon the Department of Labor, as represented by Mr. King, upon the operators and, in a much less degree, upon the miners themselves.

TO THE PUBLIC

A persistent attempt is being made to boom the Larder Lake district. In view of the prestige attaching to mining in Ontario because of Cobalt's great showing, it is not unlikely that many small investors will be induced to risk their money in one or other of the extravagantly advertised concerns which have been recently floated. At present, although something like four thousand locations have been staked out in the district, no development work of importance has been done and consequently the only foundations for the assumption that the area is a rich one are the newspaper reports of valuable finds and the publication of assay returns in prospectuses, which may mean anything or nothing. As a sample of the absurdities now being published by the daily press, we cut the following from a Montreal evening paper:—

"One prominent mining man of large experience in the different gold camps of the world, after visiting the camp, stated this could hardly be termed a mining camp at all, that it more nearly resembled a large manufacturing industry, with sufficient raw material on hand to run for centuries. The question, in his opinion, was simply one of the capacity of the machinery, and the amount of gold bars turned out would be limited only by the size of the plant for treating the ore."

How men of ordinary intelligence can possibly be influenced by such obvious nonsense as this baffles explanation. And yet the fact remains that it is just this sort of thing that the public will swallow without so much as winking.

AMERICAN INSTITUTE OF MINING ENGINEERS

The American Institute of Mining Engineers held its regular spring meeting in the auditorium of the new United Engineering Building on April 18th and 19th. Dr. Rossiter W. Raymond, the veteran secretary of the Institute, was called upon to speak by the President of the Council, Mr. John Hays Hammond. Dr. Raymond touched lightly on the history of the organization. He referred to the fact that for more than thirty years the Institute was not incorporated, nor had it settled headquarters. Any attempt to place it at one spot would simply have been a signal for the appearance of other local societies in other spots. There had been a time when Philadelphia, as the capital of a mining State, had strong claims to become the headquarters of the Institute. The establishment of a rival Institute in the West or of other national societies for iron, coal and steel had been projected at various times. But through all this troublous period the Institute, by being peripatetic, had kept itself national.

Dr. Raymond spoke in most glowingly laudatory terms of the work of Mr. Henry G. Morse, the junior member of the firm of architects who erected the building.

THE BUSINESS OF MINING

We wish to draw especial attention to an article which appears in this issue. It is entitled "Requirements of Modern Mining," and is reprinted from our contemporary, the *Mining and Scientific Press*, of San Francisco. We had intended commencing a series of articles defining and describing the *business* and profession of mining. This article covers so succinctly and so forcibly the whole subject that it deserves the most careful perusal. Taking it as a text, we shall attempt, in succeeding issues, to demonstrate how little the great majority of alleged "mining" schemes have to do with the legitimate business of mining. We most emphatically disclaim any intention of injuring individual mining camps. But, unfortunately, one or two of our otherwise promising districts have been made the hatching places of utterly extravagant schemes. If, in attacking these promotions, we cause incidental hardships to the mining districts involved, we shall be sorry—but it cannot be helped.

EDITORIAL NOTES

The recent readjustment of postal rates between Canada and the United States has forced THE CANADIAN MINING JOURNAL to raise its subscription rate from two dollars to three dollars. This applies only to new subscribers in the United States. American subscibers who have already sent in their subscriptions for the amount of two dollars will not be called upon to increase that amount until next year. But THE CANADIAN MINING JOURNAL could not continue to supply subscribers on the other side of the line at the two dollar rate without incurring considerable loss.

Although the production of nickel ore in New Caledonia showed a slight increase last year, as compared with 1905, the outlook for the industry in that colony does not appear to be very bright. As a result of the new mining law, which came into force in July last, thousands of acres of mining lands have been abandoned. This law compels the owners of mining lands to either continuously work the properties or else pay a double rental. A consular reports notes that this is tantamount to forcing production on a limited market, and as the whole of the nickel produced in New Caledonia is virtually the product of about eight of nine mines, the consequence of trying to force production on the world's markets is disastrous in the extreme, since, under fair conditions, it would be easily possible to double the present output. The total area of the mines abandoned during December, 1906, was 42,500 acres, and this will be exceeded during 1907 if the present restrictions are maintained.

The Rev. Dr. Robert Falconer has been appointed to the presidency of Toronto University. The choice is a fortunate one. Dr. Falconer is young and vigorous. He is an accomplished scholar and a successful educationist. The Provincial Government has displayed foresight and discretion in endowing the new president with large powers. Incidentally it is pleasant to note that the salary now attached to the office bears some proportion to the dignity and responsibility of such a high position.

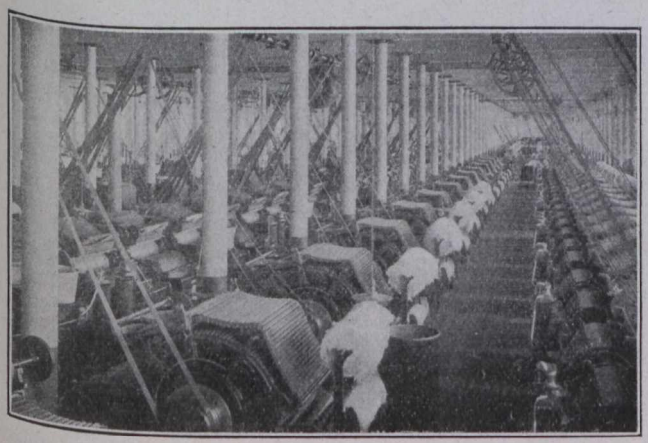
Queen's University, recognizing the value of Provincial Geologist Wilbert G. Miller's services, has conferred upon him the honorary degree of Doctor of Laws. We sincerely congratulate Dr. Miller. We also congratulate Queen's upon being the first public educational institution to tangibly express its appreciation of Dr. Miller's unique and far-reaching work in developing the mineral wealth of Ontario.

British Columbia papers, in noting the fact that several of Cobalt's mine managers have been engaged from British Columbia camps, felicitate their Province upon possessing a superior class of mining engineers and miners. This is doubtless the case. But we would remind Cobalt that, should her demand for men remain unsatisfied, Nova Scotia also produces miners trained by long experience in metalliferous mines. With both British Columbia and Nova Scotia to draw on, and our mining schools turning out dozens of young graduates, we should depend in a constantly lessening degree upon talent imported from the United States.

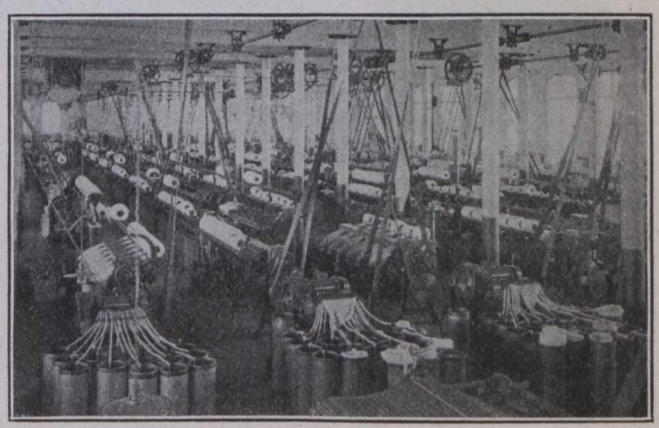
ASBESTOS

(Written for THE CANADIAN MINING JOURNAL.)

It is not intended in this article to go into the geology of the rocks or the history of the serpentines in the Quebec asbestos belt of the Province of Quebec, as the subject has been taken up from time to time in the last 30 years by many well-known geologists of this and other countries, and many interesting articles have been written by such eminent geologists as Dr. Dawson, Prof. Logan, the late Dr. Sterry Hunt, and others.



CARD ROOM—SHOWING PROCESS OF CARDING.



DRAWING ROOM—SHOWING PROCESS OF DRAWING AND DOUBLING AND COMBING.

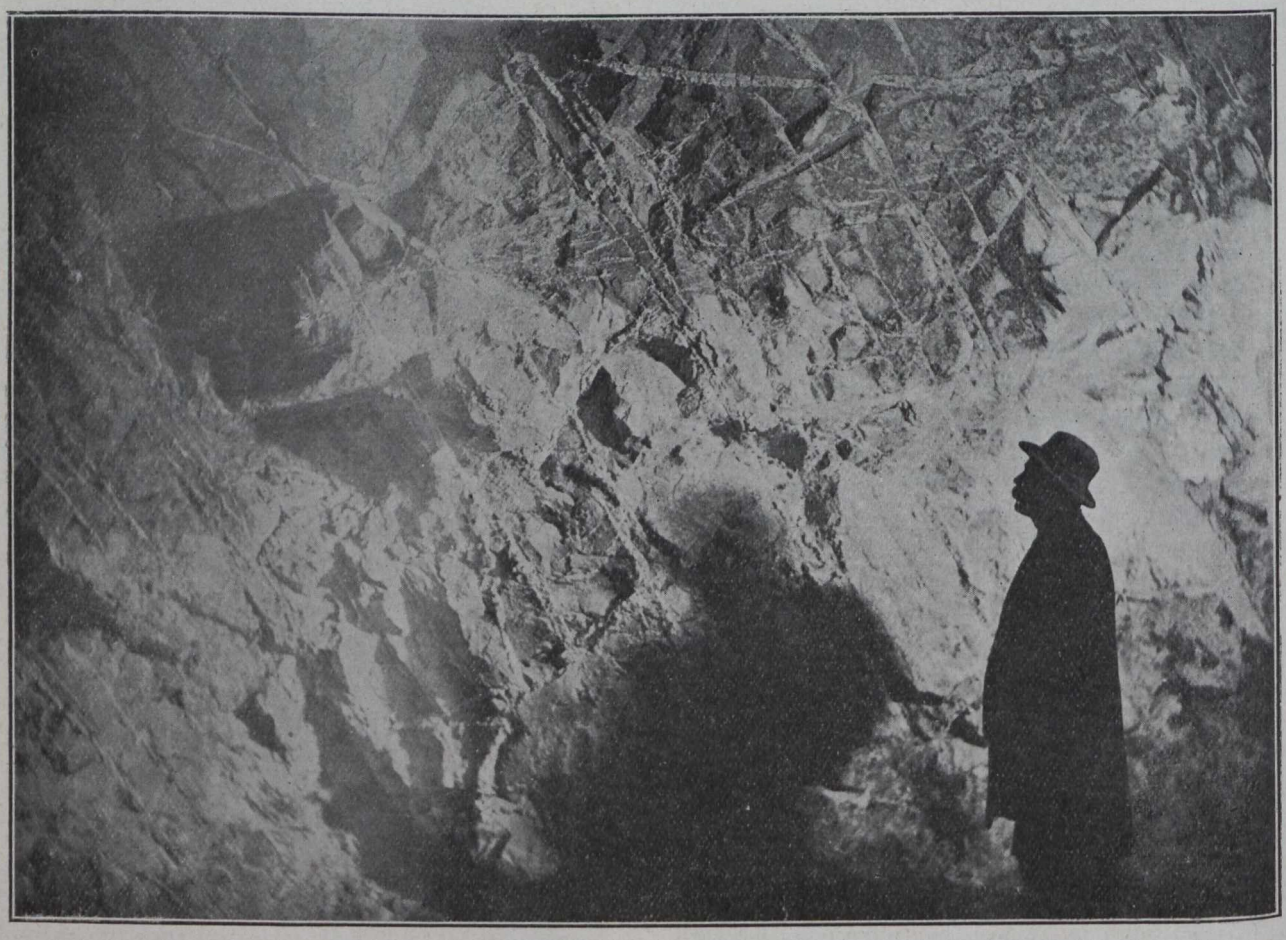
It is of the commercial aspects and general information of the asbestos industry that we intend to treat in this

article, in such a manner that the lay mind may appreciate the importance of one of Canada's most useful mineral industries, one of which perhaps, less is known than of any other. This is probably due to the fact that very little speculation has ever taken place in the properties themselves, and very few, if any, stocks have been offered upon the market, of really first-class working propositions. The owners of asbestos properties as a rule have felt that the asset was sufficiently good to keep for themselves, with the result that the mines are generally owned by individuals or small companies.

Asbestos has been mined in Canada for the last 35 years, but for probably 45 years the mineral was known to exist in the Thetford district, in the Province of Quebec. Asbestos has been known almost as far back as we can trace history, for we know of the wrappings of ancient Egyptian mummies that date back at least 2,000 dian mines. The material of the Siberian mines, however, is of a coarser grain and does not lend itself readily to the making of textiles or the finer grades of asbestos goods, and the distance of the mines from railway or water routes, even with the advantages of low wages, is not likely to permit it to become an active competitor of the Canadian article in America or Eastern Europe.

USES.

The variety of uses to which asbestos has been put are unlimited, and new uses are daily found for it. All kinds of textiles in the shape of cloths for many different uses, such as stage curtains, firemen's clothing, fireproof gloves, fireproof hose, and so forth, are manufactured from it. The same textiles, when treated with a rubber solution, make an article that is absolutely waterproof. This is used for steam packings and numerous other purposes where the mixture of rubber and

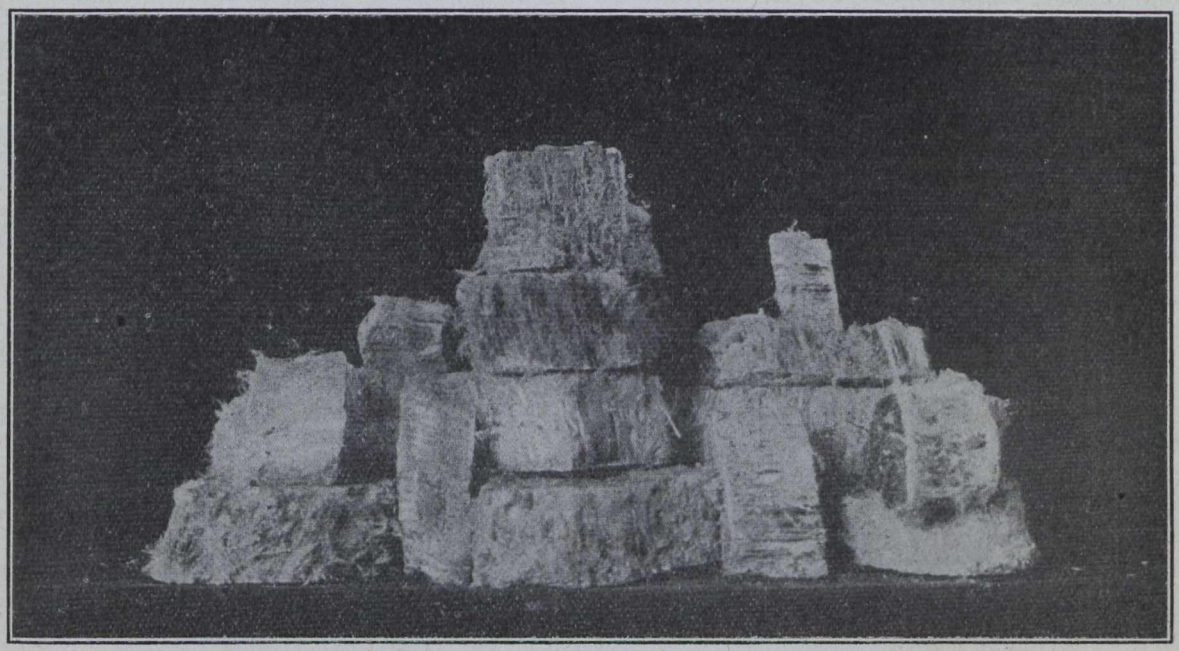


No. 2 DRIFT, 180 FEET TO RIGHT OF MAIN TUNNEL, BELL ASBESTOS MINE, THETFORD, P.Q.

were apparently made of fine hand-woven asbestos cloth, which no doubt came from the old Italian workings—the same that are occasionally worked from time to time in our present day, although little or nothing is being done in the mines in Italy at present.

Asbestos has also been known for many years in Russian Siberia, and to-day is being successfully worked in years B.C., and we know that parts of the wrappings that country. Most of the Russian products are shipped to the markets of Europe. When the Russian deposits were first discovered the working was comparatively easy, as the asbestos was found in ridges of decomposed serpentine, which readily yielded to the pick and shovel; but, as these ridges were worked down the formation of harder serpentine presented itself, so that they are to-day using practically the same methods as are in use in Canaasbestos can be succesfully employed. For electrical uses, such as the insulation of wire, on account of its fireproof quanities, it is of extreme value. It is also used for cut-outs, fuses, switchboards, etc., etc. Immense quantities of it are manufactured into paper of different thicknesses up to three-quarter inch. It is used between floors and walls for deadening sound and prevention of vermin, and recently the Keasby & Mattison Company, of Ambler, Pa., the owners of the Bell Asbestos Mines, have manufactured roofing slates from asbestos, which have proven one of the most valuable and attractive articles that have probably yet been made. These slates are made in different colors, the three principal being slate color, grayish-white (or natural asbestos color), and terra cotta; which give a very pleasing effect for the roofing and sides of houses and buildings.

They also manufacture corrugated and plain building lumber, in sheets from 2 feet to 4 feet wide by 4 feet to 8 feet in length.



HIGHEST GRADE CRUDE ASBESTOS ORE.

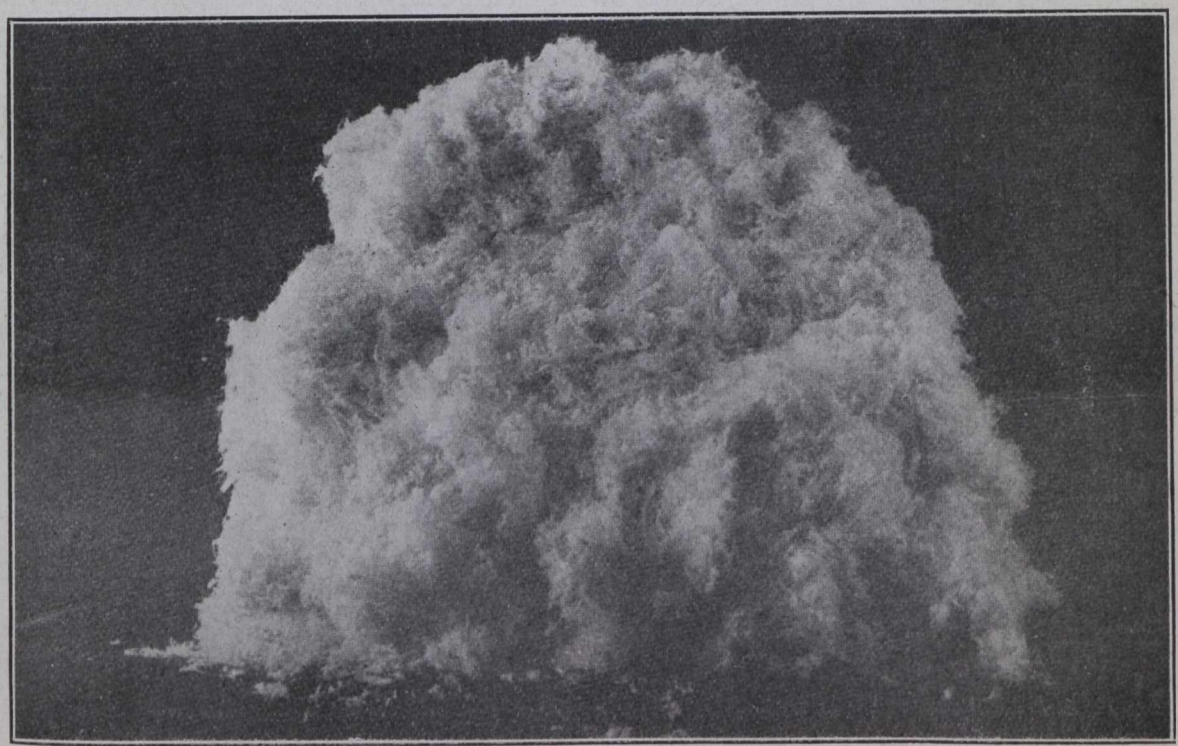
These latter can be given in any dimensions asked for, and the material is readily handled by any ordinary carpenters and cut and fitted with their tools.

Large quantities of asbestos are consumed in the manufacture of pipe and boiler covering, and it has many incidental uses in insulation, refrigerating and cold storage. The number of its uses is practically unlimited, in fact, and every day brings some new one.

MINES.

The mining of asbestos in Canada is confined to a very small area in the Province of Quebec, in the Counties of Megantic and Wolfe, in the Townships of Broughton, Thetford, Coleraine and Wolfestown. It is also mined at Danville, in the County of Richmond.

