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Robert Bell

TWENTY-SECOND YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

Vol. XXIII—No. V. OTTAWA, MAY 31st, 1904. Vol. XXIII—No. V.

Dominion of Canada

SYNOPSIS OF REGULATIONS

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

COAL.

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

QUARTZ.

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

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7 50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

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

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

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

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

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

PLACER MINING.

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

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

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

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

DREDGING IN THE YUKON TERRITORY.

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

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

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

PLACER MINING IN THE YUKON TERRITORY.

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

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

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

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

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

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

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

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

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

PETROLEUM.

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

Department of the Interior,
OTTAWA, February, 1904.

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

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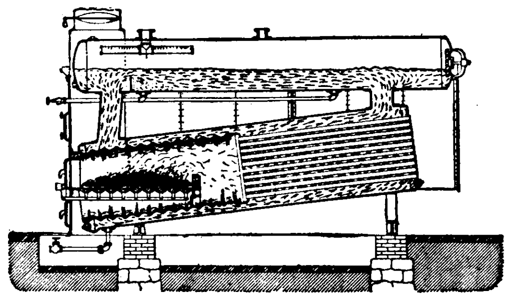

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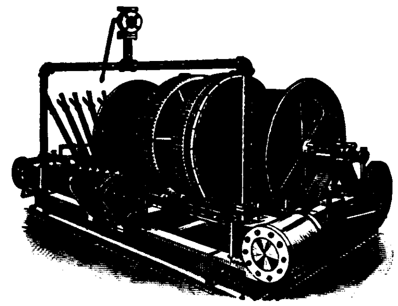

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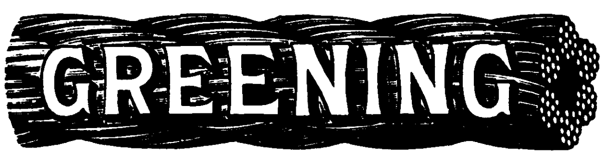

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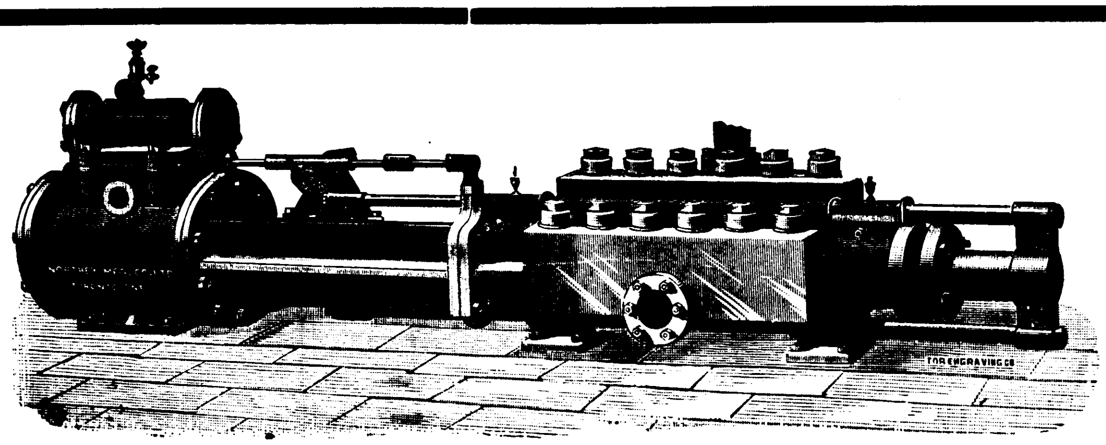

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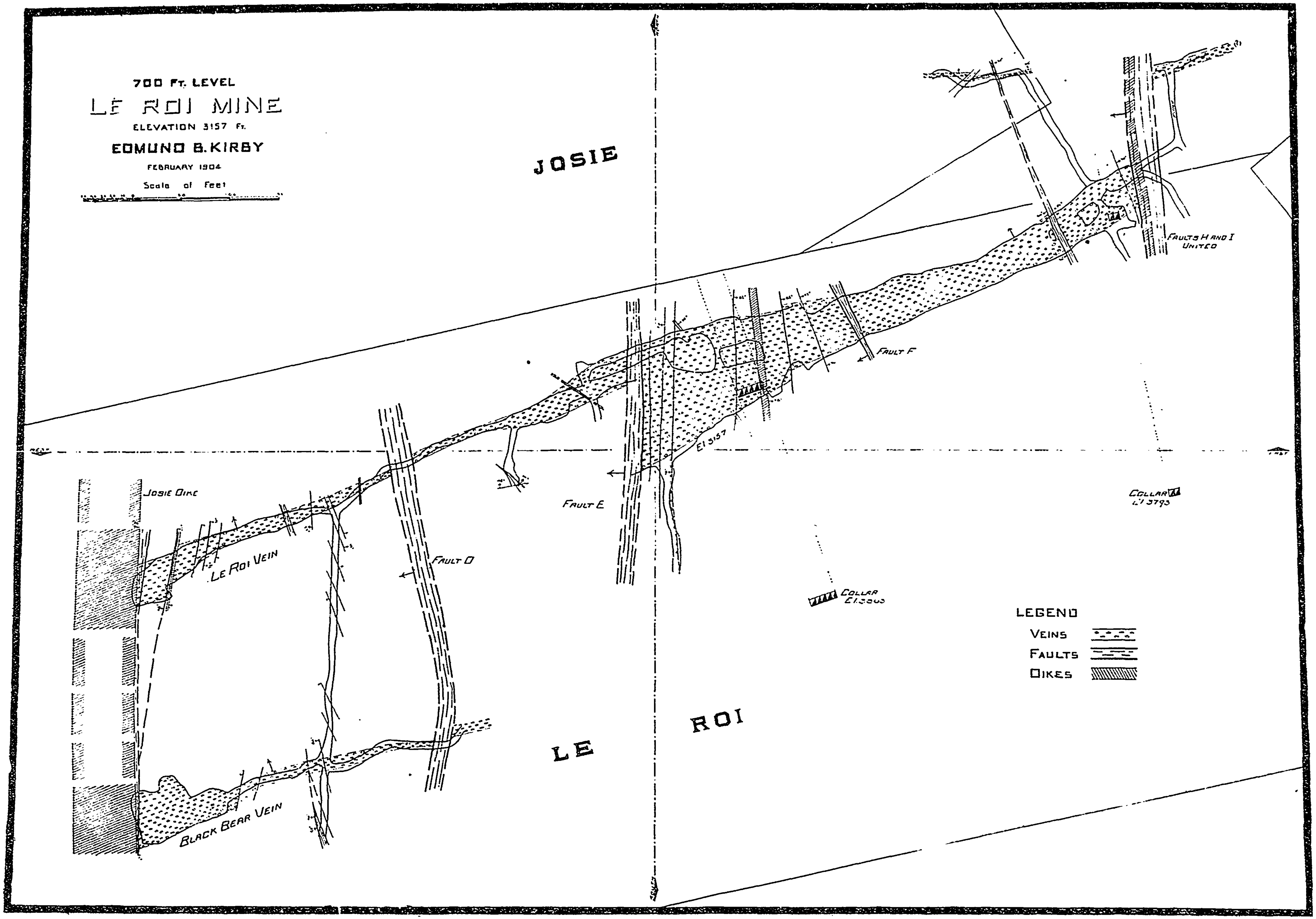
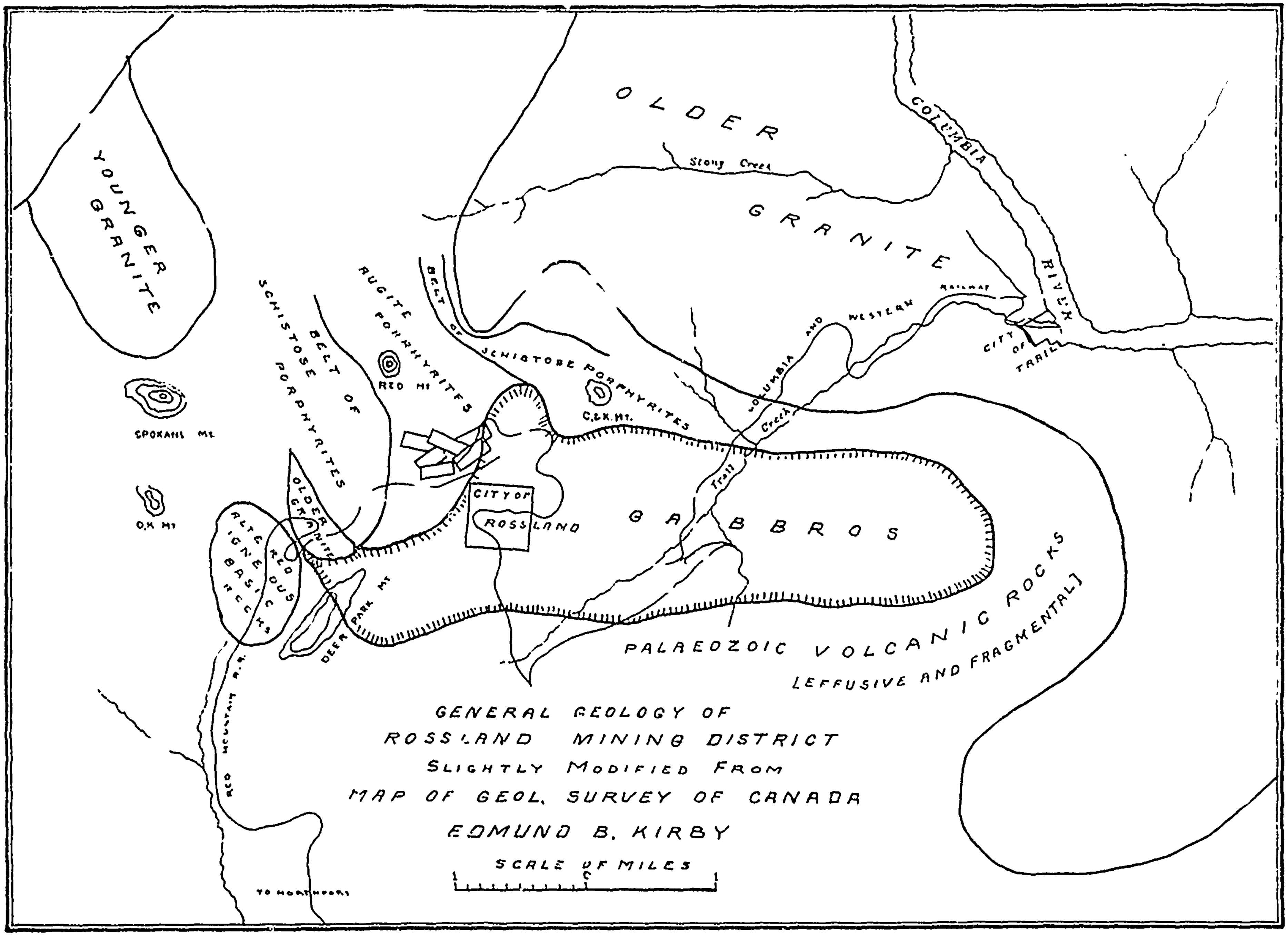


700 Ft. LEVEL
LE ROI MINE
ELEVATION 3157 Ft.
EDMUND B. KIRBY
FEBRUARY 1904
Scale of Feet
JOSIE
LE ROI
Josie Dike
Le Roi Vein
Black Bear Vein
Fault D
Fault E
Fault F
Faults H and I United
El 3157
Collar
LEGEND
Veins
Faults
Dikes



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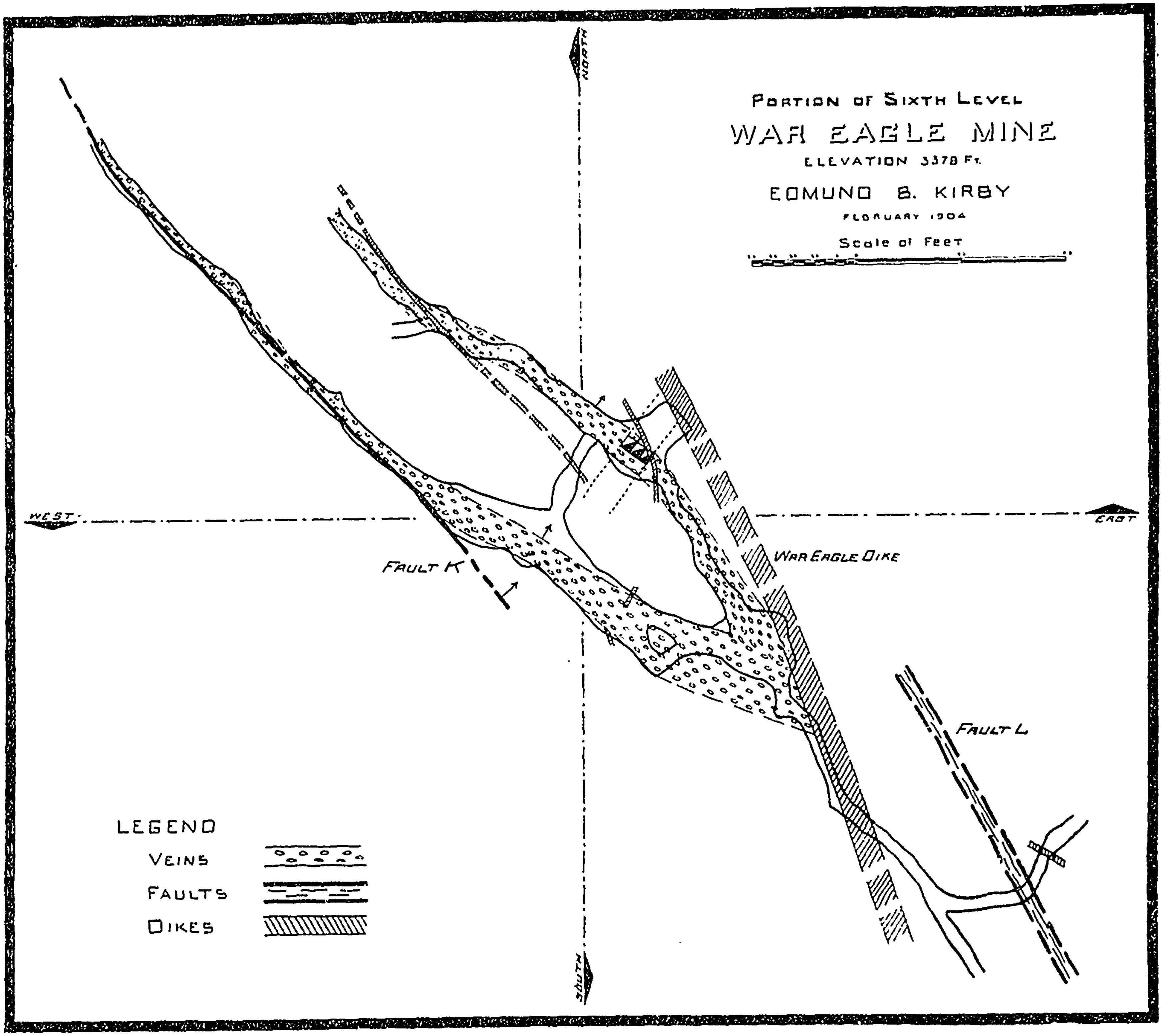
GRANITE
Stony Creek
COLUMBIA
RIVER
CITY OF TRAIL
COLUMBIA AND WESTERN RAILWAY
Trail Creek
YOUNGER GRANITE
BELT OF SCHISTOSE PORPHYRITES
AUGITE PORPHYRITES
RED MT
BELT OF SCHISTOSE PORPHYRITES
C.&K. MT.
CITY OF ROSSLAND
GABBROS
OLDER GRANITE
ALTERED IGNEOUS BASIC ROCKS
DEER PARK MT
SPOKANE MT
O.K. MT
RED MOUNTAIN R.R.
TO NORTHPORT
PALAEOZOIC VOLCANIC ROCKS
(EFFUSIVE AND FRAGMENTAL)
GENERAL GEOLOGY OF
ROSSLAND MINING DISTRICT
SLIGHTLY MODIFIED FROM
MAP OF GEOL. SURVEY OF CANADA
EDMUND B. KIRBY
SCALE OF MILES



Portion of Sixth Level
War Eagle Mine
Elevation 3378 Ft.
Edmund B. Kirby
February 1904
Scale of Feet
North
West
East
South
War Eagle Dike
Fault K
Fault L
Legend
Veins
Faults
Dikes


MONITA
PILGRIM
MUGWUMP
MASK
IRON
No 1
WAR
EAGLE
ANNIE
JOSIE
STAR
CENTRE
LE ROI
LEGAL TENDER
BLACK BEAR
NICKEL PLATE
STRUCTURE DETAILS
OF THE
ORE DEPOSITS OF RED MOUNTAIN
ROSSLAND, B. C.
EDMUND B. KIRBY
FEBRUARY 1904
STRUCTURAL GEOLOGY
BY
CARL R. DAVIS E. M.
HUGH ROSE A. B.
HORIZONTAL SECTION AT THE ELEVATION
OF 3330 FEET ABOVE SEA LEVEL
Scale of Feet
LEGEND
Veins
Faults
Dikes
Centre Star Main Vein
War Eagle Vein
Iron Mask Vein
Belt of Dikes
Le Roi Main Shaft
Centre Star Shaft
Josie Shaft
War Eagle Shaft
Black Bear Tunnel
Josie Dike
Dip Vertical

22nd YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

Estate of B. T. A. Bell, Proprietor. PUBLISHED MONTHLY. Office: Orme's Building, Ottawa.