Of the mines, the Thetford group have even been the largest and most valuable producers, and the three large mines of that district, known as the Bell Mine, Kings' Mine, and Johnson's Mine, were among the first early workings in the history of the Quebec industry. The

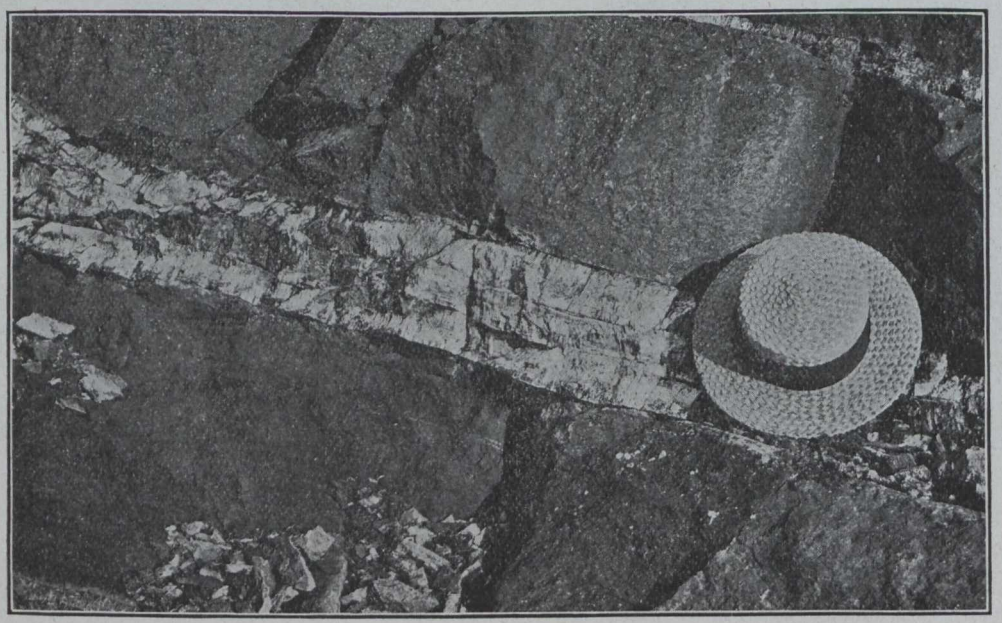


ASBESTOS FIBRE, NO. 1 QUALITY.

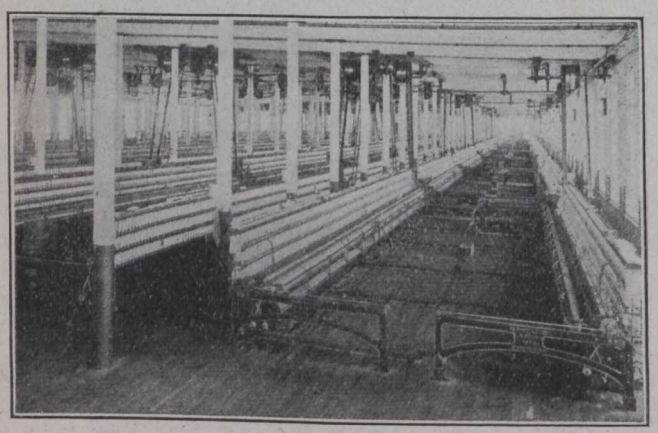
Bell Mine, which is the largest producing property and with the largest developed area, has been unique in one feature, *i.e.*, underground working, and it has clearly proven that underground working, or tunnelling and drifting, can be successfully carried on without timbering for the winter months, as they have already some 1,700 feet of underground workings, which are shown by the accompanying illustrations. The main tunnel on this mine varies in height from 17 to 28 feet, and with a general width of about 18 feet. The side drifts varying in heights from 16 to 24 feet and general widths of about 12 feet. This is the only asbestos property in which underground mining has been carried on to any extent, and the tunnelling and drifting of the past 18 months has developed workings fully equal to the main quarry, which has worked for the past 25 years, showing an amount of material which will last for many years to come. The main quarry of this mine is about 700 feet long by an average width of 250 to 300 feet; the Kings' Mine, which immediately adjoins the Bell Mine, has an opening almost equal to the Bell property, and the Johnson's Mine, south of the Bell property and immediately adjoining it, have two large pits which are nearly equivalent in size to the Bell pit. The depths on all three properties are about equal—200 feet from the highest point of the knoll on which the original discoveries were made.

The methods of mining are nearly identical in all the Canadian properties, and they are worked as ordinary open quarries with overhead cableway systems. In this short description of the properties at Thetford, we practically give a description of the works at Black Lake, Coleraine, Broughton and Danville

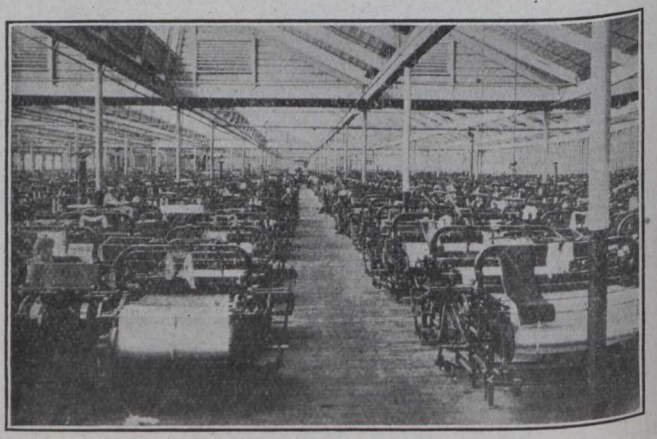
The methods of treating the ore in all cases are practically identical. After the rock is blasted, as much of the large seams as can be readily picked up in the pits are first gathered, sent to the cobbing houses for further treatment or clearing of any bits of rock that may be adhering to them. The larger pieces of rock are then block-holed and re-blasted, so that they may be all passed into an ordinary jaw crusher of large dimensions, from 12 x 20 inch to 24 x 36 inch openings. The treatment is a continuation of gradual reduction; the asbestos fibre being drawn off in the process and separated into different lengths, which give it its value. The value of the material is in the length of the fibre and its cleanliness.



ASBESTOS VEIN IN THE SERPENTINE ROCKS



MULE ROOM—SHOWING PROCESS OF SPINNING.



WEAVE SHED OF A MODERN MILL.

Much could be said in reference to the milling of asbestos and the treating of the fibre, but to go into it exhaustively would hardly be interesting to those not directly concerned in the business. The handling of the waste material or non-productive rock, is one of the large

problems in the mining of asbestos, which may be appreciated by the fact that to handle the waste material of the three large mines at Thetford 11 locomotives and over 300 five ton ore cars daily are required.

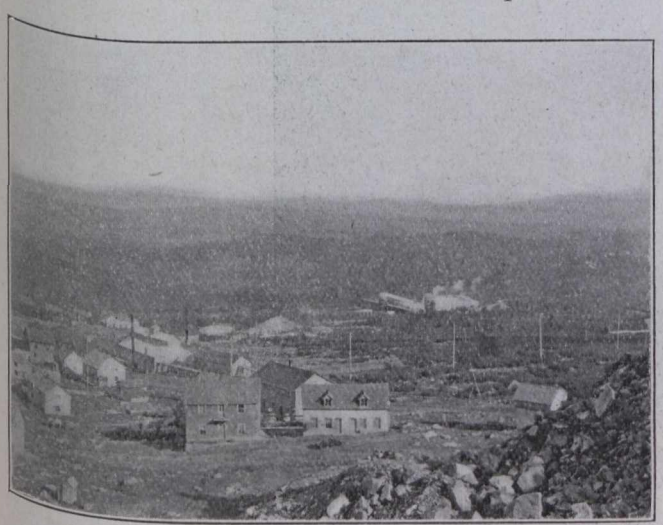
The number of men employed in the industry in Quebec is over 2,000, and the annual wage roll for 1907 will be very close to the $1,000,000 mark.

The increase in the industry is best demonstrated by the fact that in 1878 only about 400 tons of ore was shipped, and this containing considerable foreign matter, while in 1906 over 50,00 tons of asbestos of different grades were shipped and over 20,000 tons of asbestos, the latter being the refuse of the mills and principally used for wall plastering; and the output for 1907 will show a large increase over former years, but even so the demand is much larger than the apparent supply.

THE CANADIAN ASBESTOS INDUSTRY

By Fritz Cirkel, Mining Engineer, Montreal.

The asbestos industry of Canada has shown for several years past a steady, healthful progress, and it is fair to assume, judging from the present activity displayed, that this condition will not only last but that the future will see a still larger delelopment of the existing resources in the region generally designated as the Black Lake, Thetford and East Broughton areas. This is principally due to the increasing demand for the refined article in the United States and in European countries. Prices for the crude as well as for mill fibre have advanced all round, and some of the mines and mills are taxed to their utmost capacity to fill the present requirements. This caused several companies, especially those possessing the larger mines and mills, to enlarge their plants, and has also stimulated the demand for undeveloped asbestos properties in an exceptional degree. However, the number of promising undeveloped properties, unlike any other established mining district, is very limited; and as Canada is looked upon as the country which supplies asbestos for nearly the whole world, it is fair to assume that the future outlook for the companies at present operating in the district is indeed very encouraging. The only trouble experienced for the last year or two is the scarcity of men, and several of the larger concerns have been working with a crew far insufficient for the capacity of their respective plants. Wages have consequently advanced, and where a laborer several years ago was paid about $1.15 and $1.25 for a ten-hour shift, to-day $1.50 and in some mines even $1.75 is paid.



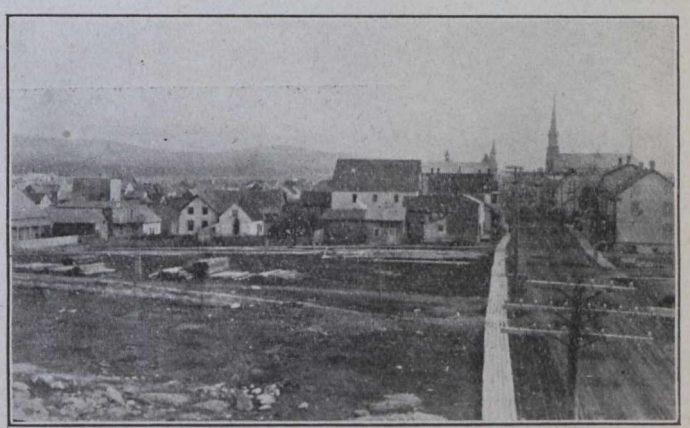
BLACK LAKE, P.Q.

Through the acquisition of several mines in Black Lake by American capitalists, this locality is displaying an activity never attained before. The American Asbestos Company, which put up a very elaborate milling plant several years ago at a cost of about $350,000, is employing about 240 men; in addition, the properties belonging to the Manhatten and the Glasgow and Montreal Companies have been acquired by the same company, and a crew of about 40 men is employed in these mines.

The Standard Asbestos Company is working at its full capacity; 45 men are employed, and the large pit, which now has been worked for a number of years, produces ore of an excellent quality.

The mill, which is located close to the mine, treats about 100 tons per day, and the fibre extracted is considered one of the best in the camp.

A part of the property belonging to the Standard Asbestos Company has been sold to American people, and the new company, the Dominion Asbestos Company, is putting up a large 300 ton mill, under the superintendence of Mr. Simpson.

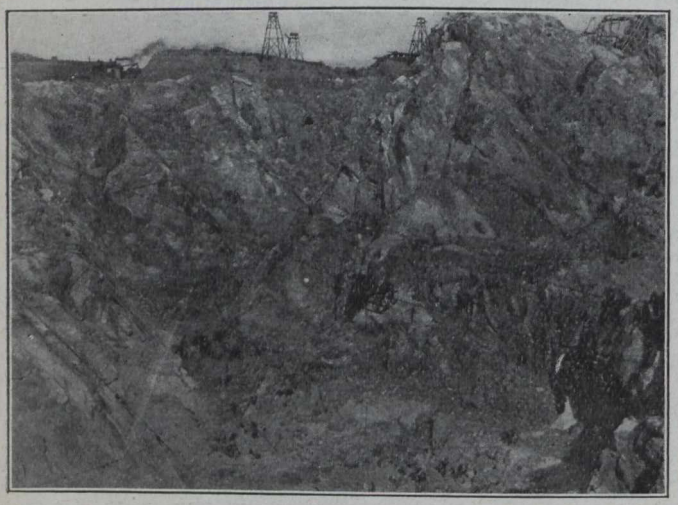


THE TOWN OF THETFORD, P.Q.

In Thetford an innovation has been made by Mr. George Smith, the manager of the Bell Asbestos Company, now controlled by capitalists of Ambler, Pa. An inclined tunnel has been driven, through which a direct rail connection is made between the large quarry and the mill. The entrance to this tunnel is located on the southern side of the Quebec Central Railroad track, and at a distance of about 800 feet from the big mill. It is intended to make this tunnel the principal part of a new elaborate haulage system to be installed at the mine; instead of the overhead cableways, the ore will be loaded in the pit directly into the large 3 ton dumping cars and drawn by machinery directly to the mill. It is claimed that a great saving is made in this way, obviating the necessity of hauling the ore twice. The tunnel penetrated some hitherto unexpected rich ground, and it is predicted that the same will form the main basis

for carrying on underground operations during the winter.

The Johnson Asbestos Company and the works of H. M. Whitney (formerly King Bros.' Mine), are working at their full capacity, while the Beaver Asbestos Company is working some very rich ground, recently discovered close to the old pit.



BIG QUARRY, BELL ASBESTOS MINE

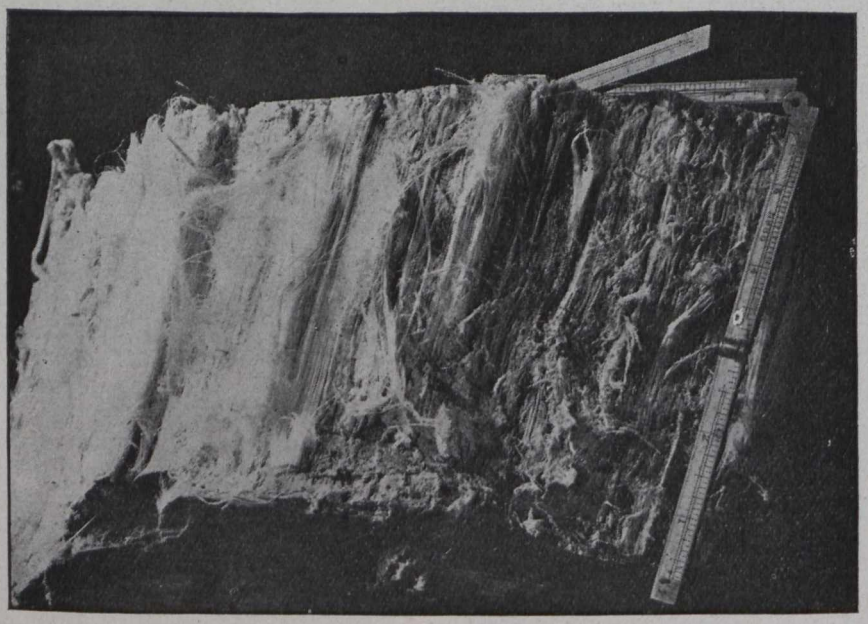
Dr. Reed, of Reedsvale, has been developing his mine on Lot 13, Range V., Township of Thetford. Asbestos occurs here on the slope of a hill; several test pits have been sunk in a light green serpentine, resembling that of East Broughton. A cut 160 feet long into the slope of the hill exhibits some very fine veins of asbestos, and several trenches indicate the extent of the serpentine formation.

Broughton serpentine is completely shattered, is softer and can be far easier mined. The asbestos here forms small gashy veins, along the cleavage planes, is sometimes crushed and drawn out and seems at places to be disseminated through the whole mass of serpentine. The fibre, though some of it is short, is an excellent quality, being when freshly broken of a grass green color. Occasionally fibre measuring 1 inch and 1 1-2 inch in width is found. This area is located at a distance of about 22 miles from Thetford station, to the west of the Quebec Central Railroad. There are only two companies working at the present time in this belt, the Quebec Asbestos Company and the Broughton Asbestos Company.

The main pit of the Quebec Asbestos Company measures 200 x 75 feet, with a depth of 45 feet. About 50 men are employed. At the present moment the company's entire plant is being overhauled; a new Campbell dryer is being installed and importantant improvements are made in the mill. The latter will have a capacity of about 150 tons in a double shift.

As the drying of the East Broughton ore is always a matter of vital importance on account of the large amount of moisture the rock contains, improvements have lately been made in the rotary dryer, usually employed for the purpose. The main tube of the Campbell dryer has a diameter of five feet and a length of 35 feet, and contains 5 smaller inside tubes parallel to the main axis. By a special arrangement at the feed end, each smaller tube receives its quota of ore for drying, and it is claimed that through the increase of drying space the efficiency is brought up to its maximum.

The Broughton Asbestos Company, which works a property close to the Quebec Asbestos Company, has suspended its mining and milling operations for the last three or four months. The original capacity of the mill was 125 tons per day, but by the additions now being made, about 350 tons can be treated. Four large rotary dryers, several new cableways, with all the necessary machinery are being installed, while a new tramway is being constructed to haul the ore from the pits located in the northeasterly part of the property to the mill. Mr. H. H. Williams is the general manager of this excellently handled mine.



CRUDE ASBESTOS

Special attention has been paid lately to the asbestos mines at East Broughton. This small detached area of serpentine is enclosed between a highly quarztose slate and greenish schists of Cambrian age. Its largest width is about 700 feet, and its general trend about 20 degrees east of north. In comparison with the serpentine of Black Lake and Thetford, which is very hard, the East

A mill with a capacity of about 200 tons is now being erected by Mr. Phillip Angers, of Beauceville, and associates, on the valuable ground located between the mines of the Broguhton and the Quebec Companies. Very fine outcrops on this property show the continuation of the asbestos-bearing ground opened up by the two companies above referred to, and there is every reason to suppose that this intervening stretch will carry just as rich ground as that worked by the neighboring mines.

There is a possibility that the mines formerly operated by the Glasgow and Montreal people will be worked again. This property adjoins the mine of the Broughton Asbestos Company to the southeast; mining was here carried on many years ago, and was confined to a peculiar vein, which was developed on the southeast margin of the serpentine close to the contact with the overlying schistose slates, which have at this place a dip to the southeast of 65 degrees.

The asbestos veins, which in places assume a thickness of 10 and 12 inches, follows a wall of soft talcose rock or soapstone from 12 to 14 inches thick. The quality of the veins is excellent; they split up sometimes into fine strings through the sepentine, and at other places uniting and forming a continuous lead. The shafts were sunk to a depth of 60, 62 and 75 feet respectively, following the slope of the soapstone.

On the east half of Lot 13, Range VI., Township of Broughton, the northeastern extension of the East Broughton serpentine belt, on which the Quebec & Broughton Companies are working, has been established by numerous outcrops and test holes, and it is likely that a company which is now being organized in Quebec will develop this property on an extensive scale.

The Danville area, located at a distance of 38 miles in a southeastern direction from Thetford, is showing its usual activity; the Danville Asbestos Company & Asbestic Company is the only company operating at present in this district. This company, with is magnificent machinery plant and miling appliances, is capable of mining and milling about 600 tons of asbestos rock per day, and is considered one of the largest asbestos operators in the Eastern Townships. The serpentine is of a very fibrous nature, like the East Broughton species, and for this reason delivers an excellent material for the manufacture of asbestic.

At a distance of four miles from the Danville mines, several locations have been made in the Township of Tingwick, Arthabasca County, apparently in the same serpentine belt. On one of them, Lot 21, Range 11, prospecting and development work have disclosed a number of promising asbestos chutes. On the bank of a small river quite a number of asbestos veins can be noticed; in an open cut about 50 feet long and 15 feet deep, almost at right angles to the river bank, veins of asbestos 1-2 inch and 3-4 inch wide are exhibited in a number of places, while in a pit not far distant, about 15 feet deep, the continuation of the asbestos-bearing formation is established.

The property adjacent to that above described has been opened up to a considerable extent by New York people; a small separation plant has ben erected on the premises, and the tests with the ore from this property

VEINS OF ASBESTOS—ASBESTOS AND ASBESTIC CO'S MINE DANVILLE P.Q.

are reported to have been so satisfactory that the option on the property has been taken up recently by the parties interested.

In conclusion it may be said that the asbestos industry of Canada is of special interest to the mining and industrial world from the fact that, in so far as is known, the asbestos areas of the Eastern Townships contain practically the only deposits, where the mineral of a quality adapted for spinning and for the finer purposes of manufacture can be mined and milled at a profit. So great are the advantages which these mines possess, particularly as regards accessibility and the ease with which the extraction of the fibre is now accomplished in the mills, that, unless fields as yet unknown and as easy of access can be discovered, the Province of Quebec will long enjoy the privilege of being the principal source of supply for this particular mineral, not only on the North American continent, but in the whole world.

As a result of the great activity in the mining of this mineral there are to-day sixteen mills in operation, three others are in course of construction, while one will be erected in the course of the coming summer. The total capacity of all these mills when completed will be in the neighborhood of 4,500 tons of asbestos rock per day, with an approximate output of 250 tons of mill fibre. Since the introduction of machinery into the separation methods, the production of the crude has lessened a great deal; the mines of Thetford, with their exceptionally rich ground, produce at present the bulk of the crude, while Black Lake contributes also to some extent towards the supply of this quality.

ECONOMIC MINERALS OF NOVA SCOTIA

Catalogue and description of a collection at the Dominion Exhibition, Halifax. Prepared under direction of the Department of Public Works and Mines by Harry Piers, Curator of the Provincial Museum, Halifax, N.S., -906.