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Advertising copy must reach the REVIEW Office *not later than the 15th of each month* to secure insertion in current issue.

CONTENTS.

Our article on "British Columbia and the Lead Bounty," in our last issue has been made the subject of comment in a letter which we are requested not to publish, but as some of the statements in our article are called in question by this private communication we feel at liberty to make some editorial comments.

Our correspondent says that there has never been any discussion, *at any time*, of the question of what portion of the bounty on lead should be received by the smelters, and further, that "no smelter has ever received any share whatever of the bounty." Speaking exactly and literally the words we have quoted may make a correct statement, but indirectly, the smelters have been large participants in the bounty through the increased freight, smelting and *especially* marketing charges, which they have imposed upon the miner.

The editorial in question was based upon the facts obtained from one of the largest, if not the largest, corporation in British Columbia interested in the silver-lead question, and it was not the intention of the editorial to in any way revive or stimulate the old differences of opinion between the producers and the smelters. The facts as stated in our article are *true*, and are not contradicted by the various articles which have appeared in the press of Nelson, Kalso, Vancouver and Spokane, during the last two months. The members of the Mine Owners Association and the gentlemen representing the smelting industries of British Columbia will know whether our writer was correct or incorrect in his generalizations; that he was well informed by people personally interested, and thoroughly conversant with the subject, is what we assure to our readers.

Mining in Newfoundland.

The annual report of the Mineral Statistics of Newfoundland issued by the Director of the Geological Survey, Jas. P. Howley Esq., F.G.S., contains some of the data which is responsible for the largely increased interest now taken in the mineral resources of the island.

The most noteworthy change from previous years was in the large decrease of iron ore shipments from Bell Island. The deposits on this island are owned (as our readers know) by the Dominion Iron and Steel Company and by the Nova Scotia Steel and Coal Company. The output of ore by the Dominion Company was 59,885 tons less than in 1902, and the Nova Scotia Company decreased its shipments by 80,041 tons, making a total decrease for 1903 over 1902 of 133,072 tons.

The shipments of copper ore aggregated 87,790 tons, being an increase of 13,182 tons over 1902; by reason of the better price ruling for metallic copper the *value* of the shipments exceeded, by $117,474.00, the value obtained in 1902. The bulk of the production continues to come from the mines at Tilt Cove, leased to the Cape Copper Company in 1890 for a term of 99 years, which produced 75,676 tons.

The pyrites industry also showed a gratifying increase, coming from the deposit on Pilley's Island. This mine marketed 42,000 tons in 1903, against 26,000 tons in 1902. The Dominion Iron and Steel Co. still holds the option on the large deposit at Rowsell's Harbor, Labrador, and it is reported that 1904 will see some production from this deposit.

1903 was noteworthy in Newfoundland as witnessing the inception of a small but promising gold production. It appears that, in addition to the quartz deposits carrying free gold which have been formerly noticed, a placer, or gravel, deposit at White Bay, known as the "Sop Arm Mine" has made a production. The value reported as obtained is $3,000.00, but note is made in Mr. Howley's report that the treatment adopted has not succeeded in satisfactorily saving the gold; many of the finer particles being washed away and not recovered.

The auriferous lode mine at Cinq Cerf Brook is in a band of quartzite, intercalcated and mixed with slates of talcose or chloritic nature. It is highly mineralized with copper sulphides (bornite, erubescite and chalcopyrite) and carries its gold in particles which sometimes are free in the quartzose rock, and sometimes are embedded in the metallic sulphides mentioned. The values in gold are low, the highest as yet being $7.00 per ton, but no fair or average test has yet been made.

The petroleum field at Parson's Pond has not been active; up to the first of the year six holes had been completed and two more partly drilled, the completed holes are producers but as no continuous pumping has been done the actual yield of these wells is yet indeterminate. From results obtained they are estimated at 5 bbls. each, per day.

The deposits of chrome iron ore at Benoit Brook remain as in 1902, undeveloped, and the talc deposits of Conception Bay are in the same condition.

The mineral industry employed 2067 persons in 1902, out of which number there were six deaths from accidents. The total *local* value of the *metallic ore* production was $1,144,845, which Mr. Howley points out is about one seventh of the *actual* value when converted into market products. The actual value, based on ruling market prices for the metals contained, is put by Mr. Howley at over $8,000,000, but we need not point out that such valuation is not permissable. To the members of the Canadian Mining Institute such an example of figuring values recalls the numerous papers and discussions on Mineral Statistics with which they are acquainted, and to the editor of the REVIEW it recalls the remarks of President Coste at the Toronto meeting of this year.

The value of a country's mineral production is what that production brings as it is used, or sold, in that country, and although the REVIEW sympathises with Mr. Howley's aim and methods in his endeavors to create metallurgical and chemical industries in Newfoundland to use the raw products which that island affords, it has to acknowledge that the Dominion of Canada is suffering, to a proportionate extent, in having a larger raw mineral production than it can manufacture. Newfoundland needs a portion of the same cure which is prescribed for Canada, viz.—a large increase of population. The statistics of ores produced are very creditable, and the report is a most valuable document for those interested in mineral productions.

Again the Le Roi Mine.

The mining portion of the British press seems to be again in a high state of excitement concerning the condition of the Le Roi mine. It appears that early in the present month the London Board received a telegram from the acting general manager, Mr. J. H. Mackenzie, reading as follows:—"Shipped from the mine to the Northport smelter during the month 3,720 tons of ore from all stopes which show the average value of the mine is $8.17 per ton; 430 tons shipped from 1,350 feet level showed $7.45 per ton. No profit at all has been made for several months. The amounts realised from the treatment of the furnace bottoms is $85,000. Owing to faulty sampling and assaying and excessive valuation, $335,000 has been made in the assets," and at the same time was advised by a cable from Mr. Anthony McMillan, the managing director, that he had not yet had time to investigaten, or to see Mr. Parrish who has been seriously ill.

Upon receipt of these telegrams the Board at once sent out copies, which administered a heavy blow to the mining shares on the market, the price tumbling from 1 5/16 on April 25th, to 7/8 on May 13th.

Since the new year began the reports emanating from the head office have been very satisfactory to shareholders because the monthly profits have been stated to be from £10,000, to £12,000; now the *acting* manager telegraphs that, owing to faulty sampling and assaying there has been an over valuation of some $335,000 or £67,000 stg. Such a telegram, if its news be verified, is indeed a cause of alarm, but the last annual report of this company, presented at the annual meeting held on the 18th February, 1904, told the shareholders over Mr. Parrish's signature, that while the average of the ore shipped during the fiscal year was $13.36 on which a net profit of $1.99 a ton was realized, yet the average value of the reserves at date of December 14th, 1903 was only $8.22 per ton. This is but 5 cents a ton different from the average value of the mine (viz.: $8.17) as given in Mr. Mackenzie's cablegram, and if shareholders had read Mr. Parrish's report they should not have been thrown "into a panic" by the recent cable news.

The position of the mine is no more serious than it was six months ago, and the REVIEW takes strong exception to the words used by the London B.C. *Review*, referring to Mr. Parrish, that "It is really inconceivable how a competent manager can have permitted this heavy loss to be incurred," etc., etc. "There has evidently been gross and culpable negligence on the part of the assaying staff for which the general management must be held responsible."

While the REVIEW is at one with the B.C. *Review* in contending that ore values have been over estimated in the past, and in being unable to take an optimistic view of the company or its property, yet it feels that the spirit of fair play will be manifested by the B.C. *Review* and that Mr. Parrish is not to be condemned for the failure of shareholders to read his report and imbibe his wisdom.

The REVIEW has never been optimistic about Rossland mines, at the same time it has realized the possibilities of the camp when it became possible to treat low grade ores at a profit. The point it desires its readers to note in connection with this flurry in Le Roi is that, no matter how competent, how able, nor how explicit in his reports a manager may be, his shareholders care nothing for what he writes unless it affects the share value of their holdings. Furthermore, in this case, the shareholders have been too blind or too lazy to read a competent manager's statement, and the result is not the fault of either the manager or the mine, but of their own limited capacity for absorbing knowledge.

Electrolytic Iron.

The article in the April issue of the REVIEW on the Electric Smelting of Iron Ores presented the existing concensus of opinion on the commercial question of smelting iron ores to a pig metal. Recent experiments in the laboratory of applied chemistry of the University of Wisconsin have shown that another application of electricity, viz; to the deposition electrically of a chemically pure iron, is not only feasible, but can be made at such a low cost as to make the application of wide commercial importance.

The process is the invention of C. F. Burgess and Carl Hambuechen who have communicated their results in a paper recently read before the American Electrochemical Society. Their researches have extended over a period of more than two years, and have been directed to the production of chemically pure iron in commercial quantities by an electrolytic process. Various electrolytes have been tried under varying physical conditions of heat, density, rapidity of deposition, and other working conditions, but the authors announce the following as the method which furnished the most satisfactory results:—

"The electrolyte consists of ferrous ammonium sulphates; the current density at the cathode is six to ten amperes per square foot of cathode surface, and at the anode slightly less; the electromotive force for each cell is slightly under one volt; the temperature of electrolyte is about 30° C.; the anodes consist of ordinary grades of wrought iron and steel; the starting sheets for the cathodes are of thin sheet iron previously cleaned of rust and steel."

The analysis of the deposited metal shows over 99 9% of metallic iron with much occluded hydrogen, which has the effect of producing a hardness which the authors state is equivalent to a high carbon steel. This hydrogen is removable by heating, after which the metal becomes soft, malleable and tough, presenting the usual features of a high grade wrought iron.

The deposited metal is not only hard but very brittle, which may operate against its use in some applications which have been proposed. In fact the question as to what use can be made of such a metal, and what market obtained for it is what is of main interest to the iron world. That it will be of very great value and service in the chemical and metallographical lrboratories is unquestioned, and the cheap cost of production, stated to be about $10.00 per ton of 2,000 lbs., will permit of a wide adoption when its field of use has been determined.

The Late Sir Clement Le Neve Foster.

Sir Clement Le Neve Foster, Professor of Mining at the Royal School of Mines, died in London on the 19th of April last. The deceased will be known by most mining men as the distinguished chief Inspector of Mines for Great Britain, in which capacity his reports were of great influence.

At the age of 19 Le Neve Foster began his practical work as assistant with Sir Roderick Murchison on the Geological Survey of Great Britain, being chiefly engaged in the counties of Kent and Sussex and afterwards in Derbyshire and Yorkshire. Resigning his position on the Survey staff he became lecturer to the Miners Association of Devon and Cornwall, and during this portion of his life interested himself greatly in the introduction into the mines of improved appliances and methods.

At the age of 27 years (in 1868) he resigned this appointment to undertake geological exploration in Sinai, and afterwards mining work in Central America, from which place he removed to Italy to engage in gold mining.

In 1872 he was first appointed to an Inspectorship of Mines, being stationed in the Devon and Cornwall districts for eight years, when he was transferred to North Wales. In 1894 he became chief Inspector, having the editing of the statistics relating to mines and quarries at the Home Office. He resigned his official position at the age of 50 and was knighted in 1903. Sir Clement was facile with his pen, and in addition to his well known books on "Ore and Stone Mining," and "Mining and Quarrying," he contributed to the Encyclopaedia Britannica the articles on mining in the seventh edition. In his death the world has lost an intelligent and courageous engineer.

A Correction of Mr. Kirby's Paper.

In the printing of Mr. E. B. Kirby's paper in our last issue there were one or two important errors which we desire to correct in this issue. On page 61 in the second column, 42nd line, the figure should be "$16.00 full assay value," instead of $15.00 and the table read thus :—

Gold (oz.)..........	0.63	0.54
Silver (oz.)..................	0.43	1.10
Copper (%)........	1.18	1.88
Sulphide Minerals (%)......	26.00	22.25

Page 62, line 28, insert "also" between "And" and "Centre Star." Pages 62 and 63 on the first column of each page, and in the 47th and 52nd lines respectively, the words "secondary" should read "subsequent" in each case. In the 28th line of the 2nd column, page 62, the following words should be inserted after the word "movements"—"and supplemented by branch fissures." In the 2nd column of page 63, 20th line, insert the word "mechanical" between the words "the" and "effect." On the 23rd line the word "segration" should read "segregation," and on the 34th line "excessive deposition" should be "successive deposition."

CORRESPONDENCE.

East Kootenay Coal and Oil Lands.

To The Editor.

Sir :—

For at least nine years East Kootenay has been the centre of attraction for ..l Canadians interested in the Coal lands of the West, and it has certainly maintained its reputation as a storm centre for politicians and speculators. The original di.coverer of the Crow's Nest Pass coals could never have anticipated the notoriety which his modest discoveries have developed, and he would be a clever man who to day could predict when the storm-clouds would pass away and the era of intrigue and grab come to an end.

The acquisition of the first large area and its subsequent development is now a matter of history, and the successful promoters have settled down to "say nothing and saw wood." The scenes which accompanied the granting of the Crow's Nest Charter in 1895 and in 1896 are almost forgotten. To-day scarcely less excitement prevails at Victoria in connection with the disposition of blocks 4593 and 4594 which, for all practical purposes, are the last of the East Kootenay Coal and Oil Lands at the disposal of the Provincial Government.

At one time, and as a matter of fact three years ago, it was believed that the coal measures of the Pass were confined to the region extending from Lodge Pole Creek in the south to a few miles, say five, above Michel Creek in the north; and from the Elk River in the west to the boundary of the Province in the east. It was known from casual travellers over the trails that coal existed in the northern reaches of the Elk, as well as in the Flathead country. The late Dr. George M. Dawson had reported coal outcrops in the North Kootenay Pass but even so high an authority as the latter spoke with caution as to their quality and probable extent, and it was generally believed that the central basin, already defined, contained most if not all of the valuable coal deposits. Even without any extensive development it may at once be admitted that this conclusion was erroneous. Without going so far at present as to say that, as valuable an area has been located elsewhere, it is not too much to say that, on the North Elk, from the point where the coal measures are exposed again, after having been cut off by the limestone for a distance of 60 miles north, there is a coal-field from 8 to 10 miles in width which, on present prospecting shows a continuation of the same coal seams as at Fernie, and of a quality at the surface which gives reason to hope that at greater depth the quality will be practically the same. This immense coal-field covers 300,000 acres. It contains at least 20 known seams and a probable tonnage "in situ" of 30,000,000,000 tons capable of yielding in operation 50% or 15,000,000,000 tons.

In the Flathead valley to the south is also an immense coal-field, although it has not been so thoroughly prospected as the one in the north, and samples of the coal taken from the outcrops do not give anything like as favorable an analysis. Indeed, so far, more has been thought of the probability of this section becoming a great producer of oil than coal. In this however we entirely disagree with the representations so widely made by interested parties. We have made a point of ascertaining all that can be definitely stated by competent authorities who have actually inspected the localities where evidence of natural oil is observable, and consider that it is quite premature to conclude that oil exists at any point in this section in paying quantities. The mere discovery of rocks and shales which on being pounded or scratched, yield an odor of petroleum or some kindred oil is poor evidence on which to base expectations of a flowing well. Nor is the presence of a film of petroleum floating on the surface of a pool of much higher value in the determination of "pay oil"; and yet this is the full extent of the evidence on which promoters are booming the "South Kootenay Oil Lands" and moving heaven and earth to secure large sums from investors in the shape of promotion money. The best advice we can procure is to the effect that the geological formation as well as the broken character of the strata throughout the whole of this country vetoes the possibility of oil in paying quantities, at any depth. This was the opinion of an eminent expert who examined the district three years ago for the Standard Oil Co., at a time when, if his Company had desired, they could have acquired the whole territory for a tithe of what is being asked now. We are therefore of opinion that the fuss which is being made about this southern block is just so much bluff on the part of those interested to create the impression of fictitious values, and the scramble for titles is intended to strengthen the impression that this Tom Tiddlers ground is a veritable El Dorado.

The coal block on the North Elk is a different matter altogether. There, it is not a question of coal either as to quantity or quality but of market. Already one large company—The Imperial Coal and Coke Co.—has been formed with a capital of $4,500,000 to purchase and develop 94 square miles of this area. Other large blocks containing from 20 to 50 square miles are held by speculators and it will yet become a matter of public interest and investigation to ascertain how such immense areas have passed into the hands of a few men—not in any case the original locators—even before the Government is in a position to grant licenses or issue any kind of title. That matter we waive for the present. Meanwhile we would point out that the Nest Pass Coal Co. have developed their mines to such an extent Crow's that they have not only overtaken the Canadian but the American demand. In a recent issue of the Fernie *Free Press* we read that the General Manager was in Montana seeking trade for the first time in the history of the concern; the B.C. Smelters were all fully supplied with coal and coke, and the mines at Fernie and Michel were working little more than half time whilst those at Morrissey were temporarily closed down.

In addition to this fact it must be borne in mind that the production of coal is increasing daily on the Alberta side of the Rockies where the output exceeds 1000 tons a day, and during the present season will reach 2000 tons.

In view of these facts there are two conclusions which seem irresistible. That money invested in East Kootenay Coal Mines will not, for many years to come, yield any returns to the investor except the satisfaction of seeing a few speculators and promoters line their pockets; and that the British Columbia Government would be well advised, having rescued blocks 4593 and 4594 from the grasp of one large corporation, to keep them permanently as a Government reserve selling a few miles at a time to "bona fide" coal operators as the requirements of the Province increase. Such a course would no doubt be a sore disappointment to the politicians of both parties who regard the public domain as their legitimate prey, but it would at the same time preserve for the public benefit the last of the invaluable coal lands of East Kootenay, and prevent millions from being squandered in a fruitless enterprise by unscrupulous promoters.

NELSON, 18th March, 1904. W. BLAKEMORE.

Mica Deposits.

By FRITZ CIRKEL, M.E., Montreal.

Mica, in its broader sense, comprises a group of minerals whose chief characteristics, distinguishing them from all the other minerals, are their great flexibility and micaceous structure, that is they have a highly perfect basal cleavage and yield easily very thin and more or less elastic laminae. If we split up a mica crystal into sheets and divide these sheets further, we find that their flexibility and also their transparent qualities increase with the division of the laminae, and this division may be continued to the thickness of 1/1000 of an inch, and more, if we had instruments fine enough to do this work. On account of these remarkable qualities mica has been used for ages in the arts, for many decorative purposes as screens, stove panels, lamp chimneys etc., and we find, that in the seventeenth century, white mica of a highly transparent quality was used as covers for dials of watches and in surveying instruments.

A further characteristic feature of the micas, is the production of so called percussion figures; the latter may be obtained if a crystal plate is supported upon a hard cushion and a blow be struck with a light hammer upon a steel rod. These percussion figures have been often investigated and consist of a six-rayed star, whose branches roughly speaking are parallel to the prismatic edges of the crystal. All species of the mica group crystalize in the monoclinic system, but with a close approximation to either rhombohedral or orthorhombic symmetry.

Chemically considered all the micas are silicates, in most cases orthosilicates, of aluminium with potassium and hydrogen, also also often magnesium, iron, sodium, lithium; further rarely, barium, manganese and chromium. Fluorine is prominent in some species and titanium is also sometimes present. All micas yield water upon ignition in consequence of the hydrogen which they contain. The amount of water in all micas being mostly between 4 and 5 p. c.

The application of mica in the arts, and to some part in technics as above referred to, having been very limited the mining of this mineral naturally was carried out on a very small scale in a primitive way and was practically of no importance, which is illustrated by the fact that, the statistical bureaus of the countries where mica mining is now successfully pursued, showed some 15 years ago a blank in the production of mica in their periodical publications, and it is not until the marvelous progress in electrical science, which is ever ready to replace seemingly high achievements of to-day by new and still higher ones of tomorrow, found a place for the successful application of this mineral in apparatus of various construction, that the mining of mica was seriously attempted. By a great many experiments in many of the electrotechnical laborities it was established that, the most valuable property of mica is its electrical non-conductivity. From the date of this discovery the application of mica in electricity, more especially in the electric transmission of power, is general; mica has become a mineral of large economic importance, and if electricity progresses in the future as fast as it has for the last 15 years, there is no doubt that the economic exploitation of mica will form one of the chief resources of countries, where the same is found to exist in payable quantities. When we compare the mica industry in Canada of to-day with that of some years ago, we must come to the conclusion that the same has assumed large proportions, which may be seen from the fact that, while the production in 1900 was practically nil, the same reached in last year a total of about

$170,000 and if reports be true, that the supply of India mica is curtailed, the production will likely exceed this year $250,000.

The distribution of mica over the globe is very general; it occurs in scaly particles as essential constituent of many metamorphic and eruptive rocks, such as gneiss, granite, porphyry and in this mode of occurence it is only of geological and lithological importance; but as an economic mineral, as a mineral of commercial value, such as it comes here under consideration, we have to refer to the actual deposits of mica, containing mica crystals of large size which split up easily into laminae. Mineralogically speaking we have the following species :—

1. Muscovite: In composition it is a hydrous-potassium aluminium silicate (K_2O, $2H_2O$, $3Al_2O_3$, $6SiO_2$) usually called potash mica (Germ: Kali-glimmer.) It has mostly a clear, white color and constitutes most of the white mica of the trade.—It has a ruby color in India.

2. Phlogopite: Chemically speaking similar to Muscovite, but contains Magnesium, generally called Magnesium mica. It is mostly of amber brown or black color and constitutes the greater part of the amber mica of commerce, as found in Canada.

3. Biotite: Magnesium iron mica, generally black in color.

4. Lepidolite or Lithium Mica: This mica is comparatively rare, usually pink in color. It occurs very seldom in crystals, but only in flakes and scaly particles.

5. Zinnwaldite: Lithium Iron Mica, in form near biotite. The color is pale violet, yellow to brown and dark gray. It occurs at Zinnwald and Altenberg, Germany; also in Cornwall.

Of the above five species only the first two are of commercial importance, while the other three are only interesting from a mineralogical point of view.

I. Muscovite is the most common of the micas. It is named from Vitrum Muscoviticum or Muscovy glass, formerly a popular name of the mineral. The distribution of this mica is very general all over the globe, but only in a few countries can muscovite mica in payable quantities be found.

The occurrence of this mica is confined more or less to pegmatite dikes, which in character may be called a very coarse granite, consisting of feldspar and quartz in variable quantities. These pegmatite masses occur in rocks of archaean age and comprise all the members of this formation from the lower Laurentian up to the Cambrian. According to I. A. Holmes,* in crystalline rocks exposed in the lower part of the Grand Canon of the Colorado in Northern New Mexico, the dikes break through the granite rocks and are of pre-Algonkian age. In most cases all the larger dikes in the Rocky Mountains have been involved in schistose and other structural modifications of the crystalline rocks, and consequently must have been formed either prior to, or during the earlier stages of the uplift of the mountains. In the Appalachian region these dikes generally are observed in connection with the schistosity of these rocks, although considerable changes of the adjacent rocks are noticeable. The condition of the material in the dikes suggests their formation either prior to, or during the early stages of, the uplift of these mountains.

In the pyroxenic region of the county of Ottawa the pegmatite rock differs from the usual varieties of this class of dikes or veins found in the Laurentian formation inasmuch as it is usually much finer grained; it occurs also as veins intersecting the gneiss in approaching the great masses of anorthosite and gobbro. Dr. Ells in his investigations found that the quartz feldspar of the pyroxene, frequently cut the gneiss along the line of the strike of the dikes, like the latter, but its intrusive character is clearly evidenced in most cases by the sending off of spurs into the mass of gneiss in contact, as well as by the fact that it frequently cuts directly across the gneiss and intersects also the pyroxene, thus demonstrating its later intrusion. Inclusions of grayish or reddish gneiss, which is penetrated by these rocks, are also frequently found in the mass both of the pyroxene and feldspar, and furnish further evidence of the intrusive character of these rocks. In some places the presence of three distinctly intrusive dikes is recognized in the same opening, the oldest being the pyroxene, the second cutting the pyroxene is a pegmatite and the third is a black trap rock.

As to the constituents of the pegmatite dikes, either feldspar or quartz predominates, an even distribution of both through the dike is not generally observed.

Apart from muscovite there are many accessory minerals found through the vein matter such as a rare earth; monazite, pitchblende, uraninite. In several of the Quebec deposits, pitchblende containing Radium, is reported to occur in payable quantities. The largest and best developed crystals occur in the pegmatite dikes associated with granitic intrusions either directly cutting the granite or in its vinicity. They are often associated with crystallized orthoclase, quartz, albite, apatite, tourmaline, garnet, beryl etc. and other mineral species characteristic of granitic veins.

Muscovite crystals generally speaking do not occur in payable quantities in pegmatite dikes of less than 2 feet in thickness, but this does not say that every dike of larger dimensions necessarily contains mica. We have instances where large dikes measuring over 200 feet in width contain no mica at all. According to the experience of the writer muscovite mica in workable quantities occurs—although there are exceptions to this rule—either on the hanging or footwall of the pegmatite dikes; the same occurs in single crystals imbedded in the matrix, or in small or larger pockets of irregular shape, in chainlike accumulations of crystals, or in so called stock-werke of smaller dimensions.

We find that occasionally the sheets of the mica have been folded under pressure; often such are useless for commercial purposes on account of producing the so called ribbon mica, the sheets being cut into narrow strips with parallel edges. These parallel edges of the rolled mica appear in all cases to be parallel to certain axes of crystallization, but the real cause of this rolling and the conditions under which it has been produced cannot well be determined.

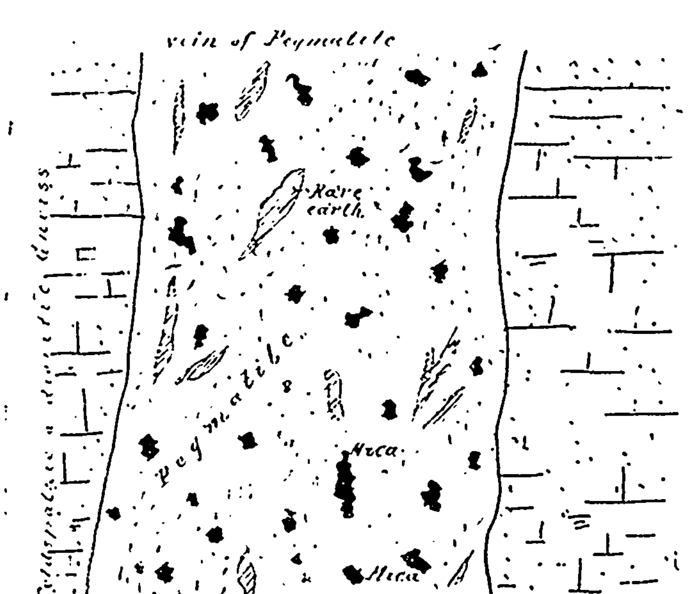
From the foregoing it is evident that the material to be blasted down and removed must be necessarily large in order to obtain the commercial product, and according to manifold experience it is a fact that only a very small percentage of the deposits discovered warrant the expenditure for their exploration. As to the crystals or books, as they are generally termed, the size of them varies considerably; while one dike may contain only crystals of small size of say, one or two inches larger axis, with very few larger crystals scattered through the matrix, another may contain only the larger size from 2 inches upwards and may yield a very fine commercial product. Many of the latter hold inclusions of foreign substances as quartz, feldspar, tourmaline, calcite and flattened crystals of garnet between the sheets; further, not infrequently magnetite in dendrite like forms follows in part the direction of the percussion figure. A muscovite crystal generally with a few local exceptions splits to perfection; it can

*Paper read before the 11th annual meeting of the Geological Society of America.

be divided in a great many fine laminae of great transparency and these as a rule are very elastic. The best qualities, or those which are used for ornamental work, have a clear white color; others, like the India mica, a ruby to rose color; others again have a greenish or grey tint. Reddish spots of iron and tourmaline, as in the Villenuve mine, are frequently met with, in some cases to such an extent as to render the crystals unfit for the use white mica is generally put to. For commercial use the crystals are split into sheets of $\frac{1}{16}$ to $\frac{1}{32}$ of an inch in thickness; the rough edges and parts are taken off by hand by thumbtrimming, and the sheets cut into the required sizes 1" x 2", 1" x 3" etc.

As to the percentage of merchantable mica in a pegmatite dike, experience in this direction shows that, a dike containing about 5% of useful mica crystals in the rough state, of fairly good quality, and allowing $\frac{3}{5}$ of this mica for waste—in others words that a mine yielding about 2% of trimmed mica should under ordinary circumstances (taking labor and locality into consideration) pay handsomely.

The localities where the mica deposits are found are very numerous and only those which are interesting by reason of their extent or geological features, will be described: In Canada, in the province of Quebec, in the vicinity of Tadousac, 10 miles from the shore of the St. Lawrence, veins of pegmatite traverse the country rock, mainly consisting of feldspathic and dioritic gneisses, and contain mica crystals irregularly distributed through the vein matrix. The dimensions of these veins are in some cases very



Tadousac Mine, Quebec.