In this pamphlet, Mr. Piers has collected and collated information about all the economic minerals of Nova Scotia. Facts and figures have been used with discretion, and we would strongly recommend perusal of this pamphlet to anyone who wishes to learn something of the remarkable extent and variety of the mineral deposits of Nova Scotia.

Meanwhile it is not unprofitable to glance hurriedly over the main features of the catalogue.

Coal.—For the calendar year 1905 Nova Scotia produced 5,279,621 long tons of coal, being over 60 per cent. of the entire coal output of Canada for the year.

Coke is manufactured at Sydney, North Sydney, Stellarton, Westville and Londonderry for use in the blast furnaces at Sydney, North Sydney and Londonderry. The Dominion Tar & Chemical Company, Sydney, obtains coal tar from the Dominion Iron & Steel Company, and manufactures refined tar, roofing cement, black varnish, crude naptha, light oil, carbolic acid, creosote oil, shingle stains of various tints, soluble disinfectant, roofing pitch, etc.

Gold.—The gold fields of Nova Scotia cover about 3,000 square miles, exclusive of the masses of intrusive granite. The gold-bearing strata, of Lower Cambrian age, have been folded into numerous anticlines and synclines, having a general east and west course and north and south dips. The gold-bearing quartz assumes the form of intercalated veins between the strata of the rocks. Denudation of the crowns of the anticlines often exposes long elliptical outcrops of the veins. Where the lower veins, untouched by denudation, pass over the axes of the anticlines, they thicken, forming "saddle backs."

Fissure veins, cutting the strata, also have been worked.

Alluvial gold is found in many places in Nova Scotia.

Nova Scotian gold has a fineness of over 900, and occurs largely as free gold in quartz, accompanied by sulphides of iron, copper, zinc and lead. Arsenopyrite is also a usual concomitant of gold.

From 1862 to 1905, inclusive, Nova Scotia has produced $15,859,345 in gold. This was obtained from 1,688,649 tons of quartz, being an average yield of 9 dwt. 22 grs. per ton., valuing the gold at $19 per ounce.

Antimony.—Stibnite, or sulphide of antimony, is mined at West Gore, in Hants County. It was discovered in 1880 on J. McDougall's farm. The ore occurs in two main fissure veins, called respectively the North and South veins. The North vein runs north 45 degrees west and dips 85 degrees to southwest, and has been traced for over 1,200 feet. It varies from a few inches to 7 feet, and has been solid stibnite in its widest part. The ore chute dips 45 degrees to the southeast. More or less gold is found in the ore, and it seems to be richest in that metal when the percentage of stibnite is high. The gold values vary from $200 per ton to $23. For a long time it was not known that the ore contained gold.

Graphite.—In some cases this mineral occurs in apparently workable quantities, but no attempt so far has been made to exploit the deposits. H. T. McDougall's property, near Christmas Island, Cape Breton County, showed:—

Graphitic carbon	50.23 per cent.
Rock matter	43.37 per cent.
Water	6.50 per cent.

Copper.—Native copper occurs at Cape d'Or in veins and joints in the triassic trap. Chalcocite, malachite, chalcopyrite and bornite are found in various localities in Pictou, Antigonish, Colchester and Inverness counties. The chalcopyrite usually carries gold and silver values.

Lead.—At Smithfield, near Upper Stewiacke, Colchester county, galena is found in carboniferous limestone, apparently replacing it in part and as a residual concentration from the removal of the rock. It is argentiferous. Certain limestones in Pictou, Colchester, Halifax, Guysboro', and in Cape Breton at Cheticamp, carry galena which is more or less silver-bearing.

Iron Ores.—Ores of iron are known in workable amounts in nearly every county of Nova Scotia. Magnetite, red hematite, limonite, ankerite, siderite, paint ores, etc., occur. At present mining operations are confined chiefly to the property of the Londonderry Iron & Mining Company, Colchester county, and to the Torbrook district, Annapolis county. Deposits are known at Clementsport, Clifton, Brookfield, Arisaig, East Bay, Boisdale, etc., etc.

Pyrite.—Large deposits of pyrite and pyrrhotite have been found in Cape Breton at George's River Mountain.

Tungsten.—Hübnerite, a tungstate of manganese, has been found near Emerald, Inverness county. Scheelite, or calcium tungstate, occurs in the Malaga gold district.

Hübnerite was discovered in 1898. It is distributed irregularly through a mass of grayish-white quartz weighing about a ton and a half, at the outcrop of a lenticular vein of similar quartz some 2 1-2 to 3 feet in width, cutting a red gneissic or granitic rock of pre-Cambrian age.

Manganese.—The ores of manganese found in Nova Scotia are noted for their purity. They occur in the limestone series of the carboniferous at a number of places in the Province. The best known locality extends from Tenny Cape to Walton, in Hants county. Here the ore has been worked at intervals for a number of years. At one time the price realized was as high as $130 per ton. The ore occurs in stringers and pockets in limestone at its contact with the underlying sandstone. Surface indications along the contact are extending over a large area, but little work is being done. Similar ores are met in Colchester county and in Cape Breton. Their value will be enhanced when railway communication has been improved.

One pocket of pyrolusite at Tenny Cape yielded over 1,000 tons of ore of exceptional purity. Pyrolusite is the prevailing form in which manganese is found, but psilomelane and manganite are also found.

Gypsum.—Deposits of this mineral are very abundant in the carboniferous limestones of the central, northern and eastern counties, and some of the beds are of great thickness. The principal quarries are operated near Windsor, Hants county. About 150,000 tons are exported to the United States annually.

Limestone, dolomite, and barite are of very frequent occurrence in various parts of the Province.

Diatomaceous Earth.—Deposits of diatomaceous or infusorial earth are common in lakes and swamps, and have been worked at Bass River, Colchester county, and at St. Ann's, Victoria county. It is used for polishing purposes, as a non-conducting material, for making soda silicate, and also as an absorbent in the manufacture of dynamite. The Bass River deposit is operated by the Fossil Flour Company.

Talc and Pyrophyllite occur in Cape Breton in commercial quantities.

Building Stones, such as sandstone, granite, limestone, metamorphosed slate, etc., are worked in many places. Several grindstone quarries are in operation.

Clay, Brick and Pottery industries are carried on in several counties.

Fire Clay, Moulding Sand, Roofing Slate and Pigments may also be mentioned.

Brine.—The Nova Scotia Oil & Gas Company borehole, Cheverie, Hants county, was put down to find petroleum. A large flow of brine was encountered.

The above gives but a scanty suggestion of the variety of Nova Scotia's mineral resources. Were a fraction of the money that is being flung freely to the vendors of worthless mining stocks to be diverted to the development of some of the deposits enumerated above, Canada would be richer by several new and successful industries.

REQUIREMENTS OF MODERN MINING

By J. R. Finlay.

(Reprinted from the *Mining and Scientific Press.*)

But neglecting questions that must become vital with our immediate descendants, it is interesting to consider the vast extent and variety of the mining industry as it stands to-day. The field is so great that it permits only of specialists. Does any one man know, in a practical way, the mode of occurrence of most of the valuable minerals? Does he know coal, iron, copper, gold, silver, lead, zinc, cement, precious stones, as they occur in the earth? If he does, can he possibly know the processes required to get them to the surface, and put them in marketable form? If he knows this, can he possibly know how to market them? If he knows all these things, will he then know how to finance and launch enterprises to exploit them?

We call a man a mining engineer if he can make an underground survey; a mining man if he owns some stock in a prospect. From these crude beginnings the experience of many individuals makes great advances, but it seems incredible that any intellect, or any energy, would be sufficient to get more than a thin comprehension of the vast subject.

I used to think I would be quite a mining man when I reached the position of superintendent of a property. Later I found that achievement to mean little. Success in handling one mine may be due to some quality that may be next to useless in the next one. At the first mine a man may need only operating talent—capacity to organize and get work out of men. At another, such ability may be absolutely unavailable, unless it be joined with intelligence and training in finding ore. As a man's experience in mining widens, he is constantly reproaching himself for want of knowledge on essential portions of the business, until he finally consoles himself with the reflection that if he had learned the things he doesn't know, he might on that account remain ignorant of the things he does know. At best, one's brain and one's opportunity have their limitations, and it does not take an intelligent man many years to convince himself that pretension to know the whole mining business can be nothing but a fraud, and the expectation to do so only a delusion. Nevertheless, if one may cover the requirements in the case of one or two metals, his equipment will be abundant to secure him his "shoes and tobacco"; and it may be of interest to discuss what these requirements are. I venture the following generalization:

The business of mining involves

1. Ore and mineral deposits.
2. Operation of mines.
3. Processes to render mineral products marketable.
4. Marketing.
5. Financing and organization of enterprises.

The first division is entirely in the realm of natural phenomena and facts. The second and third deal partly with nature in the handling of them. The fourth and fifth divisions are wholly matters of human dealings. It is rather painful to the striving engineer, after laboring over the science and technology of his profession, to find that after all he has been working on a small part of his business, and that the least important. In its broad aspects mining is far more of a question of human relations and facts, than of natural relations and facts.

Now it may be objected that this generalization is either self-evident or meaningless. I shall give an illustration to show how all these considerations must be weighed in the commonest problems of mine operation. At Joplin, Missouri, the ore consists of pieces of singularly pure galena and blende, distributed unevenly through the rock. If these ores could be sorted by hand, it would be easy to pick out stuff running from 30 to 60, or 70 per cent. in zinc or lead. Naturally it would be

desirable to do this, instead of crushing the beautiful crystals in a mill and thereby losing 20 to 50 per cent. of them. Why not do it? Simply because the market conditions at Joplin do not allow it. Local practice, too strongly intrenched for the small operator to interfere with, and doubtless founded upon good reason, dictates that a zinc ore must be cleaned until it carries about 60 per cent. zinc. Failure to bring the ore up to this grade is penalized so severely as to wipe out any possible profits in saving mill costs and losses by hand sorting. It is obviously impossible to depend on hand sorting to produce from a low grade mixture an ore that will conform to a rigid standard of value.

Here we see the human condition of marketing reacting imperiously on the method of mining. It makes a mill necessary, where under a different market it might often not be necessary. It throws the industry into a certain channel, out of which the operator cannot go without meeting certain failure. This consideration influences the view one must take of the value of a deposit, the method of mining, the requirements of milling, and, consequent on all these, the financing of a project.

In the Rocky Mountain region the smelter imposes no conditions except a freight and treatment charge, varying within modest limits according to the grade and composition of the ore. Here the question of what it is wise to spend on mining and sorting on the one hand, and how much to lose in a mill and how much to pay for freight and treatment, on the other, is a very broad one. It may be capable of many solutions, each of which may mean a different result in dollars and cents.

A gentleman in charge of a large and valuable group of silver-lead mines announced the other day, with breathless triumph, "I have raised my mining costs 10 per cent., raised the grade of my ore 25 per cent., and increased my profits 100 per cent., and, do you know, my directors are kicking about my high costs!" I submit that in this case millions of dollars in mine valuation depend upon a trick of mine operating. What a different view one would take of the property before and after the determination of the above results!

In like manner we hear of important interests in coal mining being rendered dangerous as investments, because the railroads will not furnish cars. Here the question is apt to be, not what kind of a mine have you, but, what are your relations with the railroad?

It is probably true that in the majority of cases the determination of trade and finance questions is left to specialists in those lines. Indeed, in any event, there must be questions of this kind that are as inherently the work of specialists as the work of an assayer or a machine-runner. My point is, that the mine manager or the mine valuer must be broad enough to recognize the fact that the man who sells ore, or buys ore, or promotes a scheme of mining enterprise, has just as much claim for recognition as a factor in the business as the mine superintendent or the metallurgical engineer. Perhaps far more. Reflect, that the men who now control the greatest enterprises are not mining engineers; they did not even begin as mine owners; they were business men whose business was refining oil and selling it, or financing smelting enterprises; they were men whose wits were sharpened by competition. There is not competition in the ownership of a bonanza mine. The owners are generally spoiled by having too much of a snap; they have not, as a rule, expanded to the true requirements of their business, and while hugging themselves for their success, they are really stagnating in a small corner of the field.

Much has been written about mine valuation, and mostly with a failure to recognize the full scope of the subject. Everyone knows that to take samples and measure the ore in reserve by some fixed rule, requires no more than honesty, care and some knowledge of solid geometry. That does not go far. The mine remains, and new ore is found after the ore once in reserve is gone. The geologist may go further and arrive at a correct conception of the persistence and extent of the mineralization, but does he know what the ore can be mined for? In many cases he does not know. The foundation is laid, let us say, that a million tons of ore may be relied on, carrying a certain amount of various metals. Still the valuation is only begun. The great problems remain of how it can be mined, how milled, how smelted, and how marketed at the maximum profit; and how may an enterprise be organized and financed so as to realize the maximum profit for the investor. I contend that the answering of these questions is by far the greater part of mine valuation. A mine may be a grand success, financed at $10,000,000, and a dreadful failure if financed at $5,000,000. Who will decide this? A man who can operate a mine? One who understands ore deposits? One who can operate a smelter? A man who can sell steel rails or cuff buttons? A man who can furnish the money? None of these. All of them together can perhaps; but very much better a man who can weigh with discrimination the evidence of each.

I venture to say that the men in this country who are able to bring to bear on a gold mine, or a copper mine, or a lead mine, such an equipment, and who have an opportunity to do it, may certainly be counted on the fingers of one hand. If these problems are so complex and far-reaching to-day, they are sure to be more complex and more far-reaching. What financing and what methods will be required twenty-five years hence, when the world will require several times the amount of mineral products it requires to-day! It is difficult to imagine, from present knowledge, how such vast demands are to be met. "Ore in sight" will not meet them. Scientific exploration and development, improved methods, the use of new materials to substitute those now in use, will all help. To do these things is a splendid field for good brains. It is a comfort to know that the business of mining is no fake, but a most essential—and perhaps the most distinctive—part of modern civilization. Many a young man now behind a tramcar, or a drilling machine, thinks mining a pretty tough business. So it is. So is war also a tough business. If war produced the greatest reputations, mining has produced the greatest fortunes of the world; and in both there is room for future Napoleons.

PEAT

The principal difficulty in the utilization of peat as a fuel for the various processes of manufacture, or for domestic purposes, is apparently the large quantity of contained moisture and the great difficulty experienced in its removal. This difficulty arises in large part from the porosity or springiness of the material, and many trials and experiments have been made by which this tendency to absorb moisture could be checked when once it had been eliminated. As a result of these, the plan of pulverizing the peat as it comes from the bog, drying it as rapidly as possible, and then solidifying it under great pressure, has been found to yield the most satisfactory results.

THE ANALYSIS OF SILICATE AND CARBONATE ROCKS.

By W. F. Hillebrand, Bulletin No. 305, United States Geological Survey.

This bulletin so thoroughly covers the ground outlined by the title that it could very appropriately be termed a manual.

Dr. Hillebrand, in his introductory remarks, dwells upon the small amount of energy devoted to mineral analysis as compared with the enormous volume of work spent upon the organic field.

To more strongly emphasize the importance of completeness in analysis, Dr. Hillebrand cites a few facts, deduced from hundreds of rock analyses. The existence of small percentages, usually not over 0.1 per cent., but sometimes much more, of barium and strontium in the igneous rock of the United States and in their derivations, has been conclusively proved. The amount of barium is almost always in excess of that of strontium; and the igneous rocks of the Rocky Mountains show far higher average percentages of both metals than the rocks of the eastern and more western countries. "Surely," says Dr. Hillebrand, "this concentration of certain chemical elements in certain geographic zones has a significance which future geologists will be able to interpret if those of to-day are not." Continued investigation has thrown much light on the distribution of vanadium and molybdenum.

A particularly pointed exemplification of the benefits of complete analysis is given on page 19. By invariably looking for sulphur in rocks, even when no sulphides were visible to the eye, Dr. Hillebrand found that it is almost always present. This demonstration clears up the mystifying disparity between results of ferrous iron determination obtained by the Metscherlich and the hydrofluoric acid methods. Sulphur can almost always be detected in 2 grams of rock powder. Almost all rocks and many minerals carry pyrite or pyrrhotite in considerable amount or in traces.

The thoroughness of the United States Government Laboratory work is shown by the care with which every step in the preparation of samples is investigated. For rock analysis, 20 grams is recommended as a suitable quantity for fine grinding, and agate mortars are preferable to glass or steel. The limits of error in summation of analytical results are set by the total figures, 99.75 and 100.75.

SOME PRINCIPLES OF COAL WASHING

WRITTEN FOR THE CANADIAN MINING JOURNAL.

The great majority of North American coals are fit, as mined, for steam-raising and general purposes. Many of them, however, contain sufficient impurity to render incompatible with the highest economy, or even commercially impossible, their immediate employment in metallurgy. Others, notably certain European coals, contain, for practically all purposes, prohibitive amounts of impurity. Relatively few, and quite inadequate to the enormous demand, are those which, as received at the mine bankhead, can be converted forthwith into coke meet for the ironmaster's use; and hence arises the necessity for the coal-washer, which we shall here consider exclusively as the sentinel of the blast furnace.

What are the impurities, whose presence in excess unfits a coal, otherwise suitable, for the manufacture of blast furnace coke? What constitutes an excess? Can this excess be economcially removed? There are the questions which, answered in the light of local and prevailing conditions, determine the attitude of the blast furnace superintendent toward any coking coal.

I.—Impurities in coal may be classified as:—

(a) Innate.
(b) Sedimentary.
(c) Infiltrated.

Innate impurities are chiefly such percentages of silica and alumina as, originally present in the ash of the parent plant, have persisted in the coal. They seldom constitute less than 2.00 per cent. or more than 4.00 per cent. of any coal. In very rare instances they represent the total impurity.

Sedimentary impurities are chiefly slates, shales, and clay stone, formed by compacted layers of sediment deposited from surface waters during the accumulation of a coal-forming vegetable debris, or during short periods of submergence, followed by emergence, and further vegetable accumulation.

These processes result variously in the interpolation in the coal seam of layers of slate, splint, or bone coal, according to the distinctness and relative thickness of the successive deposits of organic and sedimentary materials.

Under this head come also such fragments of roof or pavement as have become mixed with the coal in mining.

Impurity from this source will be slight in a hand-pick mine, but may become excessive where coal-cutting machines are employed.

Infiltrated impurities are those which have been deposited in the bed of vegetable debris, after its formation, from either suspension or solution in the percolating water; *e.g.*, calcite, baryta, iron oxide, phosphates, arsenides, etc., and notably sulphur, which usually occurs in one or more of three forms, viz.:—

1. Sulphides, chiefly sulphide of iron or pyrite.
2. Organic sulphur.
3. Sulphates, chiefly sulphate of lime, or gypsum.

Pyrite is formed by the reduction of ferrous sulphate in the percolating waters, or by the action of sulphuretted hydrogen in those waters, on ferric hydrate previously precipitated. Pyrite occurs as pseudomorphs, balls, lenses, plates, crystals and scales.

Under organic sulphur we include a number of imperfectly understood compounds of sulphur with carbon, hydrogen, oxygen and nitrogen, formed by the direct action of sulphuretted hydrogen on the decaying vegetable matter.

Sulphates are not so commonly met with, but both pyritic and organic sulphur co-exist in greater or lesser amounts in nearly all coals. As will presently appear, the distinction between the organic and pyritic forms is of gravest import in coal-washing.

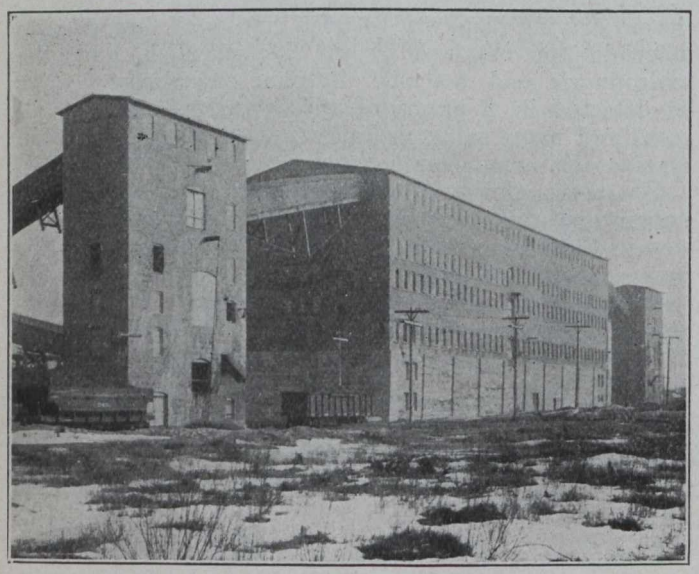
The most usual test for impurity in coal is a simple determination of ash and total sulphur. The ash includes all silica, alumina, iron, lime, magnesia, phosphates and other earthy matters present in the coal. In the absence of notable quantities of phosphorous or arsenic, such a test suffices. If there be a washing problem on hand, pyritic and organic sulphur must be separately determined.

To appreciate the effect of the various impurities in the blast furnace, we must briefly trace their history in the coke oven. Here we find:—

1. That all the ash of the coal, and practically all sulphur present as sulphate of lime, barium, etc., are retained in the coke.