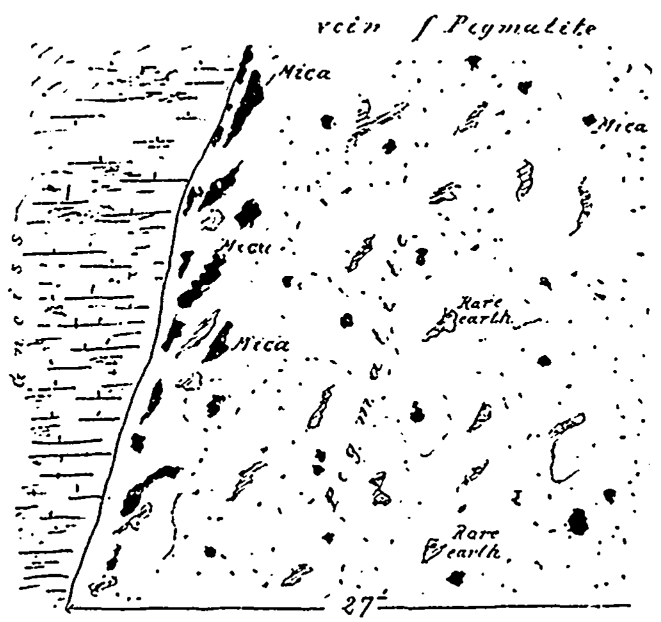
large, being 200 to 300 feet in width, while the length is from several hundred feet up to one mile. Veins of these dimensions, however, do not pay to work; veins of 20 to 30 feet width, exhibiting a fair amount of crystals generally pay to work. Crystals of black tourmaline are frequently met with, while many classes of rare earths as monazite, uranite, cerite and pitchblende are constituents of these veins. The mica coming from these localities is of excellent quality, being remarkably clear from spots, while the cleavage is perfect. The main vein of the Beaver Lake mine in the Terebonne township is 140 feet wide and exhibits a fair quantity of irregularly distributed crystals, some cutting 4 x 6 inches. In the township of Villeneuve north of Ottawa *muscovite mica occurs in a vein of pegmatite* measuring 135 feet in width, and cutting through the gneiss. It is a transparent mica, thicker laminae showing a greenish tint, sometimes with inclusions of iron and tourmaline. Other accessory minerals like cerite, pitchblende and monazite are frequently met with.

A sample of Uraninite has been analyzed by the United States Geological Survey and gave the following:—

Oxide of Uranium	37,90
Oxide of Thorium	6,41
Oxide of Cerium	0,40
Lanthanium and Yttrium	3,68
Lime	0,39
Oxide of lead	11,27
Water	1,47
Silicates and other minerals	1,28
	100,72
Density	9.055

The feldspar found at the Villeneuve mine is of a very pure quality; it is entirely free from iron as is seen from the following analysis, compared with the theoretical analysis of pure orthoclase feldspar:—

	Villeneuve Mine.	Theoret. Analysis.
Silica	63,96	64,61
Alumina	19,16	18,49
Potash	16,88	16,90
Iron	traces	——
Magnesia	——	——



Villeneuve Mine, Ottawa County, Ont.

Some very large crystals have been taken from this vein, one giving sheets of 30 x 22 inches; another crystal weighed 500 pounds and realized 500 dollars. The Villeneuve mine has yielded some 35,000 lbs of merchantable mica, and the writer is of the opinion that, if mining towards the depth of this mine would seriously be attempted, mica in payable quantities may be found.

There is a large field for the prospector of white mica in the Lake Manowan region, 250 miles north of Lake St. John; at Watshesha on the gulf of the St. Lawrence about 400 miles below Tadousac and also at Lake Pieds des Monts, 17 miles north of Murray Bay. This latter mine has come into prominence lately by the discovery of pitchblende, an uranium oxide, containing Radium; it is reported that this mine contains this mineral in payable quantities. In this connection it may be mentioned that *in the Province of Quebec where the Laurentian formation is* developed to a very large extent, the pegmatite dikes or veins, which all more or less contain muscovite mica, are closely associated with the rare earths especially uraninite, containing Radium. Here is a very large field for research work and it is not improbable that many abandoned mines may be exploited in in future for this mineral, which now is found only in very limited quantities.

The Maisonneuve mine, situated on lots II, 1-2, of the Township of Maisonneuve, Berthier, is reported to have a very good vein of pegmatite with an appreciable amount of fine mica crystals, resembling those at the Villeneuve mine. In association with the black tourmaline and garnet we find Samarskite of brownish black color. This mineral, according to an analysis made by Dr. Chas. Hoffman (Geol. Surv. Ottawa, 1880-82) contains the following:—

10,75% oxide of Uranium.
14,34% oxide of Yttrium.
4,78% oxide of Cerium.

It appears that this mine, being situated so far from railroad connections, (80 miles in a northern direction from St. Felix de Valois C.P.R.), and therefore difficult of access, has not been worked continuously.

In the township of Bergeronne, 11 miles from the little Bergeronne Bridge and 15 miles from Tadousac, the Hall mine was for years a prominent producer of very fine transparent mica. The pegmatite vein on this property strikes in a N.E. direction and can be followed for over one mile in length, but only the northern part of this vein has been prospected and to some extent developed; it has produced a considerable quantity of mica cutting 4" x 5" and 5" x 6".

In the province of Ontario, several deposits of promise have been discovered, but so far none of them have been worked to any extent. In the township of Aylwin, about ½ a mile north of Venosta station a vein of pegmatite cuts through a grayish garnetiferous gneiss and it is reported that some large crystals with excellent sheets were obtained.

In the Parry Sound district, in the township of Proudfoot, a coarse and fine grained gneiss occurs, containing biotite and gray muscovite mica. Various masses of fine grained diorite penetrate the gneiss and a great number of pegmatite dikes. These dikes have attracted the attention of prospectors on account of the beautiful crystals they contain; they vary greatly in size and composition, but even the narrow veins hold sometimes mica crystals of an excellent quality. In one of these dikes which is of very large extent, the various minerals are gigantic in size, microcline crystals reaching a length of three or four feet, and mica crystals yielding plates 8 x 10 inches in sizes. Both varieties of mica occur here, biotite and muscovite, the latter only on account of its perfect quality and cleavage being of commercial value.

In British Columbia, some mine deposits have been exploited in the vicinity of Tête Jaune Cache, about 150 miles north-west of Donald on the C.P.R. According to Mr. Mc Evoy* the mica occurs as a constituent of coarse pegmatite veins, which cut the country rock, consisting in that locality of garnetiferous mica schists and gneisses with some blackish mica schists and light colored gneisses that resemble foliated granitoid rock, the garnet mica schist being the predominating rock. The pegmatite vein has a width of 15 feet giving sometimes crystals cutting 18" long and 11" wide; these crystals are generally found on the hanging wall, while some are irregularly distributed through the vein. The mica is a transparent muscovite with a very light greenish tint and appears to be of excellent quality. There are a number of other deposits of this mica in the same locality and, according to all appearances, there is a probability that this region will produce an appreciable quantity of very fine clear mica, which, on account of its higher prices will be used for ornamental purposes only. A great drawback however, to the proper exploitation of these deposits is the lack of access and communication, all supplies being carried in by pack trains over trails which for the larger part of the year are in bad condition.

In Labrador, near the head of Lake Winokapan, fine large crystals of a greenish tint and perfect cleavage were observed by Low in red pegmatite dikes, cutting through the archaean rocks, but here also the inaccessibility of this region is a great hindrance to the development of these occurrences.

In the United States the mining of mica is confined to the States of New Hampshire, North Carolina and South Dakota although there have been a great many other deposits discovered, the quantity of mica coming from these sources is insignificant.

The most important producers in New Hampshire are the mines at Grafton, Danbury and Alstead. According to A. Hoskins* the old Ruggles mines in Grafton have produced mica for over 100 years, yielding an aggregate of over 8 million dollars worth of mica; these mines at one time furnished four-fifths of the total output of the United States. Owing to litigation which has extended for over 20 years, the mines have lately not been in operation to their full capacity, no machinery of any kind being employed and drilling is done by hand. The crystals are split into sheets of an eigth of an inch thick and the rough edges trimmed with a knife. The dealers cut it into different shapes and sizes required by the manufacturers.

At Danbury there are 2 mines in operation, one, the Empire Mining Co., being considered a good paying mine. The quality of this mica is excellent, it being free from spots and very clear. In Alstead there are three mines in operation: The Davis, the Hoskins, and the Warren French mine. The Davis mine is a large producer and considered one of the best paying mines. The mica is trimmed and shipped to Boston. The other mines are reported to deliver a very good quality of sheet mica while also a large quantity of scrap mica is produced.

In Idaho the Idaho Mining Co. is developing their many claims on Bear Creek, 13 miles from Troy, Latch County. The vein is reported to be 30 feet wide. In the beginning of 1903 the output was 2 tons per week.

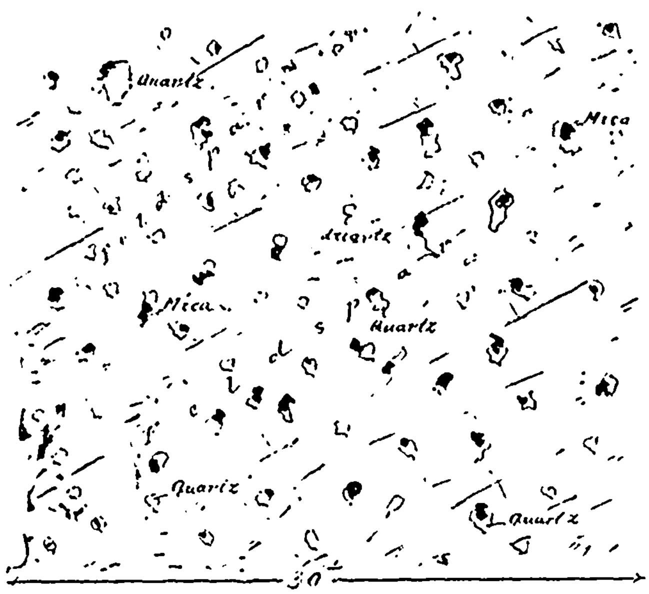
In North Carolina the principal mica deposits occur in Mitchell, Yancey, Jackson, Haywood and Macon counties. Many mines are in operation in those localities, most of them on a small scale, the mica constitutes about 1 to 10% of the pegmatite veins.

In South Dakota, Custer County, the Black Hills Porcelain, Clay and Marble Co. operate several mines. In the beginning of 1903 this Company shipped 30 tons of mica. The Crown mine, owned by the Chicago Mica Co. covers 40 acres in Custer County and is shipping regularly two carloads of mica (mostly for grinding) to the company's plant at Indiana. Dr. E. A. Smith* reports a discovery in Alabama in the north-western part of Randolph and the adjacent parts of Cleburn and Clay Counties. The mica occurs in veins of a coarse grained granite, in which the constituents assume gigantic proportions, often making masses of a

* Rep. Geol. Surv. 1898 iii S.

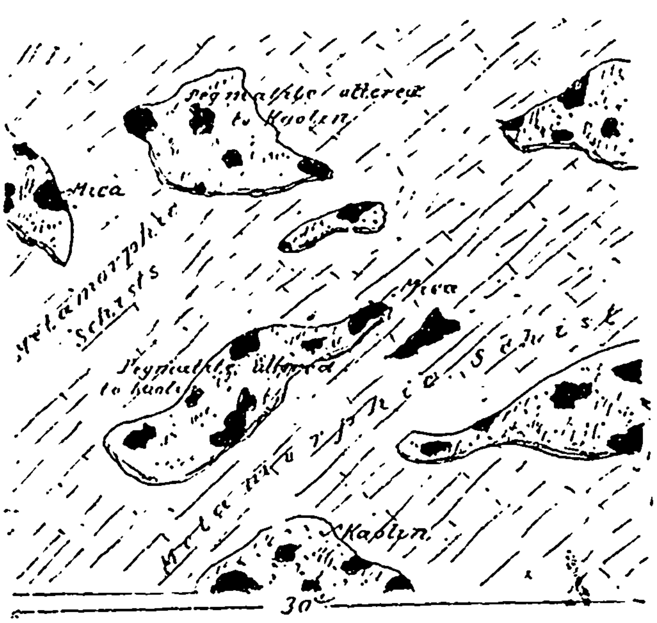
* Min. Ind. 1898 P. 507. Min. Ind. 1898 P. 478.

foot or more in size. The mica boulders, as they are locally termed, deliver sheets of large size and excellent quality.



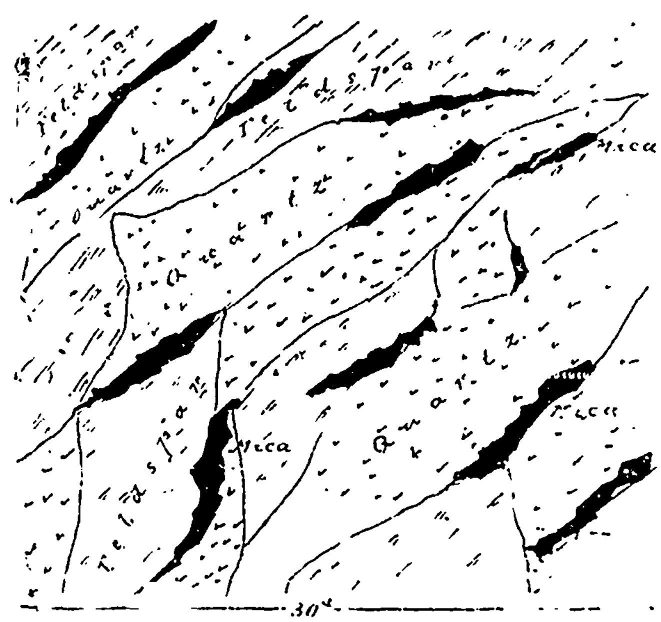
Alabama, U.S.A.

In Brazil, according to H. Kilburn Smith, mica occurs in workable quantities in the States of Goyaz, Bahia and Minas Geras. In the State of Minas Geras the mica is found in pegmatite veins, lenses or dikes in metamorphic schists near the city of Santa Lucia de Carangala, the veins running parallel to the Cayama and Papgais mountains. The deposits are generally altered to Kaolin and vary in width from 20 inches to 10 feet. There are about six mines which have supplied mica for export, only two of them, the Fonseca and Coronel Seraphino mines, being worked regularly. The Fonseca mine has produced about 30 tons of trimmed mica, the larger portion was used for decorative purposes and lamp chimneys. The total output of the Seraphino mine is 20 tons; about 50% of this output has been obtained in sheets of over 6 inches in length. The approximate cost per ton of mica at ports in U.S.A. or Europe is £63. The Brazil mica is considered the finest on the market on account of its great transparency and absence of any spots. It is largely used for ornamental purposes.



Deposits at Minas-Geras, Brazil.

In Norway the Godjeld mine near Skutterud on the south west coast has come into prominence by reason of the peculiar mineralogical character of the mica crystals. In all the crystals the two basal planes are never parallel to each other and consequently the majority of plates split out of a crystal are thicker at one end than at the other. The mica occurs in lenses or shoots between quartz and felspar or wholly in quartz. The shoot varies in dimensions, extending either across the vein as a whole, between felspar and quartz or entirely in quartz. The color of the mica is green, but a greater part is of brown coloration, due to numerous stains. These



Deposit at Godjeld Mine, Norway.

stains are mostly observed on the surface, they seem to disappear in depth. Many crystals from this mine although of perfect form have inclusions of garnets, tourmaline and of many other minerals which render a great many sheets out of a crystal useless. At a depth of 60 ft. the character of the mica begins to change considerably and although these crystals yield a small amount of sheets, still a great many of them are full of foreign matter so that they split up in flakes and scaly particles. Further a good many crystals have undergone an entire change, a greenish steatitic material taking the place of mica. This material is in places compact while in others it becomes earthy, occasionally fibrous and silky, and it hardens shortly after exposure to the air. The mica when it is first taken from the mine, is very soft, but after a few months it becomes much harder and less pliant.

From China it is reported that vast untouched deposits of mica have been discovered at Kiao-Chau Bay. Nothing further is known except that some of the mica is discolored by foreign substances. The veins are said to be up to 10 ft. wide and to contain a fair amount of commercial sheets.

(To be continued)

Magnetic Separation.

By F. T. SNYDER, Oak Park, Ill. *

Everyone is familiar with the simple fact that a magnet will pick up small pieces of iron; many persons are familiar with the fact that sufficiently powerful magnets will attract a large number of materials in which the presence of iron is, at least, not in evidence, but few persons realize that the design of magnetic separators and the practice of magnetic separation have developed to a

* Paper read before the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

point where it can be stated that there is no material which cannot be moved by magnetism if the commercial conditions under which its movement is desired will permit of the necessary expenditure. For many materials this cost is usually prohibitive, but, as a curiosity, pieces of wood, apples and other things generally considered magnetically inert, have been moved through distances of several inches.

In the early days of magnetic attraction, previous to half a century ago, it was generally thought that the law of magnetic attraction was simple, and even quite recently it has been stated in textbooks that the attraction of a magnet for a movable particle varied directly as the strength of the magnet and inversely as the square of the distance. This, in common with the other simple laws of natural phenomena, has proved to be simple only under theoretical conditions which are not secured in practice. However, the law of movement of a free particle in a magnetic field was understood and perfectly formulated at least a half century ago. In such formula the distribution of the field is assumed as known, while it is from this factor that the complications in the theory of magnetic attraction usually occur.

The early types of magnetic separators consisted of a straight bar permanent magnet or an equally simple electro magnet. The material to be separated was either touched by one end of this bar or allowed to fall near it and in that way dragged out from the non-magnetic material. From this were developed numerous types of machines, similar in theory but better in mechanical form. Two troubles which developed were, first, the entanglement of non-magnetic material by the material attracted, and second, the question of getting the attracted material off the magnet again so that the magnet could operate continuously. Most of these machines were weak and applied to highly magnetic materials only and as the results were indifferent, the commercial growth of the industry was slow. During this time—that is, in the period of the last twenty years—the question of magnetism has come to be relatively very well understood in connection with the design of dynamo machinery, and as the necessity for magnetic concentration was urged with more and more persistency, it eventually fell into the hands of competent dynamo designers. The result was magnetic separators of greatly increased power, and from them has developed a knowledge of the design of such separators which makes it possible to-day to build a separator which will handle practically all materials, the limit being that the more difficult the material is to handle, the greater will be the cost of the machine, and consequently the less return commercially. This great advance in design was largely due to the conception of a magnetic field as made up of lines of force which are assumed to emerge from a pole-piece of one polarity and pass through the air to a pole-piece of opposite polarity. In the production of this magnetic field the conditions are similar to those in an electric circuit, the magnetism produced being the equivalent of the current. The magneto-motive force due, in electromagnets, to the current circulating in the windings of the coil, is the equivalent of the electromotive force in the electric circuit, while the resistance of the magnetic circuit is analogous to the resistance of the electric circuit. It was early seen that a large portion of the cost of exciting a magnet was due to the resistance of the parts of the magnetic circuit at which the lines of force were compelled to jump through air, air having a very high magnetic resistance as compared with iron. In an endeavor to reduce this resistance, the air path was shortened by bringing the magnet poles close together. In the early types of machines the material to be separated was passed through the field in such a manner that both of the poles were on the same side of the material so that in falling, the material passed through the loops of the lines of force twice. It was this looping of the lines that led to the entanglement of the non-magnetic materials with the magnetic materials and it was this entanglement that eventually led to the abandoning of this looped field type of machine for the type where the material to be separated passes between the poles and through the magnetic field but once and in consequence escapes entanglement.

The freeing of material which had been attracted was at first secured by means of scrapers, and later by reducing the field at the point where the material was desired to be freed, but it is now generally obtained in the best machines by reversing the magnetism, producing a neutral point at which all material of whatever attractability is dropped. So well have the principles of the design of a magnetic separator come to be understood that a difference of magnetic susceptibility now offers in many cases a cheaper way of concentrating minerals than the customary way of taking advantage of the difference in specific gravity.

From its highly attractable property and from its low value, which prevented ordinarily any other method of concentration, iron ore has naturally been a special field for magnetic separation. This has been with two specific ends in view, one, the enrichment of a low-grade iron ore for the purpose of reducing the freight to a furnace, and also the furnace cost of operation per unit of iron smelted. The other use has been to free the iron from deleterious materials, such as titanium, phosphorous and sulphur. Where these occur in separate crystals which can be liberated by crushing the iron ore, the resulting separation is one which frequently proves commercially feasible. In the case of sulphur, the success depends on the fact that the sulphur compounds usually found in iron, are either more or less magnetic than the iron oxides of the ores.

The separation of iron has divided practically into the separation of magnetites—that is, iron oxide, which is naturally magnetic and can be picked up with an ordinary hand magnet—and the hematites and limonites which are less magnetic, usually so feebly magnetic as not to be attracted by a hand magnet.

In the enrichment of hematites the question has divided into two different sorts of separation, one, the separation of high-grade hematites from a sandstone in which they occur as a conglomerate, having been deposited as detrital material from older iron beds along with the sand; the other, the separation of siliceous material which was originally deposited at the same time as the iron and usually in the form of intimately entwined cyrstals.

The question of the physical condition of iron ore with reference to its impurities, is one of the more important in the magnetic concentration of such material. One of the first of the questions which are asked by a furnace man when approached on the subject of iron concentrates is "the amount of fines." If it is necessary to crush the material to such fine sizes that most of it will blow out of the top when put into a furnace, the purchase of any considerable tonnage of such material is evidently a matter to be approached with caution. Briquetting has made material advances, and large experiments are being carried on at present in the smelting of briquetted iron material. It should be noted that this matter of briquetting and the production of fines is entirely a question of the physical character of the ore. Magnetic separators now handle such feebly magnetic materials as hematite in chunks of practically any desired size, separators being constructed to concentrate material up to one inch in diameter. The cost of building and operating a separator increases about in proportion to the size of material which it has to handle. It is therefore a commercial matter as to whether the cost of briquetting, or the cost of concentrating at a larger size, out-weigh one another. Almost invariably it is cheaper to build a machine capable of handling larger sizes than it is to briquette, as in general briquetting costs more per ton than the cost of separation, including interest, depreciation and royalties on the separator when handling material as large as one inch in diameter.

In such a matter as the St. Lawrence iron sands, where the material is already crushed, and generally crushed even finer than enough to free it from the accompanying gangue, the question of briquetting is an important one and bears an aspect which should interest Canada with its water powers. The need of briquetting iron ore for use in a smelting furnace is brought about by the high pressure of the modern blast. If this blast could be eliminated, within certain limits it would be a matter of indifference as to whether the material were coarse or fine. It would still have to be granular enough to permit the escape of the gases generated in the smelting operation. Electric smelting provides the required condition that there need be no blast. The magnetites, being iron oxides, need only be mixed with carbon in the shape of any clean fuel, such as coke or charcoal, and subjected to the heat generated by an electric current, to have the carbon join with the oxygen of of the magnetite and escape as carbon monoxide, leaving the iron to be tapped off in the form of pig. These St. Lawrence magnetites could probably be dredged up and concentrated wet into an iron ore of unusually high grade, and delivered in the Ottawa valley for a cost not to exceed one dollar per ton. Their commercial utilization by means of magnetic separation would appear to offer the promise of a very considerable industry when taken in connection with smelting by means of the water power of the Dominion.

Of next importance (commercially) from the standpoint of magnetic separation is the separation of the mixed sulphides of lead, zinc and iron. This so-called "Leadville problem" has existed for many years. There was in this camp a large tonnage of zinc-lead ore which was too high in zinc to permit the lead furnace man treating it without getting into serious difficulty through the choking up of his stack from zinc accretions, and too high in lead and iron to permit the zinc smelter from treating it without the destruction of his retorts through slagging by lead and iron. The specific gravity of the zinc and iron was too close to permit of commercial water separation. Through zinc interests who were looking for an additional supply of zinc ore, this problem was attacked along the lines of magnetic separation, and in its solution was secured much of the data which now forms the basis for an established magnetic separation industry. A parallel problem existed at Broken Hill in New South Wales, Australia. Here the lead and zinc were so intimately mixed that when crushed to the proper mesh for separation, a large amount of the lead was lost by sliming, and the zinc concentrates which were secured were too low in grade to stand the freights to a European smelting point. Here, as at Leadville, the introduction of magnetic separation has resulted in the utilizaiion of a very large tonnage of what was heretofore waste material. In British Columbia there exists a similar problem. It might be pointed out that there existed two different ways of handling this problem. The mixture of zinc and iron sulphides may be roasted to reduce the iron sulphide, which normally is almost entirely non-magnetic, to a form of a highly magnetic sulphide, or it may be roasted further to bring the iron to the condition of a magnetic iron oxide, in either of which conditions it may be removed as the magnetic product. Operating in this way the cost of roasting is involved, and an additional loss due to the fact that if such roasting be deferred until the zinc smelter is reached, the sulphur can then be utilized in the manufacture of sulphuric acid. At Leadville and at Broken Hill the ore is not roasted, it being the zinc that is pulled out as the magnetic product, the iron sulphides remaining behind as the non-magnetic product. There is reason to think that this would be the better commercial way of doing it in British Columbia in those cases where the zinc sulphide is sufficiently ferruginous to permit it. Such is usually the case where the zinc is black, or, as the miners speak of it, "Black-jack".

Third in commercial importance has been the separation of manganese. Manganese, as is generally known, is used in the manufacture of Bessemer steel to which it is added in the form of ferro-manganese or speigeleisen for the purpose of reducing the oxides formed by overblowing the charge. For the purpose of making ferro-manganese the commercial requirements are for an ore that carries 50% of manganese. The tonnage of ores of this class is rather limited, while there is an enormous tonnage which carries from 5 to 15% of manganese. This is too much manganese to permit the ore being used as an iron ore, and it is not enough manganese to enable the ore to be used for the production of ferro-manganese. The magnetic separator enables the owner producing material of this character, to separate it into two products one a 50% manganese ore, and the other an iron ore carrying two to three per cent. in manganese, so making out of an unsalable product, two products, both of which find sale. In this separation either the manganese or the hematite may be the more magnetic product, depending on the local peculiarities of the ore handled.

The magnetic separation in which Canada is especially represented is the cleaning of corundum. A commercial sample of Canadian corundum purchased in Chicago was found to contain something over 10% of magnetite. Passing this over a magnetic separator, the magnetite was reduced below 3%, the change representing an increase in the corundum contents from 89% to 97%. Further experiments along this line seem to indicate that if desired, the iron could be sufficiently removed from the aluminum oxide to render corundum a possible ore for the smelting of aluminum.

The attractability of hornblende has been utilized in connection with the concentration of metallic copper. In ores of this character the gangue, which was almost entirely hornblende, was pulled away as a magnetic product from the copper, leaving a copper ore which was sufficiently rich to smelt directly for copper, although the original ore carried less than 1% of copper.

Another interesting separation has been the handling of mica as a magnetic product. This may be utilized in two ways, for the extraction of mica from other material as an impurity and also for the concentration of mica for use in making mica insulating materials.

Of all recent developments of the magnetic separating methods, the more important is the fact that the cost of such separation is now generally below that of the equivalent water concentration, so that even in cases where water concentration is particularly adapted technically, as in the separation of chrome ores from serpentine, the magnetic method still proves the better commercially. It was this very low cost of magnetic separation that enabled concentration to succeed in the enrichment of hematite after water methods had failed commercially. One fact of advantage in magnetic separation is that it can be made, as desired, either wet or dry.

It occasionally happens that the freight on moisture contained in an ore shipment to a smelting point, is a sufficient item to warrant drying it. In this case if the ore is reasonably dry as it comes from the mine, the magnetic separation can be made dry, saving the cost of drying. On the other hand, if moisture in the ore is immaterial, either from freight considerations or from the smelter's standpoint, and it occurs in a wet mine, it is possible to put it through the magnetic separator without drying, shipping the product as it occurs. This is of special importance in connection with the St. Lawrence magnetite sands. The cost of drying that material before separation would probably prohibit its commercial utilization. As it is, such sands can be dredged up by any economical form of suction or dipper dredge and sluiced through a machine with an adequate supply of water, and produce a concentrate which can be drained to less than 15% of water without artificial heat.

As illustrating the results which are being obtained at present by means of magnetic concentration, there are exhibited samples showing separation on the magnetite ores of Cornwall, Pennsylvania, of iron pyrites and talc from magnetite, representing a reduction of sulphur from 2½% in the original ore to less than ¼% in the cleaned ore. Samples of magnetite extracted from the St. Lawrence sands show an iron content of 69.3% with a trace of titanium, leaving a sand tailings carrying 2.8% iron.

As illustrating the enrichment of hematites, two samples are shown, one being the separation of hematite and sandstone, producing an iron concentrate carrying 65% in iron and .008 in phosphorous, and a sandstone tails carrying 8% in iron, .04 in phosphorous, showing a most interesting elimination of the phosphorous from the iron compound. The second being the separation of hematite and jasper, the hematite product carrying 50% iron, jasper 13%. In connection with the hematite samples it will be interesting to note the size, the material having been crushed to pass a 4 mesh screen.

As illustrating the iron-zinc separation at Leadville, samples are shown, assaying for a zinc product 46% of zinc and 3.2% iron, and for the iron product, 37% iron and 7.3% zinc. The equivalent samples for the Broken Hill ores were tails carrying 8% in zinc and heads 48% zinc.

From the manganese industry samples are shown representing the concentration of Utah manganese from silica and gangue, the manganese being enriched from 15% to 41.8%.

From the field of corundum cleaning two samples were shown one being material at 20 mesh, showing cleaned corundum having .08% of iron and a magnetite which had been taken from the corundum carrying 65% in iron. Corundum at 100 mesh showed only a trace of iron after having been cleaned and produced heads running 63% in iron.

Another sample of the concentration of magnetite was shown in the concentration of black sands from placer workings. In this case the concentration was 20 to 1, ilmenite and some of the rare metals being pulled away from the gold and other sands leaving a concentrated product which would stand shipment to a smelter.

The production of mica for the year 1903 as reported by the Department of Mines of the principal producing provinces is as below :—

Ontario, lbs............	1,896,000	$102,205.00
Quebec, "	280,624	74,119.00
"	2,186,624	$176,324.00

Exhaust Steam Boiler Feed-Water Heaters*; Hot Water Pumps and Pumping.

By W. D. L. Hardie, C.E., M.E., Lethbridge, N.W.T.

We do not know of any subjects more worthy the attention of mining men than the two we have adopted as titles for this paper. It is the purpose of the writer to rehash, in this paper, much that may be old to many of our members but of great importance to the younger ones who have not travelled over the whole of the subject of discussion here, and also to give some information that has come to the writer in his practice.

The primary object of a heater is to raise the temperature of the water and thereby increase the efficiency of the boiler plant, either by reducing the coal consumption or increasing the capacity of the boiler plant ; but there are several other objects to be gained of nearly as much importance as the primary one. If these were named in the order of their importance they might take the following classification :—

1. Increase of temperature of feed water.
2. Reduction of danger that is due to effect of cold water on boiler plates when under high pressure.
3. Precipitation of a large percentage of scale-forming matter before it enters the boilers.
4. Reduction of scale in boiler, which is another great source of increased usefulness of the boiler plant.

It is fairly well known that sulphate of lime and magnesia in connection with sand and other earthy matter, are the large scale formers. Sulphate of lime will not precipitate at less than 300° F., and can not be eliminated by an exhaust steam heater without the aid of chemicals, but the carbonate of lime and magnesia &c., can be precipitated at from 160° F., to 204 F., which is quite within the range of exhaust steam heaters. These in many water supplies form the large percentage of impurities. In most cases under my own observation, if bad mine water be excluded, from 75% to 85% of the impurities, in water objectionable to boiler feed, can be precipitated within the temperature of exhaust steam.

There are, strictly speaking, two distinct classes of Feed-water Heaters—the open and the closed, but these two classes have innumerable divisions. The closed water consists of a shell with coils of pipes within, and has two principal divisions :

1st. The water is pumped through the coils and the steam is exhausted into the shell which surrounds the coils, heating the water as it passes through the coils into the boilers.

2nd. The steam is exhausted through the coils and the water gravitates, or is pumped, into the shell and from there re-pumped into the boilers.

The open heater consists of a shell into which the steam is exhausted.