2. That all pyrite is broken up according to the equation $FeS_2 = FeS + S$; half of the pyritic sulphur remains in the coke, and half passes off with the volatile matter.

3. As to the organic sulphur, authorities disagree. Some maintain that it practically all remains behind in



General view of Coal Washer, Dominion Iron and Steel Co., Limited Sydney, N.S.

the coke. On the other hand, it is averred by others that all such sulphur is volatile. It is probable that neither of these contentions is wholly correct in any instance.

A. L. McCallum, in a paper recently read before the Dalhousie Journal Club, of Halifax, described some experiments performed by him upon certain Cape Breton coals. His work clearly shows that, at least in the case of the coals in question, a part of the organic sulphur is always volatile; that, as the percentage of organic sulphur increases, its volatility also tends to increase, that the proportion of it volatilized is practically never more than one-half, and nearly always much less than this.

It is customary, in practice, to assume that half the coal sulphur persists in the coke, for the reason that no coal containing more than very small percentages of organic sulphur is ever used in the coke oven.

Keeping this in mind, we obtain, by means of a crucible test, the approximate coke yield of the coal under consideration, and from the percentages of ash and sulphur in the latter we calculate the ash and sulphur content of our coke.

II.—The question as to what constitutes an excess of coal impurity can now be answered by a similar inquiry regarding coke. The ideal coke would contain neither sulphur nor ash. Such a coke is, of course, not commercially available.

As to what constitutes a prohibitive percentage of ash, two facts must be borne in mind; that increment of silica and alumina in the ash requires a corresponding added increment of flux and fuel in the blast furnace, and causes a proportionate increase in the ratio of slag to iron produced; and that all ash, whatever its analysis, is a diluent—it decreases the calorific power of the coke, and, moreover, eventually weakens the coke structure. The whole question is one of economy. A blast furnace is nearly always located with reference to a definite ore supply. Flux of reasonable purity is so widely distributed that it is seldom a determining factor in the calculation. The furnace, then, must be viewed as a producer of iron and slag. The quantity of impurity in the ore is fixed; local conditions will largely determine the economic limit of the slag—iron ratio; and from these data, and a consideration of the sulphur content of the charge, the maximum amount of coke ash permissible in any case may be calculated. Only under the most favorable conditions can a coke with much over 11.00 per cent. be economically employed.

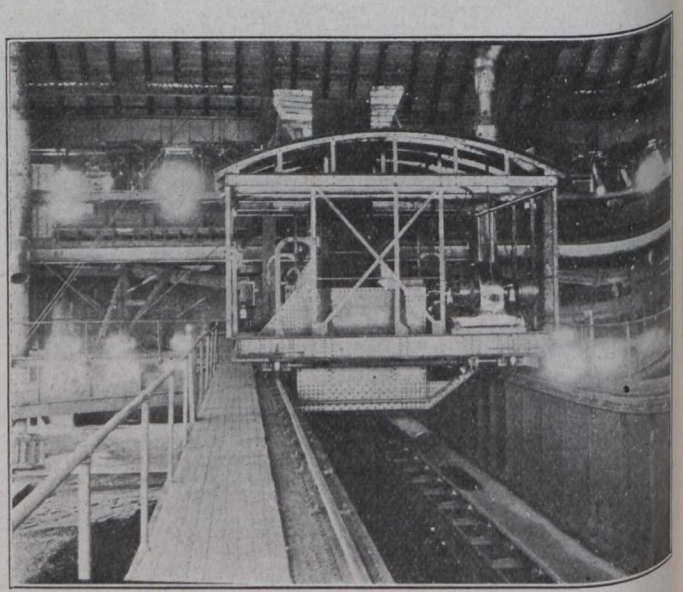
The limit of sulphur, the "blower's bane," is easy to define. A discussion of the deportment of this element in the blast furnace would lead us too far from the subject in hand. Suffice it to say, that it would be below 1.00 per cent., the farther the better, and should never exceed 1.50 per cent.

III.—Experiments made upon coke with a view to reducing its sulphur content have proven signal failures, as perhaps might have been anticipated. We therefore return to a consideration of the coal.

All coal-washing operations are more or less elaborate forms of gravity separation, and depend directly upon differences in specific gravity between coal and its associated minerals. To illustrate: Suppose that we have for examination a one-ton sample of mine-run coal, whose suitability for metallurgical purposes we desire to ascertain. We find that it contains pure coal, bone coal, slate and pyrites. We make several careful determinations, and find that the average specific gravities of these various constituents are, in our particular sample:—

Pure coal	1.29
Bone coal	1.50
Slate	2.43
Pyrite	4.90

The impurities appear, perhaps, to be very intimately associated with the coal; moreover, some of the bone coal



Washed Coal Elevator. The suspension rods and [illegible] of tables appear in the upper background. Dominion Iron and Steel Co., Limited, Sydney, N.S.

can be differentiated into more or less pure coal, and more or less carboniferous slate. We therefore crush our sample so that it wholly passes a three-eighth inch screen, or to whatever degree of fineness may be necessary to unlock the impurities. From this ton lot of

crushed coal we select a four or five pound representative sample, weigh it carefully, and place it in a two-thirds gallon cylindrical jar, preferably of glass, which has previously been almost filled with a calcium chloride solution of density slightly greater than that of the pure coal and less than that of all the other constituents (e.g, of 1.30 sp.g). We briskly stir the contents of the jar, and allow to settle. The sample is now found to be

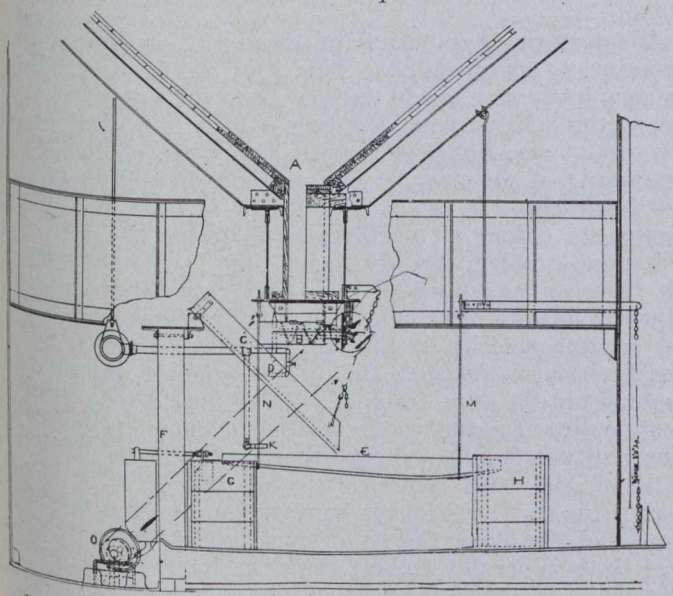


FIG. 1. GENERAL ARRANGEMENT OF CAMPBELL COAL WASHER.

sharply divided into two main portions. All particles of a specific gravity less than 1.30 have floated, while all particles heavier than this have gone to the bottom. Between these two layers there remains suspended in the solution certain particles, negligible in aggregate, whose specific gravity is about 1.30.

Floating and sinking portions are separately removed, placed on draining cloths, washed free of calcium chloride, dried, weighed, and analyzed for sulphur and ash. From the data so derived we calculate the purity and yield of the floating portion, or "washed coal," obtainable from the original lot of mine-run coal. This is the simplest and most effective coal-washing operation that can by any means be performed.

The results of such an experiment determine absolutely for any coal the maximum purity of the washed coal obtainable from it by any process whatsoever. Two very obvious inferences give us at once the answer to our third question.

(a) Only such impurities can be removed as are capable of being disassociated from the pure coal by crushing or other mechanical means.

(b) Any impurity whose specific gravity is not materially greater than than of the pure coal will inevitably persist in the washed coal.

Referring now to the various coal impurities already described, it is clear (1) That innate impurities can never be washed out. Therefore, as a very general rule, washed coal must contain at least 2.00 per cent. of ash. (2) That all sedimentary and infiltrated impurities, being heavier than the coal, are removable to just such extent as they can be differentiated by disintegration. (3) That organic sulphur, which is held in combination in the coal proper, and whose compounds are of like density with the coal, cannot be removed by any washing process. In view of this, the importance of a knowledge of the nature of the sulphur content becomes too obvious to need remark. Thus much for qualitative results.

In describing the calcium chloride experiment, we assumed the dividing line between constituents of different gravities to be sharply drawn. Though this in many cases is reasonably near the truth, it not infrequently happens that, however thorough the disintegration, there remain many particles, which are mixtures of coal and impurity in all proportions, so that there are representatives of every degree of specific gravity between that of pure coal and that of slate. Such particles all sink in a solution of 1.30 sp.g., and much good material is thereby lost in the "sludge." If we substitute a solution of 1.35 sp.g. many of these mixed particles rise to the surface and become washed coal; and we thus get increased yield, with decreased purification. In the same way, if the density of the solution could be definitely raised, we might go on obtaining progressively greater yields of continually diminishing purity until, with a yield of 100 per cent., the whole sample floated and the purification became nil.

However pure it may be, unless the floating portion constitutes a reasonable percentage of the raw coal, the economy of the process becomes doubtful. In the case of coals, therefore, whose impurities can not be sharply differentiated, it may be advisable to sacrifice quality to quantity to an extent which, for each separate instance, must be determined by the economic conditions. These remarks, be it well understood, apply strictly to ash, and then only within very narrow limits.

With sulphur, there must be no compromise. As a matter of fact, sulphur, if removable at all, is usually easily and economically removable, and calls for no compromise.

Unfortunately, the calcium chloride separation, though a beautiful laboratory method, and invaluable as a sure indication of the possibilities of a coal, is too slow and costly to be commercially applicable. Some cheaper and more practical separating medium must be substituted, and we find that water is almost universally employed in this capacity Air has also been utilized to a limited extent. Water being less dense than coal or any of its

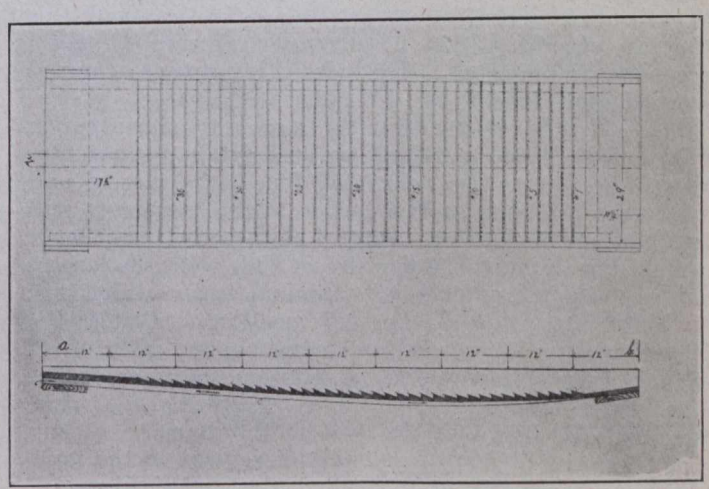


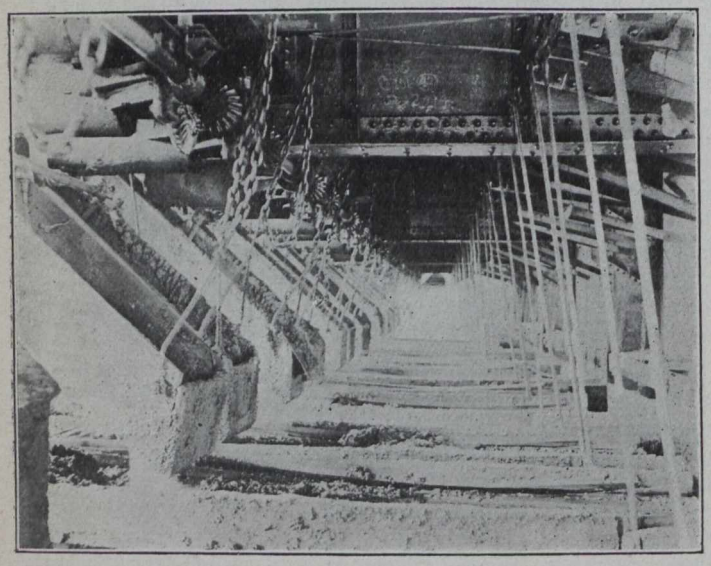
FIG. 2. CAMPBELL TABLE PLAN AND SECTION.

ordinary impurities, does not give, like calcium chloride solution, a positive separation of the constituents, but, since all particles sink, a relative separation, depending upon the different rates of fall of the heavier and lighter particles.

Laws of Settling.

The rate of fall in water, *i.e.*, the "settling velocity" of any particle, depends upon its gravity and upon its size and shape.

I.—Of two particles of the same size and shape, the heavier will settle faster than the lighter; consequently, if a number of fragments of pure coal and slate, of identical size and shape, be simultaneously dropped into a



GENERAL VIEW OF CAMPBELL COAL WASHING TABLE.
Dominion Iron and Steel Co., Limited, Sydney, N.S.

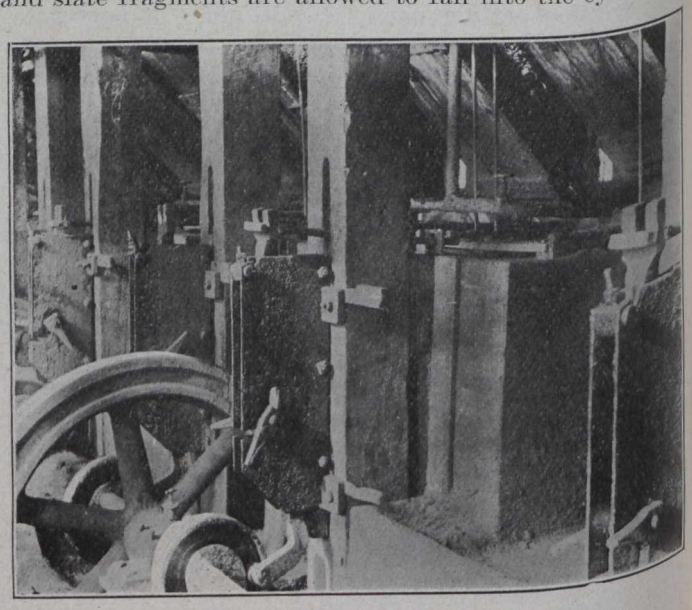
very tall, narrow cylinder of water, the slate reaches the bottom first, and the pure coal last. We have thus obtained a separation according to settling velocities, *i.e.*, according to specific gravity, since the shape and size of all the particles is the same.

II.—Of two particles of the same specific gravity, but of different diameters, the particle of greater diameter has the higher settling velocity. If we repeat the settling experiment, using mixed sizes of slate alone, the largest slate particles will be found to constitute the bottom layer, and the smallest the topmost layer Between these fall the intermediate sizes. Here again we obtain a separation according to settling velocities, and this time the specific gravity of all particles being the same, according to diameters. The same thing is true of mixed sizes of coal alone.

III.—If now we perform the same experiment upon mixed sizes of coal and slate, we still obtain a separation according to settling velocities, but both gravity and size come into play. The largest slate fragments will be found on the bottom. On top of these will be a layer comprising the next smaller size of slate with the largest size of coal, and so on to the topmost layer, which will be found to consist of the very smallest coal particles. However often we repeat this operation, the make-up of each horizontal layer, and its relation in space to the other layer, will in every case be practically the same. We shall also find that the ratio of the diameter of any coal fragment to that of any slate fragment in the same horizontal layer, or, as it is called, the "settling ratio," for these two minerals, is approximately constant for all layers. What has been said of coal and slate applies in the same way to coal in relation to any other impurity that is mechanically separable from it, the settling ratio being greater or less, as the difference in specific gravity which just pass the same screen the round fragments increases or decreases. We therefore generalize as follows:—All particles of the same settling velocity will be found in the same horizontal layer. Of two particles with the same settling velocity, that with the higher specific gravity is of smaller diameter than the other. The ratio between these two diameters, *i.e.*, the settling ratio, is, for any two minerals, constant under the same conditions. With regard to shape, of a number of fragments settle first, the longish ones next, and, last of all, the flat ones.

What is the significance of these settling laws with reference to coal-washing? This: Our task is to separate as completely as possible the coal from the slate or other impurities. From what has been said it is evident that we cannot accomplish this with a mixture of raw-coal fragments of all sizes by any method depending upon settling ratios. It is not possible, or at least not practicable, to reduce all particles to the same size, and so bring our problem directly under Law I. What we can do, however, and must do, to secure reasonably perfect separation, is to screen the coal into fractions such that the settling velocity of the largest coal particle, in any one fraction, is less than that of the smallest particle of impurity in the same fraction. Unless such screen classification precedes the water treatment, complete separation will not be effected. Obviously, the lower settling ratio of coal with reference to any impurity, *i.e.*, the nearer the gravity of such impurity approaches that of pure coal, the closer the sizing must be. Whereas, if the coal be considerably lighter than the lightest impurity, less sizing is called for.

The settling laws are still more strikingly and practically exemplified by means of a "sorting column." This, in its simplest form, is an upright glass cylinder having an inlet at the bottom, through which a gentle current of water at constant pressure is admitted. Coal and slate fragments are allowed to fall into the cylinder



Rear view of Washing Tables, showing spray pipe, false bottom, sludge receiver, bumping post, cam and bumping device. Dominion Iron and Steel Co., Limited, Sydney, N.S.

against this rising current, "the velocity of which" (Richards' "Ore Dressing") "is much less than the free-falling velocity of the particles, but yet enough so that the particles are in motion. Every particle in the mass is poised in the upward-moving water. If a grain above has a greater settling power, it quickly gets below. If one below has less, it quickly rises." The result is a series of layers, arranged similarly to those obtained with

the settling tube. Moreover, so positive is this arrangement that if any particle, having found its own level, be, by some external force torn from its own little colony of co-settlers, it will, when released, return to practically the same group as before. Particles freshly added to a column already so arranged speedily find their proper horizon as demanded by their settling velocities.

A comparison of the layers from such a sorting column, with those obtained from the same coal mixture by means of the plain settling tube, discloses the fact that the coal particles co-existing with a given size of impurity in the sorting column are uniformly of much greater diameter than those consorting with the same size of impurity in the settling tube. In other words, the sorting column gives much higher settling ratios than the settling tube does. This remarkable state of affairs has been shown to be due to the fact that the conditions obtaining in the settling tube are those known as "free settling," *i.e.*, every particle falls independently of all the others, whereas, in the sorting column, the particles are crowded together and each must settle issues, not only with the water, but with its neighbors as well. This crowded condition is described as "hindered settling." Hindered settling owes its superior effectiveness to certain phenomena connected with interstitial fall, which need not here be gone into.

It should be remarked that if the water current of the sorting column be made strong enough to carry the coal particles over the top of the cylinder, and allow only the slate to remain behind, the conditions become those of free settling.

All settling phenomena, as already intimated, are dependent essentially upon gravitation, and the path of the particles through the water is essentially vertical. The same general principles obtain equally when the particles are projected in a horizontal direction through the separating medium. To quote once more from Richards, "when a particle is given a high velocity in a horizontal direction, its path is called its trajectory." Of two particles of the same size and shape, the heavier will have the longer trajectory, and of two particles with different gravities but the same trajectory, that with the higher gravity will be of smaller diameter than the other.

The laws of horizontal travel are exemplified in the bumping table, long used in ore dressing, and more recently introduced, and with great success, in coal-washing.

We shall now briefly consider the practical application of the principles already outlined.

All washing processes must be preceded by a sufficient degree of crushing to unlock the impurities. Insufficient crushing causes a decrease in both yield and purity of washed coal, since larger coal fragments will buoy up small adherent masses of impurity, and, conversely, much pure coal will be dragged down by preponderance of associated heavy material. The general character of the coal and the distribution of the impurities must for each case determine the desideratum in the matter of size. On the other hand, undue pulverization diminishes the purity of the washed product, and should be avoided.

The importance of properly sizing the crushed coal previous to washing has already been touched upon, and from what has been said of settling ratios it will be gathered that closeness of sizing is governed by the nature of the impurity. For pyrites alone, we need not screen very closely. The same is true, in lesser degree, of slate. Thus, the coal-washing plant of the Nova Scotia Steel & Coal Company, Limited, at Sydney Mines, N.S., using Luhrig jigs, lowers the ash in one grade of slack from 13.00-14.00 per cent. down to 3.5-4.0 per cent., using only three sizes—all under 3-4 inch mesh. This they are enabled to do because their ash is almost wholly derived from a good free slate.

On the other hand, the *School of Mines Quarterly*, Vol. XVII., No. 4, describes a Mexican plant where the best results are not obtained until six sizes are made, viz.:—0 to 1-16 inch, 1-16 inch to 1-8 inch, 1-8 inch to 1-4 inch, 1-4 inch to 3-8 inch, 3-8 inch to 1-2 inch, and 1-2 inch to 3-4 inch. The impurities in the coal operated upon are so interwoven that there are present in the crushed coal particles of all degrees of gravity. Hence the settling ratios are small, and this close sizing is necessitated.

The various existing types of crusher and screen need not here be touched upon. Nor need we repeat the elaborate descriptions of the different coal-washing machines that have from time to time appeared in industrial journals. Each manufacturer naturally claims the palm for his machine, and can usually furnish columns of figures showing the results obtained by it in actual practice. These representations are in most cases, doubtless, fair and correct; but it is to be regretted that they are so seldom accompanied by adequate information regarding the character of the coal operated upon. It should be remembered that for every seam of coal there are certain possibilities as regards purification; that these possibilities, both qualitative and quantitative, can be accurately and positively determined by a series of calcium chloride separations, without the expenditure of a single dollar for coal-washing machinery; that a good washer should come only a little short of maximum possible purity as determined in this way, and that the best machine made can not surpass it.

Coal-washing devices employing water as a separating medium—not including elutriators—may be classified as follows:—

A. Surface current washers.
   1. Water stirred.
      (a) Intermittent, *e.g.*, the simple trough washer.
      (b) Continuous, *e.g.*, the Elliot trough washer.
   2. Mechanically stirred.
      (a) Intermittent, *e.g.*, the Scaife trough washer.
      (b) Continuous, *e.g.*, the Campbell bumping table.

B. Hydraulic washers.
   1. Continuous current, *e.g.*, the Robinson washer.
   2. Pulsating current, *e.g.*, all forms of jig.

The trough washer represents the most elementary effort to purify coal. It is simply a long inclined wooden trough, with perpendicular sides and a flat bottom, across which cleats are fixed at regular intervals. Water and coal are supplied together at the top of the trough. Impurities sink and are caught on the cleats, or "riffles." The water current, regulated by the inclination of the trough, carries the pure coal on over the lower end. At stated intervals operation must be stopped, or the flow of coal and water deflected into a second trough, while the riffles are being scraped out. Such an arrangement, when carefully and honestly tended, has been known to give admirable results.

The Elliott trough is similar in principle, but the fixed riffles are replaced by an endless chain of movable riffles, or rather scrapers, travelling from bottom to top of the trough. The water is admitted at the upper end, and the coal at a point midway between top and bottom. The pure coal is carried over the lower end as before, while the dirt is carried over the head of the trough by the scrapers.

The Scaife trough is an inclined trough of semi-circular cross section, two feet in diameter and twenty-four feet long, with fixed transverse riffles. The trough is longitudinally traversed by a rocking shaft carrying stirring fingers, which aid the water in agitating the coal and settling the impurities. When the riffles are full, coal and water are stopped, the trough is dropped from one side and the refuse dumped. It is then swung back into place, and operation resumed.

The Robinson washer is a wrought iron vat, in the shape of an inverted cone. Vertically in the centre of this vat stands a shaft carrying four stirring arms, whose field of revolution occupies the upper part of the vat. A continuous stream of water under considerable pressure is admitted at the bottom. Coal is fed into the open top. The slate sinks, and is discharged from time to time by means of a pair of sliding gates. The clean coal is carried over the lip of the vat with the water.

It will be observed that all types so far described operate for the most part on a free settling basis.

Under the jigs we include all machines in which the segregation of the heavier and lighter particles is accomplished by a pulsating current of water. The most rudimentary form of jig would consist of a box, with screen bottom and open top, sliding freely, with a minimum clearance upwards and downwards in an outer box filled with water. Coal, screened to the desired size, is charged into the inner box, which is then moved sharply downwards and upwards in the water by means of suitable cranks and driving rods. On the down stroke the water from the outer box rises through the screens and forms a sorting column, in which the coal and impurities are arranged according to their several settling ratios under hindered settling conditions. This phase is known as pulsion. When the inner box is raised again the water retreats from it, giving rise to the alternate phase of suction (which, by a suitable arrangement of valves, may be replaced by an interval of rest). If now we steadily supply raw coal to one side of the inner box, and continue the alternations of pulsion and suction, the operation becomes a continuous one, the pure coal is crowded over the lip of the inner box on the side opposite to the feed side, while the slate may, in any one of several ways, be continually removed from the bottom. Exactly the same result may be arrived at by fixing the sieve and causing the water to pulsate by means of a suitable arrangement of plungers. Numberless varieties of jig, mainly of the fixed sieve type, are manufactured and successfully employed in coal-washing. The most important differences are in the control, in the manner of removing the sludge, and in the arrangement of the jig bed, both in itself and with reference to the other beds. They are all only more or less complicated exemplifications of the laws of hindered settling.

Any size of particle may be treated in a jig, always provided, of course, that the particles jigged at the same time are of the uniformity prescribed by the settling ratios. For large fragments, a long, slow stroke is required; for smaller ones, a shorter, quicker stroke, *e.g.*, for coal passing a 1 1-2 inch screen and stopping on a 1 inch screen, 60-90 alternations from 2 inches to 3 inches in length are necessary per minute, while for sizes from 1-16 inch to 1-8 inch, about 140 alternations of a length from 3-8 inch to 1 inch would be required.

It remains now to describe the Campbell bumping table, a coal-washing device which, in seeming contradiction of all that has been said of the laws of settling, completely does away with the need for preliminary sizing. The contradiction, however, will be seen to be apparent only.

The *modus operandi* of the Campbell table will perhaps be best explained by a reference to the coal-washer of the Dominion Iron & Steel Company, Limited, of Sydney, N.S., where this type of washing machine has been successfully employed since September, 1904. The first of the accompanying illustrations shows the washery building, with the breaker towers at either end. Each tower contains a Bradford breaker and a roll crusher. The Bradford, as here installed, consists of two concentric drums, revolving about a horizontal axis. The inner drum is a screen, eight feet in diameter, and cylindrical in shape. Its meshes are one inch square. The outer drum has from feed to discharge end a gradually increasing diameter, with a mean of eleven feet, and is perforated with 3-8 inch round holes. The interior wall of the inner drum is provided with cast iron fingers, arranged in spiral rows. Mine-run coal, conveyed by belt from the receiving bins to the top of the tower, is fed into one end of the inner cylinder. As the breaker revolves, the pure coal, completely shattered by its own fall, passes wholly through the inch screen into the space between the two drums. All coal stopping on the 3-8 inch round holes is sent to the rolls, which are set at 1-8 inch, and thence to the washer bin. All coal passing the 3-8 inch holes goes to the washer bin direct. The larger fragments of slate, splint and pyrites, on the contrary, remain for the most part unbroken, and, aided by the arrangement of the cast iron fingers, are presently shot out at the discharge end of the inner drum as "breaker coal." The breaker, therefore, besides disintegrating and to a certain extent classifying the coal, effects a preliminary purification which is a very valuable adjunct to the washing.

Thus, a coal of the character operated upon at Sydney, contains as it enters the breaker, perhaps 6.50 per cent. ash and 2.50 per cent. sulphur. It leaves the breaker tower as a crushed coal, with perhaps 5.00 per cent. ash and 2.00 per cent. sulphur.

This is one of the reasons why mine-run coal is preferred in such instances to bankhead slack, which, besides containing higher initial sulphur and ash, cannot be benefited by the breaker, but must go straight to the washer without preliminary purification.

The washer proper comprises two independent units, each consisting of a battery of 24 bumping tables, arranged side by side, in line—a crushed coal bin extending over the entire length of the battery—water tower, sludge tanks, two concrete draining bins for washed coal, washed coal elevator, and conveying belts and accessories. Each unit is fed from its own breaker tower, and has a capacity of about 100 tons of washed coal per hour. A fair idea of the operation is given by Figures 1 and 2, which, although diagrammatic, are reasonably accurate as to scale.

E.—Fig. 1—is the table proper, shown in more detail in Fig. 2. The table is suspended from two pairs of rods, N and N, so that it swings freely in a practically horizontal plane in the direction of its long axis; and, being actuated by the cam arrangement O, is caused to bump against the post F.

The crushed coal falls steadily from the bin A through a vertical chute to the screw conveyor B, which delivers it into the trough C. The coal feed is controlled by the speed of the screw conveyor, and by a sliding gate in the chute just above B. In the trough the coal meets a stream of water from the supply pipe D, and, thoroughly mixed with it, falls upon the table. The water supply is further augmented by the spray pipe K, which, by means of a deflector, throws a fan-shaped stream across the width of the table.

The table is just sufficiently inclined towards the coal receiver H to determine the water wholly in that direction, but not enough to enable the water of itself to carry the coal over with it, *i.e.*, if the bumping stops the water still flows to H, but the coal settles on the tables. The bumping of the table against F throws all the heavier particles of impurity, against the water current, towards the sludge box G. At the same time, at every bump, the water on the table is carried backward, part of the way towards the sludge end, stirring the coal thoroughly, and on its return flowing over the coal end in sufficient volume to carry the pure coal with it to the receiver H, whence it is conveyed in sluices to the draining tanks.

These broad statements regarding the performance of the table upon material not closely sized will now be gone into a little more fully. The table (Fig. 2), which may be considered as a trough of varying depth, with perpendicular side walls and open ends, is 29 inches wide and 9 feet long. Beginning at the right hand (which in the sketch is the washed coal end of the table), is a tail board 10 1-4 inches wide, whose length is the width of the table. This is followed by 37 riffles, of the form shown in the longitudinal section (Fig. 2). The body of the riffle is of wood, with a projecting edge of galvanized iron. Following the riffles is a head board, 17 1-2 inches wide. Riffles Nos. 1-29, inclusive, are open riffles, *i.e.*, they are set about 3-32 inches apart, leaving between each riffle and its neighbor a slot which communicates with the space between the bottom of the riffle, and the false bottom C, of galvanized iron. This space, as shown by the arrows, opens on the sludge end of the tables. Nos. 30-37 are closed riffles.

The rationale of the operation is as follows: The stream of coal and water from the trough C (Fig. 1), strikes the tables about riffle No. 25. The bumping promptly imparts to each particle on the table an impulse towards the sludge end. Only the heaviest particles, however, can cope with the water, whose prevailing tendency is towards the coal end. As a result, the coarser impurities are caused to migrate to the sludge end of the table in a series of hops, which are shorter or longer, according to their size. Behind them, in the species of settling basin formed by the greatest depth of the table, a three-cornered arrangement goes forward between the coarse coal, the fine coal and the fine remnant of impurity. Every particle upon the table strives, by virtue of its gravity, to come to rest in the riffles On a perfectly fresh table the coarsest coal may possibly for a short time be on even terms with the impurity, but only a few fragments of the former are necessary to fill the riffles once and for all, and after the first few moments all additional coarse fragments are crowded out and must, perforce, move on. The fine coal particles, unable to sink in the briskly agitated water, are carried over into the coal received. Only the fine impurities, settling in the interstices of the coal, are caught by the iron edge of the riffle, ooze through the slot, and, falling upon the false bottom, make their way back unopposed to the sludge receiver.

Tests were made some months ago upon one of the Dominion Iron & Steel Company's tables, with a view to gathering some general information with regard to what might be termed the "ballistic ratios" of coal with reference to slate, etc., under working conditions. While the table was in regular operation a number of fragments of coal and marble of assorted sizes were dropped among the coal and water in the trough, and their deportment was observed. Marble was chosen, because its gravity is not very far from that of slate, and because of its distinctive color. The various experiments were repeated times enough to eliminate chance error, and it was proven:—

1. That every pure coal fragment weighing not more than 125 grams. (sp.g. 1.29), went regularly over the coal end. Slightly larger pieces still went to the coal end, but stuck in the shallow part of the table, about riffle No. 2. Still larger sizes travelled towards the sludge receiver.

2. That all limestone fragments stopping on a sieve of 10 meshes to the linear inch found their way to the sludge end, while smaller particles sank in the riffles, or at least did not come over the head board during the period of observation.

3. An examination of the sediment in the various riffles showed that all pyrites stopping on a sieve of forty meshes to the linear inch had been thrown over with the sludge, and that practically all pyrites finer than this, and all except the finest of the slate, had fallen between riffles 17 and 8, at the deepest part of the table, while the remaining riffles, 7-1, rising towards the coal end, retained the last of the slate, the contents of the last riffle consisting chiefly of pure soal.

Numerous comparisons of the regular work of this machine, with the results of calcium chloride separations made on concurrently taken samples of the same crushed coal, showed the work done day by day to be almost ideal, both as to quality and yield of product.

Equally successful work could, of course, be done with any good jig washer if the screening were sufficiently close; but screens wear rapidly, and, in spite of the most careful watching, the mesh becomes gradually larger and the sizing ineffective, so that, strictly speaking, maximum efficiency is only obtained when all the screens are perfectly new.

In the case of the bumping table, no such difficulty presents itself. The table has a long life and requires little in the way of repair, all the variables are under practically perfect control and can without difficulty be maintained constant.

In short, once regulated, the washer is doing its best work if it is running at all.

We have thus endeavored to treat, in a very general way, a few points suggested by the questions we originally propounded, laying emphasis on some details which are too often overlooked; and, in conclusion, while admitting that laboratory reports on industrial processes are often of doubtful and even negative value, we nevertheless venture to hope that the laboratory investigation of coal, as a determinant of its possibilities in the way of purification, may in future obtain more nearly its meed of appreciation.

In Cumberland, England, coal seams under 4 feet are worked almost exclusively by long-wall, and seams above that thickness by bord-and-pillar. However, the long-wall system has been adopted in several of the thicker seams, and it may be used in all cases where conditions are favorable. The yield is larger by long-wall and a higher percentage of round coal is obtained. The thickest seam at present worked by long-wall is 5 feet.

In France collieries are not worked on the pillar-and-stall method. The pillars are always taken out in their entirety, so that no coal is left in the workings; but during the first working "in the whole" the Mine Administration may require that the size of the pillars be increased.

PROSPECTING IN UNGAVA

J. C. MURRAY.

(Continued from page 112.)

An examination of Cotter's Island, the most northerly of the Nastapoka group, completed our summer's work. It had been arranged that we should meet the steamer "Algerine," carrying our winter supplies and building material for our winter quarters, about September 5th, at a point sixty or seventy miles north of Bell's Harbor. It was now the 5th of August. We had, therefor, ample time to sail up to the Hopewell Islands, choose our winter quarters and then run still further north on a short exploring excursion. On August 7th we anchored in Hopewell Sound, near the mouth of the Kongut River. Investigation of the surrounding country led to the choice of a spot on the north bank of the Innuksuak River, as a suitable location for putting up our buildings. In our ramblings here we came upon patches of blueberries growing on miscroscopic bushes.

LANGLAND RIVER FALLS.

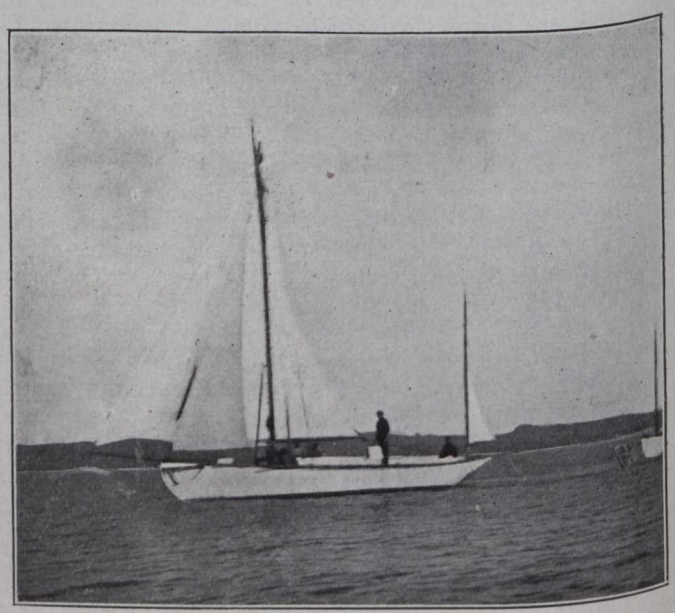
After a short cruise north beyond Cape Dufferin, we returned to Innuksuak River on August 17th. Here we laid out the ground for our winter home and began excavating. Our only tools were gold pans and drill steel. However, the soil was loose and sandy, and we made surprising progress. By the time the foundations were well under way and a landing stage, built of flat stones carried by boat from an island five miles distant, was completed, the steamer "Algerine" appeared, ten days ahead of schedule. This was August 25th. By August 29th lumber, provisions, fuel and all sundries had been removed from the "Algerine," and we had dimensions 33 feet by 17 feet, which was to be our dwelling, and another of 30 feet by 16 feet, to become mately our storehouse.

UNLOADING WINTER SUPPLIES AT PORT HARRISON.

The "Algerine" left us on August 31st, taking one of our party along with her.

WINTER QUARTERS—PORT HARRISON.

The middle of September saw our large dwelling house almost completed. By early October a small laboratory, a kitchen (both opening into the main dwelling), a large storehouse, a dwelling for the Eskimos, a substantial workshop and one or two small outhouses were entirely furnished. Our three Eskimos displayed extraordinary skill in carpentry, easily excelling our own poor efforts. As may be supposed, we did not observe union hours during construction.



THE YACHT "ALLE."

The autumn was abnormally mild. Not until September 30th did the thermometer drop to freezing point. Early in September waveys appeared, flying south in

large flocks. Our Eskimos replenished our larder with many of these edible birds. Delicious salmon trout, firm of flesh and delicate of flavor, were caught at the river mouth in abundance. White owls, also, were often on our bill of fare. These birds were captured by a singular device. Short posts were driven into the ground at some distance from the dwellings, and on these were set No. 2 steel spring traps without bait. The owls, in their delight at seeing a possible perch in that treeless country, flew literally into the trap. The flesh of these birds is sweet and entirely pleasant. Ptarmigan were shot by the dozen, and so throughout the autumn we fared sumptuously.

Early in October we hauled our yacht out of water and housed her in. In November, analytical work was started in the laboratory. As winter had now set seriously in, making ample amends for the mild autumn, it was necessary to move all the re-agents that would be affected by the cold, out of the laboratory at night

TENT OF ESKIMO CHIEF, KOMINWAK.

and place them in a small frostproof cellar. Iron ore samples, taken during the summer, were crushed in a small hand-power jaw crusher, ground to uniform size and analyzed.

The absence of several important re-agents made one or two analytical operations very cumbersome However, many iron, manganese, silica and sulphur determinations were performed. Numerous qualitative examinations were also conducted. Later in the next spring we made a long series of gold and silver assays, using a small gasolene tank furnace.

In the first week of December our Eskimos banked the dwelling house. They cut huge blocks of snow and built them carefully about the house as far as the eves of the roof. Several families of northern Eskimos had now settled in their snow-houses near us. On Saturday evening they gathered in the main room to hear the phonograph. Eskimos were constantly calling at our post on their way north and south. The season was a phenomenally good one for foxes, and already much bartering had been done. White foxes were so plentiful that it was not at all uncommon for four or five to be trapped in an afternoon within a few miles of our winter quarters.

Our winter days, under the direction of our leader, were carefully filled with work, exercise and amusement. Drafting, laboratory work and compiling notes usually occupied the mornings. In the afternoon we took long runs on skis, sometimes after ptarmigan, more often after fox. The evening was devoted to reading, writing and occasionally to bridge whist. Plenty of good food and a great deal of outdoor exercise kept us cheerful and healthy. During bad weather in January, 1902, when extended travel was impossible, we took our exercise by tunnelling for many yards in a huge snowdrift that had formed on the north side of our dwelling.

In February a micrometer survey was made of the shore line about our post, which we had, incidentally, christened Port Harrison. February proved a much milder month than January. The average temperature during December had been 1 degree below zero. January's average was 12 degrees below zero, with a maximum of about 54 degrees below.

We had last heard from civilization in August, when the steamer had brought us letters that had been written in the previous June. Now, March 14th, an overland dog-packet came in from Great Whale, a long and arduous jurney, carrying very welcome letters, written to us many months before.

On March 15th two of us started south in dog-sleds for Nastapoka Islands, to finish surveying and locating claims.

(To be continued.)

The McMurtry-Rogers Process of Desulphurizing Copper Ores and Matte

Communicated by T. C. Cloud, Member.

(A Paper read before the Institution of Mining and Metallurgy, London, Eng., April 18th.)

The ore may be of any size from 2 1-2 inch gauge down to fine slimes, but preferably the largest pieces should not exceed 1 inch gauge, nor is it advantageous that the charge should consist entirely of slime ore.

The charge must contain silica or silicious material amounting to from 15 to 35 per cent. of silica and from 15 to 25 per cent. of sulphur, but the precentages of these substances may be somewhat greater or less without very materially affecting the operations of the process, it being also essential that the charge is wetted.

With ore direct from a dressing plant the amount of water present is usually enough, but when deficient the charge can be wetted while being mixed, or while being charged into the converter; enough water should be added to make the material cohere when slightly pressed.

From experience gained in working the process, the charges which burn best consist of—roughly—one-third of pieces about 1 inch to 1 1-4 inch gauge and two-thirds of fine ore from jigs, buddles or tables. When jigged ore and slimes, or slimes only, are treated, the charges take longer to burn.

The converters used for burning the ore, which have been installed at the Wallaroo Works, are cast iron pots mounted on trunnions and inverted by means of a worm and wheel, the inside diameter being 8 feet 8 inches by 4 feet 6 inches deep, the false bottom slightly convex and placed about 10 inches from the lowest part of the converter; it is perforated all over with 5-8 inch holes. Originally these false bottoms were made of cast iron, but it was found better to use wrought iron plates,

strengthened with angle irons underneath, these bottoms being held in position by a bolt passing through the centre of the pot.