This class of heater has a large number of divisions, the principal ones being :—

1st. The heater in which the cold water is allowed to gravitate into the shell, and from there pumped into the boilers. The exhaust enters at one end and escapes at the other.

2nd. The heater in which the water gravitates into the shell, and from it pumped into the boilers. Exhaust steam is attracted by vacuum into the shell. The steam has no thoroughfare through this heater.

3rd. The heater in which the water gravitates, or is pumped through a coil into the shell, and the exhaust enters one end of the

*Paper presented at the sixth annual meeting of the Canadian Mining Institute, March, 1904.

shell and exits at the other. The hot water is pumped from the shell into the boilers.

In the case of the closed heater, if used simply for heating pure water by radiation, good results may be expected, but in the case of impure water it can not remove any of the impurities or prevent formation of scale in the boilers. If sufficient temperature is obtained to set free and precipitate the earthy salts in the feed water, they will settle on the surface of the tubes and form scale, and reduce the efficiency of the heater. In the best makes of this class of heater all possible arrangements are made for cleaning but it can scarcely be said that they are ever entirely satisfactory. Our own experience is that this class of heater requires much care, and considerable expense in overhauling and repairing. We will, therefore, dismiss the closed heater and deal more particularly with the open heater.

Prof. Chandler, the chemistry expert, says that—"Boiling water expels the free carbonic acid and causes the separation of the carbonate of lime and magnesia." This is precisely the function of the open heater. If the carbonic acid gas, hydro-chloric acid gas and other gases, and the majority of the scale forming matter can be extracted from the water before it enters the boilers we have gained a great end. It must be remembered that the evil effects of scale are due to the fact that scale is relatively a non-conductor of heat. It has been demonstrated that scale 1/16 of an inch thick requires the extra expenditure of 15% more fuel, and the proportion increases with the thickness of the scale; when scale is ¼ of an inch thick 60% more fuel is required, and at ½ inch thickness of scale 150% more fuel is required. These figures are appalling but true. However, the worst features are as follows: to produce steam at 90 lb. pressure per square inch the temperature must be 320° F., which may be secured by heating the external surface of a ¼ inch plate to 325° F., but if ½ an inch of scale is on the internal surface of the plate 700° F., will be required—a mighty good reason to keep the scale producing matter as low as possible.

But there is still another very important point which I wish I could impress very strongly on the younger members, viz: at any temperature above 600° F., iron soon becomes granular and brittle from carbonization, a condition of high class cast iron; this produces weakness of the plates and causes repairs, and predisposes to sudden explosions.

We think it a fair proposition that, except where more than ordinary care is taken, about ⅛ an inch thickness of incrustation will take place on the boiler the first year, and increase at a greater rate each succeeding year. This is more especially true of boilers that have parts not easily accessible.

In addition to extracting the earthy salts from the feed water, the open heater has the other advantage of condensing the exhaust steam into pure water for boiler feed, thus reducing the amount of water required by as much as 5% to 15%. For example, take 6 lb. of water out of the exhaust steam which is at a temperature of about 212° F., and, at the same time, raise the temperature of the whole to about 212° F., so that for 6 lb. of water at 50° F., delivered into the heater we get 7 lb. of water into the boilers at 202° F. With the closed heater, in getting 7 lb. of water into the boilers at 212° F., we would have sent 1/16 into the atmosphere as exhaust steam. The condensed steam ordinarily amounts to about 1/6 of all the cold water used. It would seem that steam space is not of particular advantage so long as the cold water is properly broken up so that the steam may be brought into contact with it, and there is sufficient space for the passage of the steam through the heater without lifting water and without creating any back pressure. However, some manufacturers of exhaust steam heaters make the rule of allowing one half square foot of heating and catching surface and 34/4 lb. of water for each horse power. In such heaters no filtering arrangement is made, dependence being put altogether in the iron trays used for breaking up the water and receiving the deposits.

By the following excerpt from an old writer we see that an open heater with the trays on an old boiler shell is a very old idea.

"At East Howle Colliery, Durham, England, the exhaust steam is turned into an old boiler. Cold water enters at the top and is allowed to fall on to a series of horizontal trays placed one below another in step form. The feed water is heated to 200° F and is then forced by a donkey pump into the boiler."

It will be objected by the closed heater advocates that we have not said anything about the very objectionable feature of the oil going into the feed water of the open heater with the exhaust. Later on we will give a description of several open heaters which will show how this objectionable feature is eliminated, but just now we will take the case of an open heater which consists of simply an old boiler shell set either longitudinally or upright with an inlet and outlet for the exhaust. In such an arrangement the water is always carried at some distance above the bottom, and the outlet to the pump is high enough at some part in the suction pipe to prevent the water falling below this line if the float did not sufficiently control the cold water supply. This causes the oil to float on the surface of the water and to be blown off at regular intervals. This method is practiced at some collieries with marked success. The heavy impurities are precipitated to the bottom of the heater, which is cleaned out regularly.

With open heaters the maximum attainable temperature in the water, if the amount of exhaust steam is sufficient in amount, should not be more than from 1° F to 4° F less than the temperature of the exhaust steam when entering heater. The saving of fuel, or what is the same thing, increased capacity of the boilers, should be 1% for every 10° F the temperature of the water is raised. When the boilers are forced, or inferior coal is used, the percentage of saving, or increased capacity, is greater.

In the writer's opinion, where the water is particularly muddy or contains lime, magnesia, etc., a filter should form part of the heater, otherwise much of the scale forming matter, after being precipitated, is pumped into the boilers and there formed into scale, and one of the principal benefits of the open heater lost.

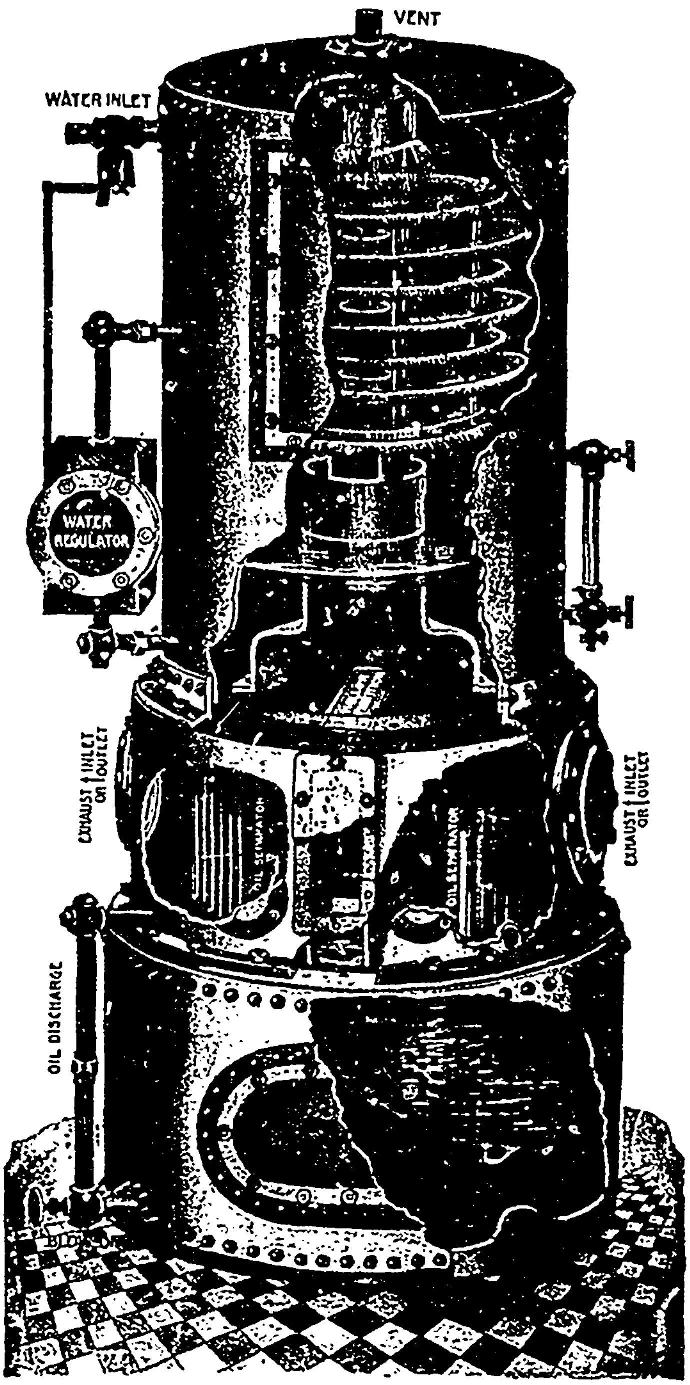
When the feed water contains incrusting materials not disengaged and precipitated at the temperature of the exhaust steam or by the filtration of the feed water, an apparatus should be attached to the heater by which the feed water can be treated with the proper chemicals to separate and remove the scale forming materials before they are pumped into the boiler.

Water impregnated with large quantities of sulphates of lime, and magnesia,, and little carbonate or silicate of lime will cause a soft formation inside the heater, mostly on the pans, but if pumped into the boiler will give a very hard scale.

In the case of heaters part of which consists of a filtering arrangement, there must be sufficient water carrying capacity to permit a very slow travel of the water through the filtering material.

Following are given cuts and descriptions of a few of the best open exhaust steam heaters on the market today.

HEATER.



DESCRIPTION.

Exhaust steam is admitted from either side and exhausts from the opposite side. The steam enters from the right hand side, as shown, strikes the "V" shaped oil-separating plates which divide the volume of steam; the ribs on these plates catching the oil and moisture in the steam, the separation is completed by the expansion of the steam in the chamber. The purified steam then enters into the enlarged portion of the exhaust tube (same being cut away to show its course) where it passes into the opposite expansion and oil-separating chamber where the steam is further purified, and discharges to the atmosphere or heating system. At the top of the heater is a vent pipe for carrying off the air and gases relieved from the water in heating. This vent pipe must be connected with the exhaust outlet or atmosphere, the air being thus removed from the upper, or heating chamber. The cold water supply from the city mains, or tank, now entering in a spray condenses the steam, forming a vacuum which draws the required amount of steam to heat the water up the large tube in the centre. But only that amount of steam necessary to heat the water comes in contact with it, the balance passes on in its dry purified state to the heating system or atmosphere.

The water supply is connected to the water inlet valve which is opened and closed by the water regulator, maintaining at all times a uniform water level in the heater. The water entering the spray box at the top of the heater overflows in a spray to the pan below; overflow from this pan sprays into the next. The water passes from this second pan through its centre to the next pan below, and so on down. The last pan is bolted to the top of the exhaust tube. The water sprays from this last pan to the water below. All pans with the exception of the bottom one are loose, made in halves, and are readily removed through the manhole. The object of these pans is to catch the lime deposit. The water after having been heated in direct contact with the steam enters the hollow partition at the back of the exhaust tube. (The dotted arrows show the water entering the opening in the hollow partition). The water discharges from the hollow partition near the front into the filtering chamber below, where the remaining impurities in suspension are removed by filtration. It is obvious that the water in the hollow partition is kept at boiling point, by having steam on both sides of it at all times. The filtering chamber is filled with coke or excelsior and at the back of this chamber is a perforated plate preventing the filtering material from passing through to the pump. A strainer plate is also placed at the blow off connections. The blow off and oil discharge pipe must be placed on the side opposite the exhaust inlet; openings are tapped for that purpose. The two oil separating chambers are connected by a small opening through the hollow portion at the bottom, through which the oil and condensed water drain from one chamber to the other. All chambers are provided with a large manhole, and manholes for cleaning. The manhole in the upper chamber is hinged, making it an easy matter to open the heater for examination and the removal of the lime catching pans. Exhaust flanges, suction and return flanges are also removable; and a heater will be furnished with any sized flanges desired up to the capacity of the heater. The water inlet valve is balanced, having a double valve, and is made entirely of brass. The water regulator contains a seamless copper float; and all connections, stuffing-box, etc., are of brass to prevent corrosion.

CONSTRUCTION.

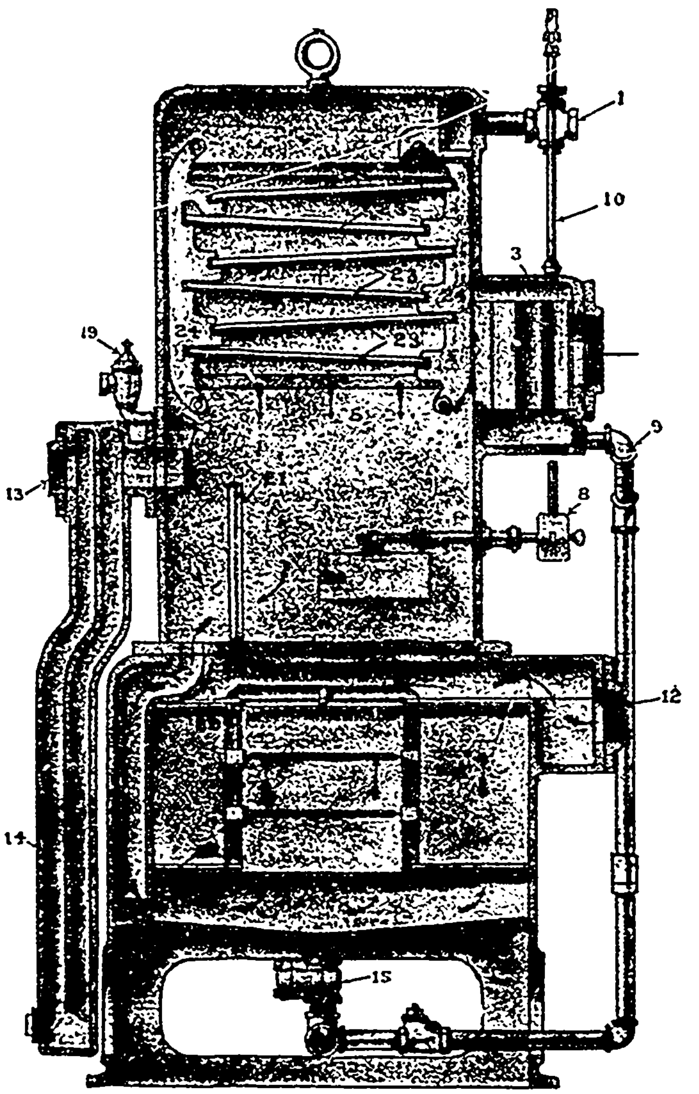
It is constructed in part of cast iron and steel plate, and in such a manner that it can be taken entirely apart with a monkey wrench. Being made on the interchangeable plan, any parts may be duplicated in the event of accident or partial destruction by fire. The top section is of steel plate, the centre section is of iron and in a single piece, including the shell, top and bottom heads, oil separating plates and the two walls forming the hollow partition. The bottom section or filtering chamber is made with a heavy cast iron bottom and cast ring at the top to which the steel shell is rivetted. For heaters of 400 H.P., and under, this chamber is made of cast iron and in one piece. These three sections are securely bolted together with special gaskets and constitute the main structure of the heater.

DESCRIPTION.

1. Water controlling valve.
3. Oil separator.
4. Exhaust steam outlet.
5. Heating Chambers.
8. Counter-balance weight for sink pan.
9. Oil drip connection with check valve.

10. Connecting rod between sink pan gear and water controlling valve.
11. Filter chamber.
12. Pump suction chamber.
13. Overflow connections.
14. Overflow seal.
15. Drain valve.
19. Combination shifting valve for ventilating heating chamber and relieving excessive vacuum and pressure.

HEATER No. 2.



20. Open sink pan, controlling water regulating valve.
21. Vent pipe, to prevent accumulation of air at top of suction chamber.
22. Upper and lower retaining screens for filtering material.
23. Perforated copper heating trays.
24. Heating Tray Brackets.
25. Water inlet seal trough.

This illustration shows clearly the construction and operation of the vacuum feed-water heater, purifier and filter.