The blast pipe enters at the back of the pot under this false bottom and is 8 inches in diameter.

Such a pot would hold eight to nine tons of wet ore.

The *modus operandi* consists in first covering the false bottom with pieces of a previously burnt charge broken to from 3 to 4 inch size, then lighting a small fire in the middle of the pot on top of this burnt material, using a light blast to urge on the fire, then charging the ore on top of this fire till the pot is about half full; after increasing the blast, and when the ore becomes more or less red in several places, the balance of the charge is added till the pot is full.

To start the fire a few chips of wood kindled by any ordinary means are used, and when these are burning well, sawdust is charged in on top till the whole fire is covered, allowed to burn a short time, then more sawdust is added wherever the fire appears.

By starting a small fire in this way in the middle of the pot and slightly coning up the sawdust, it drives the fire out in a circle towards the edges of the pot.

When the ring of fire has reached about one-third to half the diameter of the pot the ore is charged in on top, the first being put on with a shovel, so as not to scatter the fire too much, but after a layer has covered the whole of the bottom the ore is then fed in by an elevator from the feed bins below, being spread by a man over the surface in such a way that when the pot is half full the ore is piled up more at the sides than in the middle, presenting a concave surface; the reason for this being that the fire has a tendency to make for the sides rather than up through the middle.

For some time coal was used, or a mixture of coal and fine coke, but sawdust was found to answer better, as the fire was not so hot.

When the pot is about half full and the charge distributed as stated, a number of holes are pricked near the centre, a slight distance down into the charge, with a 1-2 inch rod; the object of this being to give more or less free vents for the uncombined sulphur and sulphur dioxide to escape and so quicken the burning.

These holes must be closed in before the fire burns through, otherwise blow-holes would be formed; the man in charge soon learns to tell when the fire is getting near the top of any hole by the color of the smoke given off.

During the spreading of the charge the blast is usually turned off to enable the man to work comfortably, and after the holes have been pricked half blast is given for about an hour, being then increased to full pressure.

The full pressure of blast used is 13 ounces, but it can be largely increased if necessary; over 20 ounces has been used, which latter pressure quickens the time of burning. The volume of air used per minute at this pressure for each pot is about 1,000 cubic feet.

Each pot has to be covered by a hood in order to take off the fumes, a connection being made from the hood to a flue, or a large pipe taken out from the top of the hood through the roof of the shed.

When the evolution of sulphur dioxide slackens and the charge has become red hot throughout, the blast is turned off, the blast pipe disconnected and the converter inverted.

In order to break up the sintered material more readily the cake is allowed to fall on some four or five cast iron cones, which help to split it into smaller pieces; these being subsequently cooled on the outside with water, and further broken up to a suitable size for smelting operations.

When the cones are not used the cake as a rule turns out of the converter in one solid block weighing over six tons (with the exception of a little loose unburnt ore on the surface), and even the fall to the ground is often not sufficient to break it.

The time taken to burn a charge varies with the mixture of ore used, but eight to twelve hours is the usual time. If the charge contains fully one-third of its bulk in pieces of 1 inch to 1 1-4 inch, well distributed, the time is often eight hours or under, but, as previously stated, with all fine material a longer period for burning is required. Like all converter pot processes, it pays to have the burning well looked after, to see that the blow-holes are stopped as they form, and also to allow as many holes as possible for the escape of free sulphur; by looking after these two points the time of burning can be materially reduced.

The shape of the converter pot has something to do with the successful burning of the charges. The first large pot used for experimental purposes was an old lead refining kettle with a hole at the bottom for the blast and a false bottom about 2 feet 6 inches diameter.

In burning ore charges in such a pot the difficulty was to get the ore near the sides alight, and in order to help this, sticks of wood about 18 inches long were put into the charge when the pot was a little over half full, radiating from the centre towards the sides; these as they burnt formed holes for the air to come up and so cause the ore near the sides to burn; with the proper pots installed for the ore treatment the sides are very much straighter, being for some distance at an angle of 14 degrees only from the vertical, and no sticks are required with them.

The product obtained consists of a porous sintered mass of ferrous silicate containing shots of rich copper regulus and free silica (ferric oxide only being observed on the outside of the cake), and forms a most suitable material for blast furnace treatment; the bulk of iron being in the ferrous condition renders it fit for slag formation without having to be first reduced from the higher state of oxidation.

The difficulties in treating fine-dressed ores of copper by first calcining and then smelting are well known to copper metallurgists, one of them being the heavy mechanical loss which occurs in the calcining operations, and again in the charging of the reverberatory furnaces with the hot calcines; true, these two sources of loss can be minimized by the use of good dust chambers and long flues, but even then the flue dust is not the easiest thing to re-treat.

Another difficulty is that the calcined ore is not suitable for smelting in a blast furnace, so that reverberatories must be used if there is much of this material to be treated, and in large works the two methods of smelting are frequently employed; the blast furnace for the rough ore, and the reverberatories for the fine.

These two difficulties are overcome by the use of the sintering process, as the loss is small owing to the ore being wet; the only time any dusting occurs is if a blow-hole is allowed to go unchecked, and this is seen at once and can be stopped; then the product can be smelted in either a blast furnace or a reverberatory; with the latter, however, it has to be broken up smaller than for a blast furnace.

The elimination of sulphur is as good as is obtained by most calcining processes for copper ores, and if the sintered product were smelted alone, without the addition of some uncalcined ore, the regulus produced would be too high for good work.

The result of a sample from a large pile waiting for blast furnace treatment gave 5.65 per cent. of sulphur; other results have given under 5 per cent. of sulphur from raw ore containing about 20 per cent. of sulphur and 10 to 12 per cent. of copper.

The presence of lime or compounds of lime is not essential to the working of the process.

The first experiments were made during 1904, and at the present time the plant which has been installed at Wallaroo is treating from four to five hundred tons of ore a week. At this point mention should be made of the help received from one of the writer's metallurgical assistants, Mr. S. Radcliff, in making the process the success it is at present.

The cost of desulphurizing by this process, including the cost of breaking up converter product for smelting, is only slightly higher than that of calcining rough ore of similar composition in pyrites burners.

Regulus or Mattes.—In treating these products the addition of some silicious material is necessary in order to take up the iron contained and form ferrous silicate; the proportions to be used are, preferably, from 15 to 25 per cent., but these may vary considerably. The silica may consist of such materials as coarse sand, jigged tailings, silicious carbonate ore, silicious oxide ore, and even silicious sulphide ore, such as dressed ore from buddles and Wilfley tables, has been used. The regulus should be crushed to pass a screen with meshes of from 1-2 to 3-4 inch square; with some mattes the larger screen should be used, but with hard low grade mattes it is better to take the 1-2 inch size.

The silicious material must be well mixed with the crushed matte or regulus, and the whole wetted to the same extent as with the ore.

In actual work it has been found better to take more trouble in charging the converters than is necessary in the case of ore, the best method being to add a few shovels full at a time over any part of the charge where the fire is showing through, until the pot is full.

The starting of a regulus charge does not need as large a fire as in the case of ore, and very good results were obtained by using the lead kettles previously mentioned for this work, starting the fire with a little wood and sawdust on the top of the rough pieces of burnt material; the pots which are in use for the burning of rich regulus or "regule," to be subsequently described, were also found to give very good results in matte burning, as the product, being smaller, was easier to break up than the large cakes obtained from the lead kettles.

With matte it is not necessary to prick holes in the charge, there being no free sulphur to eliminate unless sulphide ore is used to mix with the matte.

The product of the reaction is normally ferrous silicate, with a little monosulphide of iron and sulphide and silicate of copper.

A little metallic copper may be formed owing to reactions occurring between oxides of copper and sulphide of copper.

When the charge contains a moiety of oxidized ore, a fair proportion of copper is reduced to the metallic state; this, however, does not decrease the speed at which the desulphurization takes place.

The blast used must not be too high, 6 to 8 ounces being enough at first, as the lower layer next to the fire is apt to run up to too high a temperature if a greater pressure is maintained at starting; the pressure can, however, be increased towards the end to the same extent as with the ore.

The product after inverting the converter may be broken up and melted down in any suitable furnace, with the production of a very rich regulus and more or less metallic copper.

Owing to the difficulty of sampling such a product, and to the fact that some of the sulphur is in the form of sulphate, which in melting reacts with unchanged sulphide, no assay was done for sulphur in this product, but the result of the work is soon seen when the material is smelted, and gives a better guide than any assay would.

On burning matte assaying 25 to 30 per cent. of copper with one-third its bulk of silicious slimes, the product on melting gave regulus assaying from 64 to 67 per cent. of copper. With richer mattes the result was better, and in most cases it was necessary to add a certain amount of raw matte to the charge in order to keep the regulus produced on melting only just over 70 per cent.

Using the lead kettles as converters, a charge of from 6 to 7 tons of a mixture of matte and silicous material could be burnt in nine hours, and at times three six-ton charges were treated in twenty-four hours per pot, or eight hours each.

"White Metal" or "Regule."—The most satisfactory results obtained were with "metal" assaying from 78 to 80 per cent. of copper, that grade known as "spongy regule" being the best, owing to its porous nature.

This material is not easy to calcine in any form of furnace, great care being necessary owing to its low fusing point; in fact, it is seldom calcined except where the so-called "direct process" is carried on, and from experience gained in calcining it for this process, the difficulties and great cost of such calcination were amply proved.

By using the converter process for this operation the same end is obtained as far as the subsequent refining is concerned, but the troubles in the calcining are largely overcome and a more suitable product obtained for charging into the refining furnaces, and, the material being in lump form, less loss from dusting results.

Against this, more slag is produced than is the case with the Nicholls and James process, but the elimination of the impurities is decidedly better than is obtained by treating "regule" by either the ordinary Welsh roasting process or the Nicholls and James process; this latter fact is of great importance where the better classes of copper are required, as, for instance, "Best Selected."

In treating this material the regule is crushed to 5-8 inch gauge and only wetted with water, no silica being required, as the product operated on is nearly free from iron and consists of practically pure copper sulphide, Cu_2S.

The iron pots used for this are much smaller than with either ore or regulus, and are mounted on trunnions in a carriage running on rails. These pots are conical, being 5 feet 3 inches at the top, 11 1-2 inches at the bottom, where the blast pipe enters, and 3 feet 6 1-2 inches deep; such pots will each hold about two tons of regule.

The method of working is to light a small fire on the false wrought-iron plate with which the pot is provided, and then put on some well-burnt pieces of product from a previous charge, broken up to about 3 to 4 inch gauge; these pieces consist (as will be seen later) of almost pure copper; when they have become a dull red and the fire has burnt low, the wet regule is tipped in from a tram until the pot is half to three-quarters full, a low blast being then turned on (about 6 ounces), and when the

charge has burnt through in several places the balance of the regule is added.

It does not matter how wet the regule is that is being treated; water has been seen running out of the bottom of the pot before now and yet the charge has burnt well; the chief difficulty is to get the men to keep the fire small enough in first charging; if too hot a fire is used the regule, which melts at a very low temperature, simply runs and blocks up the holes in the false bottom, so preventing the air from getting through.

These charges take about eight hours to burn, the blast pressure used being from 8 to 10 ounces only; when high pressures are employed the regule melts and so stops the process.

The final product obtained consists essentially of porous metallic copper mixed with oxide sulphate, and some unchanged regule, and for some time the main trouble was to break up the mass; this, however, was overcome by using a heavy iron ball weighing about 16 cwt., which was hoisted up by a steam winch 20 feet high and allowed to drop on the sintered regule product; a few blows generally served to divide it into several pieces, which could be further reduced if necessary by the use of a sledge hammer and gad.

It is only necessary to break up the pots of sintered regule small enough to enter the side doors of the refining furnace to which the product is sent.

The fines which are made in breaking up, as well as any small amount of unburned regule, are put into a travelling hopper, which runs over one of the ordinary roasters, and is there converted into pigs of rough copper; this roaster taps beds of copper every twelve hours.

This method of treating regule comes very much to the same thing as adopting the so-called direct process of Messrs. Nicholls and James, except that the troublesome calcining of white metal is done away with; the product is better to handle, being mostly metallic copper; it is not necessary to have the samples run down to see when the right amount of calcined material is present; there is less loss in flue dust both in the calcining and refining; the product being in lumps is easier to melt in the refining furnace, and the quality of the copper is better; on the other hand, more slag is produced than in the direct process.

Some experiments were conducted as to the elimination of impurities from regule, using, 1st, the ordinary Welsh roasting process; 2nd, the direct process of Messrs. Nicholls and James; and 3rd, the McMurtry-Rogers process, and in the case of nickel and bismuth the following are the results. Taking the ordinary Welsh process as one, the ratio of elimination is:—

	Nickel.	Bismuth.
Welsh process	1.0	1.0
Direct process	1.5	1.12
McMurtry-Rogers process	1.87	1.39

Higher results than here given were obtained for nickel, but this is considered a fair average.

Experiments were also undertaken to see if the gas given off from sintering could be used for the manufacture of sulphuric acid, but, like all processes using an air blast in a converter, the gas varies considerably in composition.

The following are some of the results obtained:—

	SO_2.	O.
Gas from ore	5.4	8.0
"	3.0	...
" regulus	5.5	12.0
" regule (mean)	11.1	5.6

An experiment was conducted with gas from the regule by blowing it with a fan into the first chamber of the acid works, but although acid was made it caused trouble in other ways by reacting on the Glover tower and ore burners, so had to be given up; but it is quite possible that this could be used for the manufacture of sulphuric acid, if required.

Reactions.—When calculating the heat of combustion of sulphur-bearing materials—taking into account the heats of combustion of the metals present and heat of formation of silicates formed (if any), as well as the heat furnished by the sulphur—we find that even a very silicious mixture contains a sufficient amount of available energy to keep the temperature of the mass above ignition point, provided that the combustion takes place with sufficient rapidity to neutralize the unavoidable loss of heat by radiation. As a proof of this statement it has been found possible at Wallaroo to burn material containing only about 5 per cent. of sulphur and 5 per cent. of iron, with no more than sufficient fuel to start the combustion.

In ordinary calcining processes when the percentage of sulphur is low and the ore is fine, heat must be supplied from an external source to make up for the radiation losses. If it is attempted to quicken the combustion of ore in sulphur by blowing air through it, a very large amount of dust is produced; but when the ore or crushed product is wetted the mixture can be desulphurized to any extent required in practice and with great rapidity; the water added plays a very important part in the process and cannot be dispensed with.

The mechanical effects of the water in holding the upper portions of the charge together, and so preventing dusting, is obvious. There are other effects caused by the water which are not so apparent. In the first place, the wet mixtures used conduct heat badly and so keep up the temperature at the seat of the combustion and cause this zone to move upwards as a fairly horizontal layer. The products of combustion also leave the surface of the charge from a large number of points distributed all over the surface.

(To be continued)

It is difficult to estimate the amount of potential power lost in the form of waste coke-oven gas. But it has been calculated that, assuming an oven is carbonizing at the rate of 7 tons a day, the waste gas from such an oven would be equal to about 40 horse-power in a gas engine.

Platinum metals have a very curious relation to mercury. So long as the sodium amalgam is rich in sodium they amalgamate perfectly, but as soon as the sodium is spent the platinum metals leave the amalgam and will not remain combined with it.

The hydraulic method of working auriferous gravels, with or without the "giant," delivers a stream of water and gravel to the upper end of a long set of sluice boxes which have riffle blocks along the bottom. As the water and gravel rush along, the heavy grains of gold, platinum, magnetite and other heavy minerals settle into the crevices or riffles between the blocks. The gravel, which has been deprived of most of its values and heavy grains, goes off the lower end of the sluices as tailings.

ONTARIO FELDSPAR

According to the Ontario Bureau of Mines' Report, recently issued, the production of feldspar is increasing. The output of the Richardson mine, owned by the Kingston Feldspar Company, is now about 130 tons per day. No. 1 pit at this mine, on the southwest side of the quarry, has a depth of 75 feet and an area of 250 feet by 50 feet. No. 2 pit, on the northeast side, has an area of 300 feet by 50 feet and an average depth of 50 feet. A shaft 30 feet deep has been sunk between No. 1 and No. 2 pits, and the water drains from the pits to the shaft, where a No. 10 Cameron pump raises it to the surface. The feldspar in No. 2 pit is dipping to the northwest under the body of quartz which appears on the surface.

The Jenkins mine, near the Richardson, has been closed for the last year.

At Border mine, in the Township of Portland, feldspar is being taken out of an open cut some 200 feet long, 20 feet wide and 25 to 30 feet deep. The dike of feldspar runs in a northeast by southwest direction, and cuts across the gneiss formation. Bodies of quartz are found in the dike.

The Kingston Mining & Development Company also work a mine in Portland Township. This open cut is 200 feet long by 25 feet wide and 8 feet deep. The feldspar occurs in a large pegmatite dike, and is the predominant mineral in that part of the dike being worked. The dike occurs cutting a dark gneiss.

EVALUATING COAL

In *The Colliery Guardian* (London, England), for April 12th, is a report of the monthly meeting of the Manchester Geological and Mining Society. During the meeting Mr. W. H. Coleman gave an exhibition of the new calorimetric bomb, and explained its use in ascertaining the value of coal. The bomb is made of steel, of such a thickness and shape that it will stand a pressure of more than 200 atmospheres. Before explaining how the bomb is worked, Mr. Coleman spoke on fuel valuation in general, treating the subject under three heads: (1) Sampling of the fuel, (2) determining its calorific value, and (3) comparing different fuels to find out which will serve the purpose in hand most economically.

As to the first point, the chief difficulty in the way of determining the calorific value of a fuel was the fact that it was not at all easy to obtain an average sample, and unless the sample was what it professed to be—unless its composition was the same as that of the whole bulk of the fuel under question—it was useless to waste time and money in making elaborate calorimetric determinations.

Mr. Coleman then pointed out the necessity of obtaining a large original sample of coal, under the everyday conditions of shipment. A cart load, after thorough mixing, should be quartered down to 100 pounds; great care being taken to preserve the right proportions of lump and fine. The sample was next crushed and again quartered to 2 pounds or 3 pounds. This quantity was then crushed to a moderately fine powder. The whole of these operations should be done as rapidly as possible.

Three ways offered themselves for determining the calorific value. First, an ultimate analysis of the coal might be made and its theoretical calorific value calculated. This, though accurate, took a considerable time, and required the services of an expert chemist. Second, the moisture, ash, volatile matter and fixed carbon might be estimated and the calorific value calculated from one of the numerous formulæ given by different authorities. This simple method, though useful in checking deliveries, the calorific value of which had been accurately determined before, was not sufficiently accurate to discriminate between several different qualities of coal.

In addition to the calorimetric determination, the length of flame, the quality of the ash and other factors must be taken into account; but, given several samples of coal, all of which are otherwise suitable for the intended use, the most economical coal can be selected by the calorimeter.

THE LEGEND OF THE FIRST PROMOTER

In ages prehistoric,
When legends allegoric
Were the only kind of substitute for papers,
The Son of Tubal-Cain,
In language crisp and plain,
Was instructed to abstain from silly capers.

For that sinful son of Tubal
Said: "I know that every Rube 'll
"Want to buy a share in Eden's only venture."
(He had found a chunk of gold
Where Euphrate's waters rolled,
And he straightway started in to merit censure).

'Twas to Adam first he went,
And the case he did present;
He recited how in fooling on the margin
Of the river he had seen
That yellow golden sheen;
And Adam said, "You're sure you're not enlargin'?"

So it ended up in this,
That Adam said: "I wis
"I'm up to buying shares in something good,
"But, grandson, by your leave,
"I'll consult with Mother Eve—
"She's sewing leaves together in the wood."

And the consequences were
(For the man persuaded her),
Poor Adam gave a mortgage on the Garden;
And the Son of Tubal-Cain
His only was the gain,
And the sons of men are working yet for pardon.

But Tubal-Cain himself,
He scorned the dirty pelf,
And he spoke in accents scathing to his son:
"Since this wicked world began
"I'm the first Straight Mining Man."
And he smote him for the thing that he had done.

And Tubal spake again—
Very shame did him constrain—
"To think that I have bred a d—d promoter;
"I'm a plain blunt mining man,
"And if I conceived a plan,
"I couldn't talk one-half enough to float her."

Now of schemes there were no more,
In those misty days of yore,
Till Noah and "Consolidated Ark";
But his venture paid because
All the water outside was—
And the Son of Tubal-Cain did not embark!!!

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA.

East Kootenay.

The recent cessation of work in the coal mines of the Crow's Nest Pass is causing much anxiety throughout the mining districts of Southern British Columbia particularly, and generally in the other parts of the Province which depend on the Canadian Pacific Railway for their transportation facilities. At the time of writing no arrangement, not even a temporary one, has been made for a resumption of work by the coal miners, pending investigation by the Board appointed under the Conciliation Act lately passed by the Federal Parliament. The following press despatch from Fernie, where the operators and miners are now discussing the points at issue, will serve to show the seriousness of the position so far as it affects the industries directly concerned:—

"The number of men affected by the strike directly, and in the other trades and industries dependent on the immediate supply of coal, is conservatively estimated by a prominent mining official here as 15,000 men; that is, smelters, supply men, miners and train crews.

"Dealing with the coal mining industry in the Pass alone, the following are the names of the mines affected, estimated number of men employed and the daily output of coal and coke:

"In British Columbia.—Crow's Nest Pass Coal Company's Coal Creek mine—850 men, 2,300 tons of coal and 300 tons of coke. Michel mine—450 men, 1,500 tons of coal, 250 tons of coke. Total—1,300 men, 4,800 tons coal, 550 tons coke.

"In Alberta.—International Coal & Coke Company's Coleman mine—400 men, 1,500 tons of coal and 250 tons of coke. Canadian-American Company's Frank mine—275 men, 600 tons of coal, no coke. Hillcrest mine—175 men, 450 tons of coal. West Canadian Collieries' Lille mine—300 men, 600 tons of coal and 30 tons of coke. Bellevue mine—175 men, 450 tons of coal. Total—475 men, 1,050 tons coal, 30 tons coke.

"Brekenridge & Lund Company, Dundbreck mine—75 men, 200 tons of coal.

"Galbraith mine—20 men, 50 tons of coal.

"Pacific Coal Company, Bankhead mine, anthracite coal—550 men, 1,200 tons of coal.

"McNeil Company, Canmore, anthracite coal—275 men, 500 tons of coal.

"Total—3,400 men affected, 9,000 tons of coal daily, and 1,100 tons of coke."

Rossland.

An advance of wages of 25 cents per day is to be given to shovelers, carmen, ore sorters and surfacemen employed in Rossland mines, as from May 1st, inst. This will bring the wages of men so engaged up to $3 per day, instead of $2.75, the rate heretofore paid in Rossland camp. Men similarly employed in Boundary district mines have long been paid at the rate of $3 per day. The companies agreeing to this advance are the Consolidated Mining & Smelting Company of Canada, owning the Centre Star War Eagle group of mines; Le Roi Mining Company, owning the Le Roi and Black Bear, and operating under bond the Spitzee mine; the Le Roi No. 2, owning the Josie and No. 1 mines; and the White Bear Mining Company, owning the mine of that name. The letter from the mine managers to the executive of the Rossland Miners' Union, acceding to the request for the advance abovementioned, also intimated that no other increases would be made. It stated that: "In view of the fact that the ores of Rossland camp are low grade, containing low copper values, and, therefore, affected only to a small extent by the increased price of that metal, making it difficult to carry on operations at a profit, it would be distinctly understood that in thus meeting the views of the men employed by the undersigned they have done the utmost possible to do, and that further requests for increased pay cannot be considered."

Similkameen.

The Daly Reduction Company has resumed operations at its 40-stamp mill at Hedley. As yet there is not sufficient water flowing to give power enough to run all the stamps, but as the season advances and the snow melts the number dropping will be increased until the mill shall be running at full capacity. In connection with the Nickel Plate mine, which supplies the mill with ore, the air compressor is working and both electric and gravity tramways that between them connect mine and mill are being operated. Those in charge of mine, mill, etc., are:—G. P. Jones, mine superintendent; E. A. Holbrook, general superintendent of lower works and cyanide plant, and A. Clare, in direct charge of stamp mill, vanners, etc.

It is announced that Chas. Camsell, of the Geological Survey Department of Canada, will spend the ensuing field work season in the Similkameen, continuing the geological work he was engaged in last year. The object of the work is a topographic and geologic survey for a sheet to embrace the whole of the Similkameen district.

Vancouver Island.

The Tyee Copper Company is now receiving more custom ore at its smelter at Ladysmith than at any previous time since it commenced smelting operations. For two or three years it has employed Mr. W. M. Brewer as its ore buyer, and he has paid particular attention to the gradually developing lode mining fields in Southern Yukon and Southeast Alaska. At length tangible results from his assiduous attention to that field are being obtained, in the shape of regular shipments of copper ore from mines on Prince of Wales Island and other northern mining camps. The Britannia Smelting Company is also receiving much ore from the Mount Andrew mine, Prince of Wales Island, in addition to its customary large shipments from the Britannia mine on Howe Sound, distant about 60 miles by water from the smelter at Crofton, V.I.

Coal mining continues active at the several collieries of the Wellington Colliery Company and the Western Fuel Company. The former is operating the Wellington (Extension) and Comox (Cumberland), Collieries, each with three or four mines, and the latter the No. 1 Shaft, Protection Island Shaft, and No. 4 Northfield mines, all in the neighborhood of Nanaimo. The coal measures in all three districts are extensive; those already explored are known to contain large reserves of coal, sufficient to supply for many years even a larger annual output than that of recent years. There is beside a considerable area of country known to be coal-bearing which has not yet been prospected. Preliminary figures of production in 1906 (the annual statistics have not yet been published by the Provincial Bureau of Mines, so are not available) showed: Western Fuel Company's mines, No. 1 Shaft and Protection Island, 290,000 tons; No. 4 Northfield—a newly opened mine—83,700 tons; total, 373,000 tons. Wellington Colliery Company's mines, Cumberland, 409,000 tons; Extension, 381,000; total, 790,000. Total gross output of Vancouver Island coal mines, 1,163,700 tons. Beside its coal sales, the Wellington Colliery Company sold last year between 17,000 and 18,000 tons of coke, made at its ovens at Union Bay, Comox district. The foregoing production figures are given with the object of conveying an adequate idea of the extent to which coal mining is carried on by Vancouver Island collieries. So great has been the demand for coal for several months that this year's output to date will probably be found to have been larger than for several years last past, if not greater than for the corresponding period of any previous year in the history of these coal mines.

General.

The Government of British Columbia has decided not to give its assent to any prosecutions under the Lord's Day Act, so the Attorney-General stated in the Provincial Legislature just before

it was prorogued on April 25th. It is understood that the members of the Eexecutive Council of the Province gave the matter their careful consideration and eventually came to the conclusion that conditions prevailing in British Columbia differ so much from those obtaining in Eastern Canada that in their judgment it would be best to take advantage of the optional power the Act gives Provincial Attorney-Generals to refuse assent to prosecutions under its other provisions. It will follow, therefore, that the interruption to carrying on the mining and smelting industries of this Province, as in the past, will not take place, as has been prematurely suggested it would. Incidentally it may be mentioned that some of the larger mines have for several years been in the habit of suspending all mining work on Sundays.

The hearing of the extra-lateral rights mining case of Star vs. White by the full court of British Columbia has been concluded, and judgment has been reserved. This cause, in which defendant is being sued for a large sum of money as compensation for ore taken from the claim of plaintiff, has been before the courts for about sixteen years. About two years ago the Chief Justice gave judgment in favor of defendant, but last year plaintiff secured an order from the full court directing that certain additional work be done, and W. E. Zwicky, manager of the Rambler-Cariboo mine, Slocan, was appointed by the court to supervise the doing of this work. Both sides called experts to pronounce upon the result of this work—for the plaintiff, Frank L. Sizer, of Helena, Montana, and S. S. Fowler, of Nelson, B.C.; for the defendant, Max Boehmer, of Denver, Colorado, and W. J. Elmendorf, of Spokane, Washington. The recent hearing occupied the attention of the full court for about a fortnight, and as the amount involved is $500,000, its judgment is awaited with more than ordinary interest. The mines concerned are adjoining properties in the vicinity of Sandon, Slocan.

The Provincial Legislature has passed an Act providing for an eight-hour day for smelter employees, as under:

"No person shall be employed in or about any smelter, sorting, handling, removing or smelting ores or matte in any stage of preparation for a longer period than eight hours in any twenty-four hours.

"Any owner, agent or manager, or anyone acting on their behalf, employing any workman or person in contravention of this Act, shall be liable to a penalty not exceeding one hundred dollars for each workman or person so employed, and any workman or person so working for a longer period than specified in section two of this Act shall be liable to a penalty not exceeding one hundred dollars nor less than twenty dollars.

"Twenty-four hours for the purposes of this Act, shall mean midnight to midnight.

"This Act shall come into force on the first day of March, 1908."

ONTARIO.

ALGOMA.

Very favorable reports are coming in with regard to the copper mining prospects of the Dean Lake neighborhood, which is now being extensively prospected and opened up, and which, from all accounts, appears to be one of the richest copper districts in Algoma.

A promising-looking property, known as the Allan Eckel Mine, has recently been opened up by some Toronto people, and a good showing of ore is reported, while several other good prospects have been located. The Jury Company are finding an exceedingly good showing, one portion of their vein at a depth of 20 feet carrying two feet of almost solid ore. Their property consists of 320 acres, and the vein which they are now working extends almost continuously for 1 1-2 miles, with a width of 8 to 16 feet.

The Northern Ontario Company are also going steadily ahead and are raising good grade ore. They are now employing about thirty men on their workings.

Mr. T. Hayes Sheen, general manager of the Copper Mining & Smelting Company, of Ontario, Limited, has now returned from England. He has obtained an option on the Bruce Mines & Algoma Railway, which it is intended will be extended from Rock Lake, 16 miles north of Bruce Mines, to join the C. P. R. main line, thus opening up a very rich mineral country. If this extension is carried through important developments may be looked for in the mining industry in Algoma.

COBALT.

The resignation of the Hon. William Templeman from the presidency of the Airgiod Cobalt Mining Company lends color to the oft-repeated rumor that he is soon to accept an appointment as Minister of Mines in Premier Laurier's Cabinet. While Minister of the Interior he felt perfectly free to take an active interest in this important enterprise, and it is probable only because he feels that as the head of the Government's Mining Department he should have no connection with private mining enterprises that he retires from the position. While the corporation regrets the loss of Mr. Templeman's services, there is much satisfaction that Hon. L. Melvin Jones, of Toronto, has been willing to take the presidency in his place. The vacancy thus occurring on the Board has been filled by the choice of Hon. James Ross, formerly Commissioner to the Yukon, who becomes chairman of the Executive Committee.

Frequent reports are made of important finds at the mines lying at the foot of Cobalt Lake, and extending around to the west of the railroad. During the past week rich veins were found at the Trethewey and the Buffalo, and during one night over $6,000 worth of ore was taken from the most recently discovered vein at the Townsite, although the plant is as yet running at but one-half capacity. These mines are all in a direct line with the La Rose, Nipissing, McKinley-Darragh and other properties that rank as the most valuable in camp.

The possibilities for the development of these mines, as of all others in this district, are good, as has been shown frequently in the past. Among the many odd stories of the unexpectedly rapid increase in values is that O'Brien, whose name is borne by one the biggest mines in the camp, once offered his property in exchange for a carload of horses valued at $2,100. He has since been offered and has refused $6,000,000 for what he once thought was of so little value. It has also been figured out that $500 invested in Hudson Bay stock three years ago would now amount to $186,000, in addition to several thousands in dividends.

Work on the development of the Airgiod property is progressing rapidly, and Mr. Askwith, the engineer in charge, believes the plant will soon be in full operation. A complete outfit of machinery has recently been received, and is now being installed. In the meantime hand work has been pushed, and only last Saturday a discovery of smaltite very rich in silver was made in shaft No. 9.

Work has begun upon the development of the property of the Sutton Bay Silver Cobalt Mining Company, located at Sutton Bay. Lots No. 1 and No. 2 will be opened up at once under the supervision of Mr. Rupert Simpson, who was formerly in charge of the Townsite Mine.

Mr. A. T. Budd, who has just returned from a visit to Toronto and Ottawa, states that the Cobalt Native Silver Company has practically decided to begin active operations toward the development of its property in the second concession of Bucke Township, adjoining the Thompson and Annex claims. He thinks a small plant will be purchased and started on the 10 inch vein of galena.

Mr. Joseph Houston, chief engineer at the O'Brien Mine, is getting everything in shape to turn over to his successor, for he is soon to take charge of the Right of Way property, where a much larger plant is to be installed as soon as delivered.

Mr. William S. Mitchell reports a recent valuable discovery in one of his properties in James Township. This is on one of the discovery claims of the district, and is among the nest of claims

composed of the Munroe, Saville and others, which Mr. Mitchell has incorporated into the "Elk Lake Mines, Limited."

The Temiskaming Mining Company shipped a carload of ore last week which will undoubtedly be a record-breaker for richness. Their vein from which it was taken is one of the richest in the district, and was struck at the eighty-foot level, and has given great encouragement to those who expect their values to increase with depth.

Mr. M. T. Culbert, of the O'Brien, has returned from an extended trip through Mexico, where he has been examining and reporting on silver properties.

On Wednesday evening, May 1st, the first regular meeting of the local branch of the Canadian Mining Institute was held in the Prospect Hotel, Chairman Cole presiding. A paper, which was read before the Mining Institute in Toronto by Prof. Van Hise, of Wisconsin University, entitled "The Geology of the Cobalt District," was read. The animated discussion showed how interesting the geology of this district is to the mine managers, and many new points were brought out. Interest was given to the meeting by the presence of Prof. Brock and Capt. Tyrell, who gave interesting addresses. The next meeting will be held on the first Wednesday in June.

A magnificent new vein was discovered last week on the Buffalo property. This property, under the able mangaement of Mr. Jones, has developed into one of the big things of the camp.

Mr. R. W. Leonard, president of the Coniagas, accompanied by Mr. Peak, of the North American Cobalt Smelting & Refining Company, of Thorold, were in town for a few days last week.

The towns in the mining district are fast assuming city airs, and both Cobalt and Haileybury can boast of clubs.

The Cobalt Club has secured very comfortable quarters in the Exchange Building, where they have two flats, consisting of billiard room, reading room, smoking rooms and card rooms, all furnished with mission furniture and decorated in excellent taste. The club now boasts of a hundred members, and it is the intention to erect a building of their own, with dining room and all the conveniences of a city club. At the annual meeting, held on 27th April, the follwoing directors were elected:—F. H. Marsh, manager Imperial Bank of Canada, Cobalt; S. H. Logan, manager Canadian Bank of Commerce, Cobalt; C. B. Flynn, of the Colonial Mining Company; George Ross, barrister, Cobalt; J. McConnell, manager Green-Meehan Mine; manager of Government mines; J. Lorne McDougall, barrister, Cobalt. The new Board are all quite enthusiastic, and the future success of the club is assured.

The Haileybury Club is another organization which tends to afford some social advantages and comforts to the bachelors of Haileybury, and probably to a number of benedicts, at present homeless in their search for the white metal.

Kingston, Ont., is to be the site of the smelter of the Stanley Smelting Works. The Kingston Council has granted the company a free site of five acres. A four hundred ton concentrator and an aerial tramway are to be installed at the company's mine. For the smelter, Kingston, with its admirable harbor, should be an excellent site.

Eight inspectors will be sent by the Ontario Government to Cobalt and Temagami districts and the outlying country, to investigate claims and confirm or cancel discoveries.

The Ontario Department of Mines, recognizing the difficulty of carrying on development work under the severe conditions of this very protracted cold weather, has decided to exclude the period between April 15th and May 15th in computing the time within which work or mining operations are required to be performed by the Mines Act on any mining claims covered by working permits, in order to prevent forfeiture.

Nova Scotia.

Springhill.—A short description of Springhill may interest some at least of your readers. Springhill is essentially a mining town. A town of one industry—coal mining. It is a city set on a hill, several hills. It is a common saying that to leave the postoffice to go anywhere *in the flesh* you go uphill. The postoffice, the largest and most important public building, occupies a central position in the town. The building is of brick, and is rather a handsome structure. It is the hub, so to speak, of a wheel, formed of stores and other buildings, save toward the north, where the Cumberland Railway & Coal Company's reserve lands permit an uninterrupted view for miles towards Shepody Mountain range. The northern frontage of the town runs parallel to the crop of the working coal seams, following its various windings. This irregularity in the outcropping of the seams takes the form of an S in the three and a half miles of developed working. From the centre of this distance for probably a mile the line of strike is east and west, nearly. On the east it makes a gradual curve to the north, while the west side curves very decidedly to the south for a long distance. The town, in consequence of following the gyration of the outcrop, appears from a north view to be built in a semi-circle, the west end being suddenly rounded off to the south. There are no dwelling houses, therefore, built over the workings, or possible workings of these seams. To the north are the mines and their extensive and up-to-date surface plants, the railway, the various sidings and branches, and the railway buildings. To the east, south and west is the town, which owns the distinction of being the highest mining town in Nova Scotia, its elevation being 600 feet against the 216 feet credited to Westville, of Pictou County. In the matter of population, a few years ago Springhill was the most populous mining town in Nova Scotia. But Springhill to-day must give place to Greater Glace Bay, in Cape Breton, and possibly to Sydney Mines. The population of Springhill is in the vicinity of 7,000. There is one thing, however, I think Sprinkhill leads in. This is the workmen's ownership of land and houses. Of Springhill it can be said that for a town of but one industry there is none in the Province, possibly none in Canada that contains so many residences owned by workingmen. There are over 1,300 dwellings in the town. In ordinary mining towns a large proportion of the mining men are housed by the operating companies. On the tenant roll of the Cumberland Railway & Coal Company there are about 180 tenants. As the company has on its pay roll, at the present time, 1,700 names, it is at once apparent that the company has made no provision for housing a very large majority of its employees. There are, comparatively speaking, very few houses in Springhill built for the purpose of renting. So it is very evident that by far the largest number must be owned by the occupants, who are in the company's employ. In building, in recent years, the tendency is to get back from the works, the town extending east, south and west. The buildings are mostly of wood, the exceptions being the Postoffice, Town Hall and Academy of Music, which are of brick. The Technical and High School Building to be constructed this year will also be of brick. Springhill is a very healthy place as a rule; but is subject to epidemics, as a recent experience has shown. The town has a magnificent water supply, of the very best quality, brought in by gravity from a lake distant some seven miles to the south of the town, on the notrhern shed of Maccan Mountain range. The cost to the town was approximately $180,000, but this was money well expended. With the splendid water supply, however, we have no sewer system. To this fact are attributed the frequent outbreaks of typhoid fever and various ills. Especially is the north side of the town affected, the fall of the ground being towards the north. The open drains, with their accumulated impurities, make ideal breeding places for all sorts of disease germs. This condition will soon, however, be changed. The city fathers are getting busy over the question of sewerage, and decided improvement is looked for this year. There is one other thing this town can boast of, and that is good roads. It was not always so, but with the discovery of red stone as a macadam, an era of decent streets began, and for years past we have enjoyed the driest and cleanest streets of any town in the Province. It may not be out of place to remark that this red stone is a product of the mine. Rock

and fire clay from tunnels and roof strippings, slate, shale, splint, coal and wood refuse are sent up out of the mine, dumped in a huge heap, and this accumulates for years. It ignites through spontaneous combustion. It smoulders and burns until anything of a combustible nature is burnt out. There remains but a diminished heap of hard rubble, bright red in color, with not a particle of anything in it that makes for mud. This material, when spread a foot deep on the worst road, will stand years of the heaviest hauling without serious rutting. When placed on foot paths it will attain the smoothness and solidity of cement without the clothes-destroying dust that rises from the cement sidewalk. Although the red stone does not "make" in sufficient quantities for an extensive export trade, some hundreds of tons have been purchased by our progressive shire town of Amherst for street macadam. Springhill is somewhat noted in other ways. According to the population, it has more churches and other religious institutions, more societies, more clubs, more children, more schools, more *strikes* (to its credit or otherwise) than any mining town in Canada.

I will later give a description of the surface plant and collieries that may be of some interest.

GENERAL MINING NEWS

British Columbia.

The British Columbia Copper Company, operating at Greenwood, will presently install a cyanide plant of 500 tons per day capacity at the Napoleon Mine, Pierre Lake district, Washington. The Napoleon claims are two miles from Boyd's Station, on the Great Northern.

What is probably the first carload of coke ever imported into Canada from New Zealand will soon arrive in Vancouver on the steamer Pardo.

In the Lillooet district, B.C., the Alexandra Hydraulic Company are prosecuting work vigorously on Alexandra Creek, a tributary of Bridge River. The company has endeavored to induce the Government to construct a bridge across the Bridge River at Jack's Point.

On Sunday, April 21st, the Dominion Copper Company's Boundary Falls smelting plant was blown out. This was directly a consequence of the coal miners' strike.

Under the regulations governing the disposal of Dominion lands within the railway belt in the Province of British Columbia, coal lands may be purchased at $10 per acre for soft coal and $20 per acre for anthracite. Not more than 320 acres may be acquired by any one individuel or company. Royalty at the rate of 10 cents per ton of 2,000 pounds is collected on the gross output.

The Sudbury group of mines, not far from the Mother Lode and Sunset groups, in Deadwood camp, is being taken up by James Schiene, of Spokane.

The Ellemar copper mine, in Prince William Sound, in Southwest Alaska, has been sold to H. C. Elliott for $1,000,000. Mr. Elliott is president of the Hubbard-Elloitt Copper Mines Development Company. The mine was one of the first locations made in Southwest Alaska.