Materials used in its construction are cast iron for the shell, copper and brass for the valves and fixtures, each of which resist the destructive action of impure waters. The large heating chamber, upper section of the heater, is provided with perforated copper trays for the distribution of water, as hereinafter explained. The entire valve gear, automatically controlling the water supply, is of brass.

As will appear from illustrations, the shell is of cast iron, rectangular in form, and composed of two single piece main castings, securely bolted together.

The heater has an inclined bottom to facilitate thoroughness in draining, and is amply strengthened for the pressures obtaining in ordinary practice. Access to the interior may be had by removing the manhole doors located in both the heating and filtering compartments, the latter forming the heater base.

The water supply to the heater is controlled automatically, the valve for this purpose being operated by an open gravity sink attachment, by which the inlet of water to the heater is increased or diminished, as may be necessary to furnish the required amount of feed water for the boilers, and also maintain a uniform water level within the heater.

The steam supply is drawn to the heater through a branch from the main exhaust pipe with a valve in it. This abrogates the necessity of expensive piping and further abrogates the difficulty attending taking all of the exhaust steam with the oil through the heater. *It also prevents the waste of water absorbed by the uncondensed steam passing through the heater.*

In the rectangular casting forming a steam connection to the heater there is placed an efficient *oil separator* of large surface, so constructed of steel baffles that the entrained water and oil are conducted to a receiving well at right angles to the flow of steam. The oil present in the exhaust is thus effectively separated and removed through a drain pipe of ample size provided for this purpose.

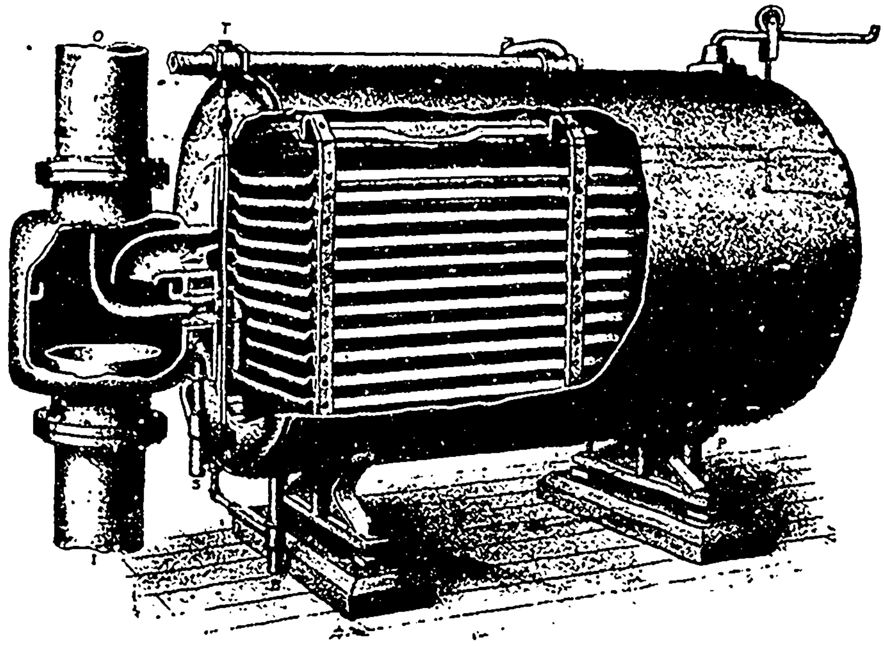
The feed water enters the heater through the water inlet at the top and is discharged into and fills a trough, forming a water seal, thus preventing the familiar water hammer, which is caused by steam entering the water pipe when only partially filled. The water overflowing through the trough is then distributed over a series of oppositely inclined, perforated copper heating trays, which in their vertical arrangement are staggered, so that the water on its downward course falls from tray to tray and passing through the perforations is broken up in small particles, whereby it becomes thoroughly mingled with exhaust steam and absorbs all the heat possible. In leaving the trays the water falls upon a plate on a heater which separates the heating chamber from the filtering chamber.

The filter is located in the lower casing and operates in the following manner: After becoming heated to the highest attainable temperature, the water in the heating chamber passes through a down-cast pipe into the settling chamber, above which the filter bed is located. In this settling chamber opportunity is given for the precipitation and retention of the heavier solids and impurities without clogging the filter. On account of the large size of this chamber the water entering it remains in an almost quiescent state, insuring the rapid deposit of the heavier solids from the feed water. The water then rises upwards through the cast iron perforated screens which hold the filtering material in place, through the filtering material and upper screens to the under side of the division plate, whence it travels to the pump outlet.

It will be manifest that the filtering material, as arranged, has only to deal with the lighter impurities in the feed water, the heavier particles having been deposited in the settling chamber.

The filter bed is commonly composed of coke, excelsior, or other suitable material, which are contained between the perforated division screens.

The overflow for ordinary service in heating, purifying and filtering feed water connection is made to the regular overflow outlet on the heater.



DESCRIPTION.

The above cut shows another type of vacuum heater. By the use of this attachment great saving in the pipe work, valves and fittings for connecting the exhaust supply to the heater is effected. By this arrangement no valves are required for the exhaust pipe connections to the heater in order that the heater may be cleaned or examined while the plant is in operation.

As is clearly shown in the illustration, the exhaust enters the bottom of the chamber and passes out at the top direct to the atmosphere, or to the heating system, as may be desired. The exhaust steam flowing upward through the induction chamber strikes directly into the mouth of the large downwardly curved pipe and supplies the heater with an ample amount of pure exhaust steam to heat the water to 210 degrees, even when the heater is worked to more than twice its rated capacity.

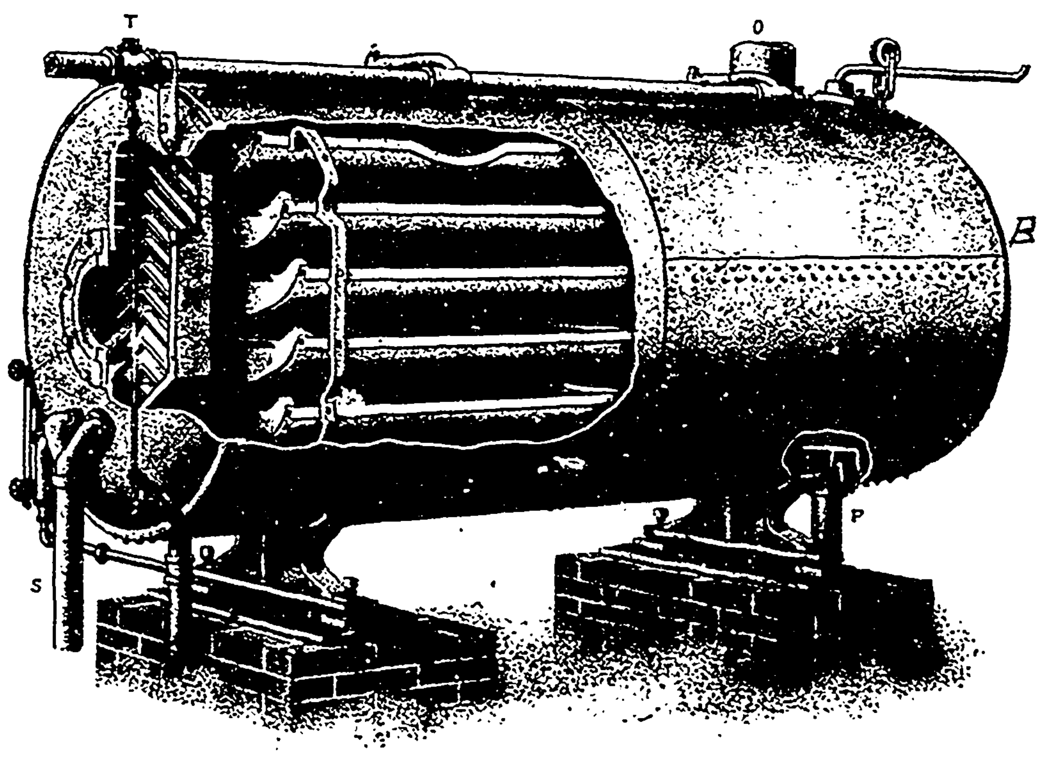
To allow the steam to enter the heater it is necessary that the air and gases be permitted to escape, and this is accomplished by heating the small curved pipe where it passes through the chamber and also by the current of exhaust steam passing the upper end of the pipe.

The attachment is also a first-class oil eliminator and grease extractor. It is a well known fact that oil and water follow the inner walls of the pipe, and when steam enters the chamber this entrainment is first carried over the edges of the flaring nipple extending up into the body. This nipple and the inner walls form an annular well which is always partially filled with water, the surplus being always drawn off by the drain pipe. Just above the centre, and extending around the inner wall is another gutter which is also partially filled with water, the excess being drained off to the lower well by the small pipe shown at the side. This gutter is intended to catch any oil that may creep up the sides of the chamber and to secure its complete interception.

In the last two of the heaters just described the vacuum principle is adhered to, and it has also had attention given to it in the first one, although the exhaust travels through it.

DESCRIPTION.

This heater consists of a cylindrical shell of steel plate, and is provided with neat cast iron heads, the front one, B, of which is removable for taking out the pans and for access in cleaning. The exhaust steam enters at the back end, and, after passing through

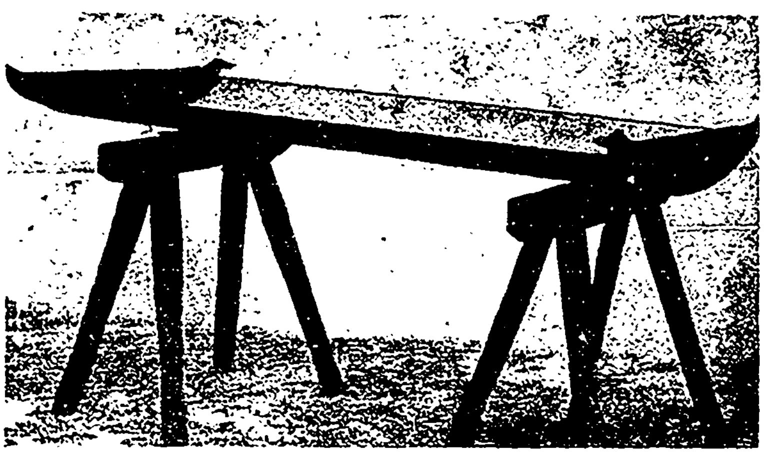


an ample self-cleaning oil catcher, A, enters the heater proper, from which it escapes through the pipe O on top, and at the front end. The pipe S is the drip pipe leading from the oil catcher to the sewer.

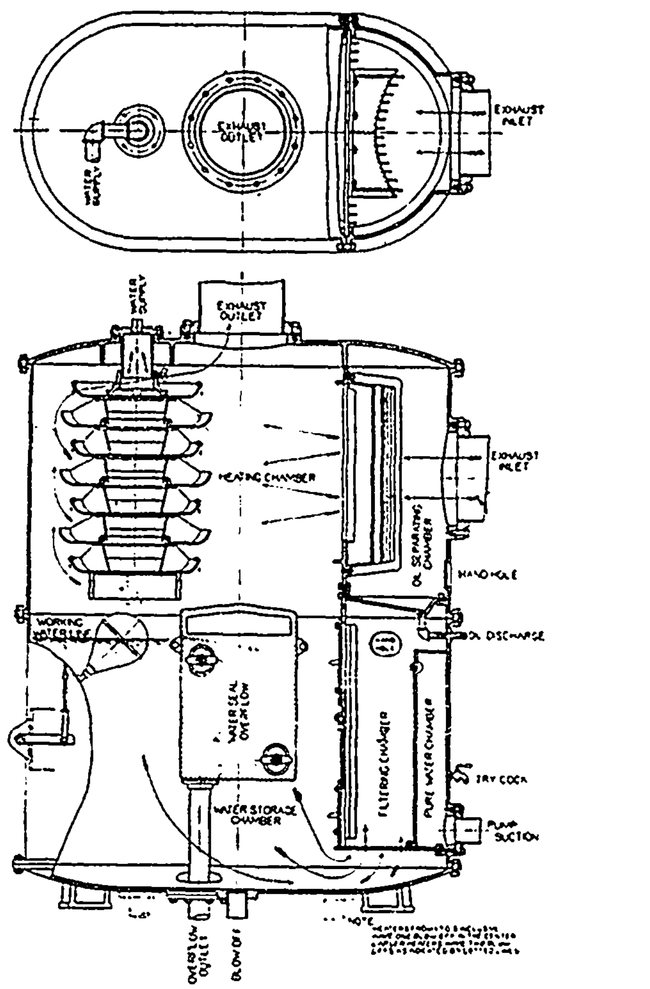
The admission of water to the heater is automatically regulated by a drained float, shown underneath the oil catcher, by operating the balanced valve at T. The float may be put in an upright 8" or 10" pipe attached to the suction if desired, in which case the balance valve will be at the other end of the heater. The water on entering the heater falls into the top pan first and flows downward over each pan to the chamber at the bottom of the shell, from which it passes to the pump through pipe P.

While in operation the pans are full of water and are completely surrounded by the exhaust steam in the shell. Owing to the convex shape of the bottom of the pans, the water is caused to flow in a thin film along the under side in such a manner that the exhaust steam always comes in contact with it, and thus heating it to the highest degree obtainable without back pressure. The pans afford ample settling chambers for the mud and solids in suspension to precipitate, and the lime and other solids in solution form, as fast as liberated, into scale on the under side of the pans.

It is claimed by the makers of the above last two heaters that no filtering arrangement is required because the pans thoroughly remove all the impurities that can be taken out or precipitated by exhaust steam. In support of this a cut of the pan before use is shown, and another cut of the same pan after having been in use in the heater for forty-two days.



Our experience would indicate that a filtering arrangement would be of considerable advantage.



DESCRIPTION.

By referring to the drawing above, it will be noticed that the exhaust steam is led into the heater through an inlet on the right and impinges upon the concave baffle plate immediately in front. It then passes around the ends of the concave baffle, and is thrown against the corrugations at the extreme ends of the separating chamber, and passes on into the body of the heater through two long, narrow ports on either side of the main baffle.

During its progress it has been practically freed from cylinder oil, and it then commingles most thoroughly with the cold water, which enters at the point marked "Water Supply", and flows down slowly over the tier of inner and outer discharge pans as shown by the arrows. After passing completely over the entire set of pans, the water drops down into the pure water chamber, which comprises the entire area of the lower portion of the heater below the water line, except that taken up by the filtering and pure water chambers.

It will be noted that, in proportion to the capacity of this heater, the settling space is very large, giving the water ample time to deposit in its passage, all the heavy particles, such as mud, sand, etc. It then passes upward through a filtering chamber, and overflows into the pure water chamber from which point it is taken by the pump, as required.

It will be noted that the water level is automatically controlled by the float on the left, the cold water valve being attached on the pipe, just above the water supply inlet.

The method employed of draining the oil chamber of oil is also quite clearly shown.

It should be noticed that the overflow is entirely automatic in action, and provides for *skimming* off all floating particles and the small residuum of oil which remains in the water after it has passed through the separator.

The heater is supplied with handholes for cleaning out the oil chamber, and also for washing out the filtering medium. Unless it is desired, there is no possibility of back pressure on this heater, on account of the fact that the outlet is made the same diameter as the inlet. The large hinged door provides almost instant access to any part of the heater.

The system of upward filtration should always be given much consideration, as it not only makes it possible to use the same filtering material for a much longer time, but prevents absolutely any floating particles from going into the boilers.

In connection with any heater there should be a by-pass, so that the steam can be turned into the heater or into the atmosphere at will.

(To be continued.)

The Lead-Mining Industry in British Columbia.