In the last week of April the erecting engineer of the Jenckes Machine Company and the Canadian Rand Company, turned over the new plant recently installed in the Idaho property to the Dominion Copper Company. The plant has since been operating smoothly. The compressor furnishes air for the Brooklyn, Idaho, Rawhide and Stemwinder mines, and operates two diamond drills and three pumps. It is a Rand type, and was manufactured in Sherbrooke, P.Q. It has a rated capacity of 25 drills, and is driven by a 450 horse-power Canadian Westinghouse electric motor. The current is taken from the South Kootenay Power Company's high tension hydro-electric lines, being brought from Bonnington Falls, on the Kootenay River, some 75 miles distant. To furnish the Rawhide with compressed air, a six inch pipe line was laid for more than a mile.

To illustrate the effect of the car and fuel shortage and the severe weather conditions of last winter, a comparison of the output of refined copper from the ore of Boundary mines, during the first quarter of 1906 and of the same period in 1907, may be made. For the first three months of 1906 the quantity was 7,500,000; for the first quarter of 1907 it was 5,000,000.

The Rambler Mine, in the new working between levels 7 and 9, is developing a vein of rich ore. A series of new stopes on each side of the 1,350-foot shaft is being started. New bunk-houses are being built and hoisting machinery installed.

Ontario.

On the Big Ben mine property, Bucke Township, four new buildings, to accommodate 40 men, are now completed. An 80 horse-power boiler, a compressor and a steam hoist are to be installed.

The unsurveyed territory immediately south of Lorraine Township is reported by prospectors to be, at least, promising. The formation is principally conglomerate and conglomerate slate. It is said that gold, silver copper, galena and cobalt bloom have been found there.

Pulp Mill No. 1 of the Sault Ste. Marie Pulp & Paper Company was almost entirely destroyed by fire on April 24th. Overheated bearings are supposed to have been the cause. Two hundred men are out of employment. The loss is heavy, though partially covered by insurance, and it will likely require eight months to rebuild.

The Ontario Government has refused to grant liquor licenses except in towns and cities within 20 miles of the Transcontinental Railway.

The Laurentian Mine Company has advanced the pay of its drillmen to $3.25 per day; helpers, $2.90; carmen, $2.75.

Sixteen miles north of Bruce Mines, in Morin Township, a discovery of cobalt bloom is reported.

Ontario—Cobalt.

The Badger mine property, consisting of 80 acres, staked out by students of the University of Wisconsin, has been bought by an English syndicate. The purchase price is said to be about $1,000,000.

Kerr Lake is to be partially drained by the Kerr Lake Mining Company, with the object of exposing a considerable amount of the lake bottom for prospecting. The Silver Leaf Mining Company has granted permission to the Kerr Lake people to use part of their property as a building site.

The directors of the Coniagas mines have declared a dividend of 2 per cent., and notify shareholders that the intention is to declare 2 per cent. every two months hereafter. This is at the rate of 12 per cent. per annum, and on the $4,000,000 stock will take $480,000.

Nova Scotia.

The iron ore deposits of the Eskasoni and McPhee Mountains have been bought by an English company. The surface indications are good and an excellent harbor will afford shipping facilities.

A ten-stamp gold mill is to be erected at Middle River, Cape Breton.

At Dominion No. 2 Colliery, the explosive Alexite is being experimented with exhaustively.

The site has been selected for the new Sydney Rolling Mills. The property comprises 28 acres.

The new Bessemer converter was blown in at Sydney on May 1st.

It is stated that the Gowrie & Blockhouse Collieries Company has been absorbed by the North Atlantic Collieries Company, Limited. The capacity of the pit at Port Morien is 400 tons per day. This capacity is to be increased to 1,500 tons per day. One hundred and fifty thousand dollars is set aside to effect improvements. At Long Beach, a mile distant, another shaft will be sunk, and the shipping pier will be largely improved. Several

boats are to be chartered. The company controls about 36 leases, on which six seams of gold are known.

The Nova Scotia Steel & Coal Company are about to close a deal whereby they will acquire large deposits of iron ore in the interior of Brazil. Mr. Harvey Graham is conducting the final negotiations.

Ten stamps will soon be added to the five already in operation at the Beaver Hot gold mine. Mr. S. Clifford MacLean is the resident engineer.

The amount of coal shipped by the Dominion Coal Company from Louisburg during the past four months was 450,766 tons. About 335,000 tons of this amount was shipped to Boston and Portland, while the balance was distributed between Maritime and Gulf ports and Newfoundland.

A rich find of gold-bearing quarts has been made at Montague, near Halifax. It is supposed to be a continuation of the old Rose lead.

Belief is growing in the probable consummation of a merger of the Dominion Iron & Steel and the Dominion Coal Companies.

At a special meeting of the Pioneer Lodge of the Provincial Workmen's Association at Springhill, N.S., it was decided almost without a dissentient vote to refer the "Stone Trouble" with the Cumberland Railway & Coal Company, to a Board of Conciliation for investigation.

ALBERTA.

A seam of coal six feet in thickness has been uncovered near Strathcona.

Coal has been discovered within the city limits of Calgary.

ALASKA.

About the middle of April a general lockout and strike was reported at the Treadwell mines. The trouble is attributed to the poor diet provided for the workingmen.

BOOK REVIEWS

THE MINING MANUAL FOR 1907, by Walter R. Skinner, London, 11-12 Clements Lane, Lombard street, E.C. Twenty-first year of publication.

The information set forth in the Mining Manual is classified into three sections—Australia, African, and Miscellaneous, covering 1,135 pages. The pressent issue contains particulars of 3,054 companies, of which 410 are Australia, 1,033 African, and 1,611 miscellaneous. As in previous issues, alphabetical lists of mining directors and secretaries and a dictionary of mining terms are included. These are supplemented by a list of engineers and mine managers, giving the names of the companies with which they are connected. A remarkable amount of information is condensed within the Mining Manual. Its practical utility is at once evident from the mere mention of what a field it covers.

FIRE ASSAYING, by Evans W. Baskett, B.S., D. Van Nostrand Company, 23 Murray street, N.Y., pages 105, price $1.25. This is a most useful outline of fire assaying. The illustrations are numerous and well chosen. Particularly valuable are the chapters on "Reagents and Fluxes" and on "Laboratory Tests." Being written with the avowed object of clearly presenting the subject to persons of no technical education, it is simple, lucid and direct in diction and manner. The book should prove useful to those who wish to acquire rapidly a working knowledge of fire assaying.

PERSONAL

Mr. J. Dix Fraser has returned to New Glasgow, after an extended visit to England.

Mr. A. G. Burrows is among the newly appointed Ontario Mines Inspectors.

We regret to learn that Superintendent S. D. Madden, who has been in charge of the diamond drill work on Little Nipissing, is temporarily incapacitated owing to an accident. We wish Mr. Madden a speedy recovery.

Dr. A. E. Barlow was in Toronto on mining business on the 5th and 6th of May. He then left for Cobalt.

The Hon. Frank Cochrane, Minister of Mines for Ontario, has returned from a long visit to the Old Country, restored in health.

Mr. Nicholas Flynn has been appointed general manager for the La Rose Mines Company at Cobalt.

Mr. A. P. Low, Director of the Geological Survey, has returned to Ottawa from spending a few weeks in the South. We are glad to learn that his health is completely restored.

Mr. J. C. Haas, of Spokane, Wash, well known as one of the pioneer engineers of the Boundary district, where he has still large interests, recently visited the Cobalt district to report on properties for a syndicate.

The Dominion Coal Company is being sued by Mr. Austin King, formerly superintendent, for $85,000 for wrongful dismissal.

Mr. Frank Robbins has been engaged to report on placer deposits on the Colorado River.

Mr. R. R. Hedley has been commissioned by the Federal Government to report on the smelters and reduction works of British Columbia in connection with the work of the recently created Department of Mines. The appointment is an excellent one, and the authorities are to be congratulated upon securing the services of so well known a metallurgical expert to undertake the duty.

Mr. Thos. Kiddie, formerly manager of the Tyee Copper Company's smelter at Ladysmith, B.C., has assumed the management of the Alaska Mining & Smelting Company's smelter at Hadley, Prince of Wales Island, where it is proposed to install the Kiddie hot blast system.

STATISTICS AND RETURNS

The following figures give the ore shipments of three districts of British Columbia for the week ending April 27th, and for the year to date:—

Boundry shipments—

Mine.	Week.	Year.
Granby	19,836	178,060
Mother Lode	6,808	53,649
Brooklyn	1,440	23,643
Snowshoe	2,699	20,756
Rawhide	1,760	19,481
Sunset	736	8,004
Emma	303	3,021
Mountain Rose	140	1,803
B.C.	12	1,358
Oro Denoro	814	990
Idaho	384	896
Providence	74	467
Morrison	150	469
Strathmore	31	53
Duncan	21	21
Other mines	...	327
Total	35,208	313,000

Kootenay-Slocan shipments—

Mine.	Week.	Year.
Sullivan	600	9,600
La Plata	46	1,177
La Plata, milled	425	6,800
St Eugene	354	4,321
Queen milled	185	2,960
Second Relief, milled	145	2,330
Hunter V	107	1,546
Silver King	645	691
Queen Victoria	80	352
Last Chance	22	274
Sunset	31	74
Idaho	26	48
American Boy	18	18
Other mines	...	5,711
Total	2,684	35,902

The total shipments from the mines in the above districts for the past week were 43,375 tons, and for the year to date 326,143 tons.

Rossland shipments—

Mine.	Week.	Year.
Le Roi	2,974	40,211
Centre Star	1,414	25,288
Le Roi No. 2	386	6,645
White Bear	149	577
White Bear, milled	500	2,200
Other mines	...	2,320
Total	5,423	77,241

Cobalt shipments, week ending May 4th, 1907:—

April 30th—O'Brien Mine, to American Smelting & Refining Company, Perth Amboy, N.J., 64,640 lbs.

May 4th—O'Brien Mine, to American Smelting & Refining Company, Perth Amboy, N.J., 65,750 lbs.

May 3rd—Townsite Mine, Canadian Copper Company, Copper Cliff, Ont., 40,070 lbs.

May 3rd—Silver Queen Mine, Canadian Copper Company, Copper Cliff, Ont., 44,000 lbs.

May 4th—Coniagas Mine, American Smelting & Refining Company, Perth Amboy, N.J., 62,000 lbs.

Total, 276,460 lbs.

CANADA'S IRON PRODUCTION.

The pig iron production of the Dominion is keeping pace with the growth of other industries. In thirteen years the increase has been about 1,200 per cent., an average of nearly 100 per cent. per year. In 1894 the output was 44,791 tons, and in 1906, 541,957 tons. The production of last year was double that of 1904, when the output was only 270,942 tons. The output per year since 1894 up to last year is given in the following table:—

1894	44,791
1895	37,829
1896	60,030
1897	53,796
1898	68,755
1899	94,077
1900	86,090
1901	244,976
1902	319,557
1903	265,418
1904	270,942
1905	468,003
1906	541,957

Last year there were thirteen blast furnaces in operation, and in 1905 there was thirteen during the first half of the year and twelve during the latter half. The outlook this year isexceptionally bright, and when the immense iron ore discoveries around Port Arthur are developed an ouput of at least half as much again as that of 1906 may be looked forward to.

The following figures give the approximate output and shipments of the Dominion Coal Company for the month of April:—

No. 1 colliery	35,925
No. 2 colliery	54,379
No. 3 colliery	33,360
No. 4 colliery	49,434
No. 5 colliery	72,858
No. 6 colliery	16,708
No. 8 colliery	20,038
No. 9 colliery	33,208
Total output	315,911
Total shipments	212,772

CATALOGUES AND OTHER PUBLICATIONS

The rapid advance of the B. F. Sturtevant Company, Boston, Mass., in the electrical field has been noticeable and is particularly marked at this time by the issue of their Bulletin No. 63, showing various types and sizes of generating sets. These range from 3 to 100 kw. in output, the smallest size being driven by a 3 1-2 x 3 vertical engine, and the largest by a 14 x 14 horizontal centre-crank engine. A separate series, ranging from 7 1-2 to 100 kw., is equipped with vertical compound engines. All the types of Sturtevant engines illustrated are completely enclosed and arranged with watershed partitions to prevent the water from the piston rod stuffing box reaching the interior of the frame. All interior bearings are supplied with oil under a system of forced lubrication, thereby securing a mechanical efficiency considerably in excess of 90 per cent. Many of these generating sets in the vertical, simple and compound types have been designed to meet the rigid specifications of the United States Navy Department, and their successful passage through the inspector's hands appears to be the best evidence of the standard which is being maintained by the B. F. Sturtevant Company.

Bulletin No. 12, from Mussens Limited, Montreal, illustrates their double cylinder, single drum mine hoists and cages.

A revised price list of sprocket wheels has been received from the Link-Belt Company, of Chicago.

Two very attractive catalogues have been received from the Robb Engineering Company, Limited, of Amherst, N.S. One, on "Steam Boilers," traces the evolution of the Robb-Mumford boiler. The Mumford boiler was designed by Mr. J. A. Mumford in 1885, primarily as a portable boiler for saw-mills, mining purposes, etc., when a light, compact boiler was required with internal fire box. With its large, round furnace it proved a great success. In 1889 an outer casing of iron was added and other improvements made with a view to securing the utmost possible economy of fuel. The present type was designed by Mr. Mumford in 1896. Improvements embodied in it provided for position circulation, larger margin of water line, prevention of scale formation, and facilitated the removal of scale and sediment. Further improvements were made in 1902. In construction the Robb-Mumford boiler is especially adapted for carrying high pressures of steam with safety. Another catalogue describes the design and method of manufacture of the now celebrated Robb-Armstrong engine, of which many types are made for every variety of duty.

"Merralls' Mills" is the title of a descriptive catalogue which comes from the Merralls Machinery Company, 1123 Broadway, corner 25th street, New York. The Merralls people manufacture an especially substantial stamp-mill with certain features which recommend it to all practical men. One of these features is the individual mortar. Each stamp also has its own ore feeder and water supply. Screens on all four sides of the mortars afford quadruple discharge and effectually prevent sliming. Each stamp may be hung up for cleaning, repairs, etc., without in the least interfering with any other stamp. A great increase of amalgamating capacity is claimed as compared with the five-stamp open mortar. The individual mortar tends to prevent flouring of the mercury. A short, fast drop of a much heavier stamp gives the Merralls' stamp mill a very large crushing capacity. Sectional mills are made, by this firm, that are easily transportable.

EXCHANGES.

The Coal Trade Journal for May 1st predicts a record-breaking year in anthracite output.

A history of British Columbia placers, past and present, is started in the May 4th number of the Mining World.

Many good papers, among them "Stoping Systems at Broken Hill," appear in Mines and Minerals for May.

"Preservation of Mine Timber from Decay" is the title of a leading article in The Engineering and Mining Journal, May 4th.

The February number of the British Columbia Mining Record is on our desk. A very readable paper on the British Columbia Copper Company's Greenwood smelter is contained in this number.

Mining and Scientific Press, April 27th, has an excellent description of "The Geology of the Meta Madre," written by the editor, Mr. T. A. Rickard. In this number the announcement is made that the Mining and Scientific Press has once again taken up headquarters in San Francisco.

The Colliery Guardian, April 19th, has been received.

The Mining Investor for April 29th has been received.

The Chemical Engineer, April 1907, contains an exhaustive summary of recent literature on asphalt.

Canadian Machinery for May has been received. Robert W. Angus writes on "Some Features of Large Gas Engines."

The Mining Reporter, April 25th, administer a mild reproof to the daily press of mining camps.

The Industrial Advocate, April, gives a full and well-connnected report of the proceedings of the Nova Scotia Mining Society.

The Engineering and Mining Journal, April 27th, presents a copiously illustrated description of some of the leading Cobalt mines.

No. 3, Vol. XXV., of the Proceedings of the South Wales Institute of Engineers. The technical papers given in this issue are of a very high order.

"Quebec Mining Law," issued by the Department of Colonization, Mines and Fisheries, Quebec, in the form of a neat, compact booklet, has been received.

A valuable paper entitled "The Blast Furnace Practically and Theoretically Considered" is given in Iron and Coal Trades Review, April 19th.

Among other articles of interest, one on the "Black Sands of New Zealand, the Pacific and Tierra del Frigo," appears in the London Mining Journal, April 20th.

The earthquake anniversary number of the San Francisco Mining and Scientific Press (April 20th), in an incisive and cogent article, deals with the "Requirements of Modern Mining."

The Engineering Magazine for May has its usual number of first-class technical articles. "The Technical Student and the Engineering Apprenticeships Course" is worthy of careful perusal.

Compressed Air for April contains an account of a novel use of that substance. An ingenious New Yorker has discovered that compressed air can be used to good effect in quelling a storm at sea.

In the Mining World, April 27th, R. T. Hill writes on the "Geology of Sierra Amoloya, Mexico." A mine correspondent writes appreciatingly of Dr. David T. Day's work on the "Black Sands of the Pacific States."

COMPANY NOTES

In order to keep pace with the requirements of their increase in business, the John McDougall Caledonian Iron Works Company, Limited, of Montreal, have opened sales offices at the following places:—Montreal, 82 Sovereign Bank Building; Toronto, 810 Traders Bank Building; Winnipeg, 251 Notre Dame street; Vancouver, 416 Seymour street; Nelson, Josephine street; New Glasgow, N.S., Telephone Building.

Their principal products are waterworks equipment and all kinds of hydraulic and mill machinery.

The following new directors have been added to the Board of the Foster mine:—Mr. E. F. B. Johnston, K.C., Mr. Jos. Oliver, Mr. John Gowans Kent, and Mr. G. H. Doran.

The Ontario Gazette for the week ending May 4th contains the following list of new mining companies incorporated:—

The Ottawa Mica Mining Company, Limited, capital $350,000, head office Ottawa.

The Larder Lake Gold Hill Mines, Limited, capital $1,000,000, head office Toronto.

Imperial Consolidated Mining Company, Limited, capital $1,500,000, head office Toronto.

The Gilbert Consolidated Mining Company, Limited, capital $2,000,000, head office Toronto.

The Temagami Copper Company, Limited, capital $2,000,000, head office Toronto.

King Solomon Larder Lake Gold Mining Company, Limited, capital $1,000,000, head office Toronto.

Monitor Cobalt Prospecting & Developing Company, Limited, capital $500,000, head office Toronto.

Smaltite Silver Mining Company, Limited, capital $1,000,000, head office Toronto.

British Columbia.

Mounts Sicker and Brenton Olives, Limited. The annual general meeting was held in Victoria on April 16th. The financial statement submitted showed disbursements of $9,491.

METAL, ORE AND MINERAL MARKET

Aluminium, for No. 1 ingots—49 to 51 cents per lb.
Antimony—20 to 23 1-2 cents per lb.
Arsenic, white—7 1-4 to 7 1-2 cents per lb.
Barytes, crude—$11.25 to $14.50 per ton.
Bismuth—$1.40 to $1.50 per lb.
Cadmium—$1.40 to $1.46 per lb.
Carbons, for drills—$75.00 to $85.00 per carat.
Carborundum, powdered—8 cents per lb.
Chromium, pure metal—80 cents per lb.
Cobalt, fo.b., Cobalt, Ont., unrefined—40 cents per lb.
Corundum—7 to 10 cents per lb.
Feldspar—$7.00 to $15.00 per short ton.
Flourspar, lump—$8.00 to $10.00 per long ton.
Graphite, domestic—$45.00 to $150 per short ton.
Gypsum, lump—$4 per long ton.
Infusorial earth, ground—$15 to $35 per long ton.
Lead—6 cents per lb.
Manganese, pure—75 cents per lb.
Mica, groud—$65.00 to $85.00 per short ton.
Mica, scrap—$13 to $15 per short ton.
Molybdenum, pure—$1.70 per lb.
Molybdenite ore, 95 per cent. pure—21 cents per lb.
Nickel—45 to 50 cents per lb.
Platinum, ordinary metal—$32 per ounce.
Pyrite, 38 per cent to 45 per cent sulphur—11 to 11 1-2 cents per unit.
Quicksilver—$41 per flask of 75 lbs.
Talc—$15 to $20 per short ton.
Tungsten, pure metal—$1.35 per lb.
Tungsten ore, 60 per cent. pure—$400 per ton.
Tin—42 3-4 cents per lb.
Zinc sheets—$8.60 per 100 lbs.

MARKET NOTES.

American iron and steel market is firm. Pittsburg bessemer stands at about $23 per ton.

Copper is quiet, with an improving demand. Lake copper, 25 to 25 1-2 cents per lb.; electrolytic, 24 1-4 to 24 1-2 cents per lb. The London market is displaying an upward movement; standard, £106 15s. per long ton.

Tin.—New York, 42 3-4 cents per lb.; London, £195 10s. per long ton.

Lead.—New York, 6 cents per lb.; London, £20 6s. per long ton.

Silver.—New York, 65 1-4 cents per ounce; London, a fractional advance to 30 7-16d. Mexican dollars, 50 1-4 cents.

Spelter.—New York, 6.52 1-2 cents per lb.; London, £25 17s. 6d. per long ton.

The first reference to the occurrence of silver in Canada is found in a paper by General Baddeley, R.E., read before the Literary and Historical Society, Quebec, 1830, where the deposit of galena at Bay St. Paul is alluded to. The percentage of silver is not stated, but the quantity of galena was thought to be insufficient for successful working.