(From our Special Correspondent)

Mr. G. O. Buchanan, the Government Agent for the distribution of the lead bounty in British Columbia, has completed his task to date and the total amount paid out is $120,000. This represents the arrears that had accumulated from the date that the bounty became operative and covers a period of nine months. From now the returns of shipments will be made monthly, and after being checked will be certified for payment, and the amount be disbursed month by month. From the above figures it might appear that only a small portion of the total bounty granted, viz: $500,000, will be earned; such a conclusion however would at least be premature. The payment is certain to be very much larger than indicated by the monthly earnings so far, whether or not the Government consents to the payment of a portion of the bounty on exported ore. If however, the request of the lead miners in this respect be refused, there will be a large increase in tonnage over 1903. Local opinion inclines to the belief that the St. Eugene will work to its full capacity whether the export bounty be granted or not, as development work is being pushed rapidly and every preparation is being made for a busy season. Apart from this, however, a stimulus has been imparted to the industry throughout the the Slocan. More men are working than at any time during the last three years, the last estimate being 750. Many small mines are being re-started, and the principle of leasing, so well adapted to this camp, is spreading. The effect of Government aid was slow in manifesting itself, probably because of the delay in providing for and paying the bounty, but as soon as it was seen that the help was really forthcoming and that market conditions were improved there was a steady increase in production. It is gratifying to be able to note that the machinery to handle this matter is running without friction, and that all parties are satisfied with the treatment they are receiving. The recovery has come none too soon, for things were looking very blue throughout the Slocan, and one of the most important and legitimate industries in the West was languishing almost to the point of extinction.

MINING NOTES.

NOVA SCOTIA.

The Intercolonial Coal Co., Westville N.S., are to put in a new and larger air compressor to supply the requirements of No. 4 slope.

The Nova Scotia Steel and Coal Co. has chartered for the season some 16 steamers to carry its coal and iron ore.

The Fundy Coal Co., near Amherst, N.S., are to increase their plant to a capacity of 1,000 tons per day. The Company controls 10 square miles and are working a seam with an average thickness of 6 feet.

Sydney despatches state that orders to relight all idle open hearth furnaces have been given and that large orders for billets and rods have been booked. Two furnaces are now in blast, and the other two are being relined.

The output of the Dominion Coal Co., for the four months ending May 1st, was 864,736 tons. The daily output ranges from 13,000 to 14,500 tons, and since navigation on the St. Lawrence river opened the shipments have averaged nearly 8,000 tons per day.

Under date of the 13th instant, it was reported that two of the collieries of the Dominion Coal Company were obliged to stop cutting coal as all available space for banking purposes was filled. Over 120,000 tons are reported to be banked awaiting shipment. Shortage of vessels for shipment is reported as the cause. The Company's operations have been considerably hampered by the lateness of the spring, which has been unfortunate by reason of the large contracts which have been entered into.

A liquidator has been granted by the Supreme Court of Nova Scotia for the Canada Coals and Railway Company, more familiarly known as the Joggins Mines Company. Under the winding up order granted, Mr. James Rodger, representing the Gault interests, was appointed to the position. The present corporation was formed some 12 years ago, and has never paid a dividend. The seam is thin and the fire-clay band is thick, and to these natural difficulties was added the burden of heavy fixed charges and gross over capitalization.

NEW BRUNSWICK.

The Canadian Coal Mining Co., operating in New Brunswick, have applied for a charter to build a railroad from their mines to the Intercolonial Railway. The distance is eight miles.

QUEBEC.

The Summer School of Mining and Geology for McGill University left Montreal on the 25th of April accompanied by Professors Adams, Porter and Stansfield. The students were nineteen in number, and the first stop for work was made at Sudbury, Ont. Here courses in metallurgy under Prof. Stansfield, and in field geology under Dr. Adams, were given. The party then proceeded to Alberta to study the coal deposits at Frank and the Crow's Nest Pass. It will visit the St. Eugene mine and mill in East Kootenay and will take in as much of British Columbia as can be accomplished in the six weeks ending June 4th.

ONTARIO.

Reports from the Sultana Mine continue to be of good character, and the ore that is being mined has a satisfactory profit margin.

A Winnipeg telegram advises that a mining revival in the Keetwatin District is probable, and states that ten stamps in the Sultana mill are dropping on ore coming from the fourth, seventh and eighth levels.

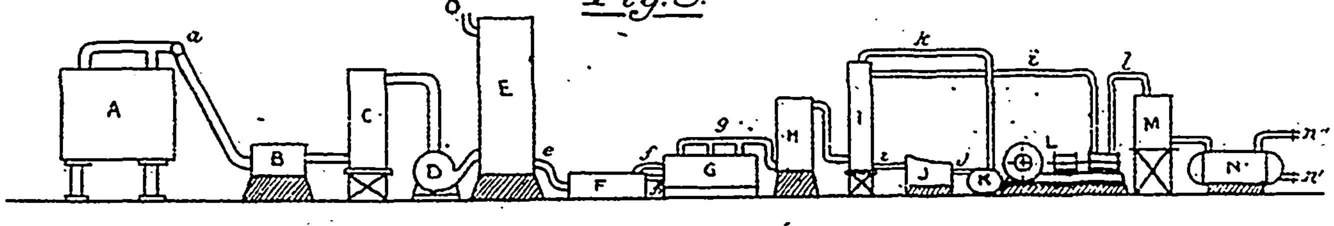
The Bureau of Mines reports the discovery of iron ore (hematite) 60 miles north of North Bay in the Temagami Reserve near Rabbit Lake. Particulars as to quantity and quality of the ore have not been ascertained.

The Twentieth Century Mining Co., report that the shaft has now reached a depth of 100 feet, and that ore from the bottom is of good value. Levels have been started off at 80 feet, which, so far, have also shown good values.

Ontario enjoys the distinction of having a "lady" mine owner and mine operator, Mrs. C. A. Bridgewood, who is working mica mines in Haliburton Township. Mrs. Bridgewood states that she is operating at a good profit, and proposes to start a form of co-operative mining among the farmers:—they will do the mica mining, and she will buy the product, trim it and morket it.

A reported discovery, which may be of great importance, is said to have been made on Hunter's Island, a few miles north of the Vermillion Iron Range of Northern Minnesota. The ore is both specular and hematite, and is said to be low in sulphur, phosphorous and silica. The location is accessible from a point on the Port Arthur, Duluth & Western Railway, about 100 miles west of Port Arthur.

Fig. 3.



The above is the correct cut for Fig. 3 of Mr. Sjostedt's paper printed in our April issue; the cut given as No. 3, was one which was sent to us in error.

The Bureau of Mines has announced that the summer schools, under the direction of Dr. W. L. Goodwin assisted by Mr. J. W. Bain, will hold sessions as follows:—Bannockburn Pyrite Mine, May 2 to May 8; Olden Zinc Mine, May 10 to May 17; Radnor Iron Mine, May 19 to May 26; Craig Corundum Mine, May 26 to June 3; Haileybury Mine, June 6 to June 13; Greighton Mine, June 16 to 23; Massey Copper Mine, June 25 to July 3; Superior Copper Mine, July 5 to July 12; Location A.L., 282, July 15 to July 22; Gold Rock, July 24 to July 31; Sultana Gold Mine, August 3 to August 10.

BRITISH COLUMBIA.

Mr. J. L. Parker, late superintendent of the North Star Mine at Kimberley, East Kootenay, has been appointed to the superintendency of the mines of the Brown Alaska Co. on Prince of Wales Island, Alaska.

A 50-ton Hendryx Process plant has been contracted for by A. H. Kelly to be placed upon the property of the Reliance Gold Mining and Milling Co. on Forty Mile Creek, below Nelson. Mr. Kelly expects to have the plant in operation some time in July.

Continued good reports of the operation of the Iowa-Lillooet dredge have been received, and if they are substantiated, the gold industry along the Lillooet, and portions of the Fraser River, will be rehabilitated to a marvellous extent.

On Boulder, McKee, Spruce, Pine and Birch Creeks, and on the Stevenduke lease, piping water for hydraulic sluicing will begin shortly. Preparations are all ready. On Boulder Creek and on Spruce Creek individual miners, operating by hand, are taking out very good gravel.

The Oro Denoro mine, in the Boundary District, is making changes and installing additional machinery to enable it to ship 250 tons a day. The present capacity is 150 tons per diem, and this output has been maintained for some time. A new superintendent has been appointed in the person of Mr. F. W. McLellan, who comes to the Oro Denoro from the Sumpter District in Oregon.

Advices from the vicinity of Yale, B.C., are to the effect that numerous good strikes have been made in that district this spring. These strikes have been made in both placer and lode mines, and have attracted many prospectors from other parts of the province. Boston Bar and Hill's Bar, and Siwash Creek are the special localities mentioned.

On Siwash Creek there has been a development of free milling ore which is deemed sufficient for a new 10-stamp mill, the erection of which began this month. A 3-stamp mill and a 5-stamp mill have been at work on two other deposits with satisfactory results.

On the 10th instant Mr. Justice Drake of the Supreme Court of British Columbia, ruled that the majority value in the reorganization of the Lenora Mining Co should rule. The matter came before his lordship in an application to sanction the acceptance of the liquidator's offer made to the unsecured creditors of the old company. At a previous shareholders' meeting a majority of *votes* had been given against the offer, but a large majority of *value* was in favor of the offer. The substance of the offer made was that the owners of the Crofton smelter should take £100,000 in first preference shares and cash; the owner of the sawmill and 400 acres of timber land should take £10,000; the unsecured creditors to the amount of about £50,000 should take second preference shares for that sum, and the owners of the mine £100,000, with a reserve of £40,000 for working capital.

The judgment of His Lordship, Chief Justice Hunter, in the case laid against the Wellington Colliery Co., Ltd. for employing Chinese underground, is that the clause (34) of the Coal Mines Regulation Act, under which the charge was laid, is ultra vires of the province. His Lordship's judgment was concurred in by Mr. Justice Irving, the case having been heard by a special session of the Full Court. The information on which the original case was based was laid by direction of the Provincial Government. Clause 34 of the Act which is declared ultra vires reads: "No Chinaman or person unable to speak English shall be appointed to, or shall occupy, any position of trust or responsibility in or about a mine subject to this Act, whereby through his ignorance, carelessness or negligence he might endanger the life or limb of any person employed in or about a mine, viz; as bankman, onsetter, signalman, brakeman, pointsman, furnaceman, engineer, or be employed below ground or at the windlass of a sinking-pit."

The conditions under which the regulation quoted was enacted are well enough known to require no comment. The decision given by the Full Court is a distinct blow to the opponents of Chinese labor below ground in the coal mines of the province.

There is a return apparently to the old system of shipping out lead bullion from British Columbia smelters to the Selby Smelting Works, San Francisco. For a time after the lead bounty was put in force, it was noticeable that there was no lead bullion reaching the coast. It has been the practice in the past to ship several cars by each steamer which sailed from Vancouver for San Francisco. For a short time none was going south. In the last two or three trips, however, some lots have been arriving. Yesterday the steamer City of Puebla took out three cars of lead bullion to be refined at the Frisco works. The trip before, the Umatilla took out two cars. It is of course known that the bullion cannot all be treated at the new British Columbia refinery.

There are three freighting steamers, the Selkirk, Cascade and Oscar, engaged in carrying ore from British Columbia coast mines to the Tacoma smelter.

A rather peculiar law case arising out of conflicting mining regulations was disposed of by Judge Martin this week. The Lucky Jack claim in the Poplar Creek free gold camp was recently staked over as a placer claim by a prospector. There is a good deal of wash over the vein in places, consisting of boulders from the vein matter, which is at various places 80 ft. in width. If this were allowed to be worked as placer ground such a claim would be undoubtedly valuable. The learned judge in deciding the case ruled that such a claim was legally staked. Of course an appeal is to be taken. The placer claim is suggestively named the "Do Who."

NORTH-WEST TERRITORIES.

The International Coal and Coke Co. at Coalman, Alberta, is now shipping about 150 tons of coal per day. A force of men are at work on the coke ovens preparing foundations and getting in material for the bedding of the oven.

The Frank Mine of the Canadian-American Coal and Coke Co. has its main entry in a distance of 6,500 ft. reaching a vertical depth of over 1200 ft. The quality of the coal now mined and the amount of the output is greater than it was before the disastrous slide, which about a year ago completely closed all operations.

Mr. O. E. S. Whiteside, the general manager of the West Canadian Collieries, has placed Chas Emerson, formerly at Canmore, Alta., in charge of the Bellevue mine. The Bellevue is becoming one of the prominent mines belonging to the West Canadian Collieries; it furnishes about 150 tons per day of a superior quality of steam coal, all of which is supplied to the C.P.R for locomotives.

YUKON.

James MacDermott, a claim jumper of White Horse, received the severe sentence of two years' imprisonment by the local judge last month.

The Commission appointed to examine into certain mining matters in the Yukon territory and better known as the Treadgold Commission, has been reconstituted by the appointment of Mr. Justice Britton as sole Commissioner.

Dr. G. C. Martin, the geologist who investigated the Alaska coal deposits in the summer of 1903, has reported that coal, very closely approaching true bituminous coal, has been found in quantity at the foot of the Chugach mountains on the United States side of the boundary. Dr. Martin also reports a seam 20 ft. in width, of a semi-anthracite on Carbon Creek. The tests made show it to be closely allied in heating power as well as in the low percentage of ash with the famous Pocohontas coal of Virginia.

The White Pass and Yukon Railway Co. has posted its tariff of rates into the new Alsek fields. From White Horse to Mendenhall for each passenger $10.00, return fare $17.50. Freight rates in either direction are 75c. per 100 lbs. For horses and cattle the rates are $7.50 per head into Mendenhall and $5.00 coming out back to White Horse. Each passenger is allowed 150 lbs. of baggage free. The distance from White Horse to Mendenhall is only 70 miles.

INDUSTRIAL NOTES.

Mr. H. F. Frevert who, for several years past has been the manager of the New York departments of the Niles-Bement-Pond Co. and the Pratt & Whitney Co., has severed his connection with the above concerns and has established a machinery office on his own account at 114 Liberty street. Mr. Frevert will also continue to represent the Norton Grinding Co. of Worcester, Mass., and the Brightman Manufacturing Co. of Shelby, Ohio.

Mr. H. V. Croll who has been in charge of the Salt Lake City, Utah, Office of the Allis-Chalmers Company, for several years, and who was before that the representative of the E. P. Allis Company at Spokane, Washington, has been appointed to the charge of the Allis-Chalmers Office in San Francisco, as the successor of Mr. Geo. Ames, who has resigned. Mr. Croll's San Francisco Office is 623 Hayward Building.

A new corporation known as Allis-Chalmers-Bullock, Limited, announce that they have taken over the business and representation in Canada of the Bullock Electric Manufacturing Co., Canadian Bullock Electric Manufacturing Co., Ltd., Allis-Chamlers Company, Ingersoll-Sergeant Drill Company, Lidgerwood Manufacturing Co., Wagner Electric Manufacturing Co., Canadian Engineering Co., Ltd., and that the head office and works will be at Montreal, with branches at Toronto, Winnipeg, Vancouver, Rossland and Halifax. The new organization will operate in close relations to the American Companies represented and will manufacture machinery, identical in design and of the same high grade of material and workmanship. It assures customers that, with shops of the most modern design and equipment, and the benefit of the wide engineering experience of the American Companies the finest class of machinery will be produced. This corporation has been evolved from the Canadian Engineering Co. Ltd., which has now been merged into the larger enterprise. Offices have been in the Coristine Building, Montreal, but larger offices are now being fitted.

The B. Greening Wire Co. Limited of Hamilton, Ontario, report a steadily growing demand for the *wire* barrel hoop in place of the old-fashioned *elm* hoop. There is such a difficulty now experienced in getting material suitable for wooden hoops that not only has the price greatly advanced but it seems impossible to get stock of suitable quality to supply the larger shops. In consequence the wire barrel hoop has come into use. The wire barrel hoop consists of a piece of No. 9 to No. 12 gauge steel wire with the ends twisted together, forming a perfect circle which is slipped down over the barrel into place without binding at any particular point; the cost is as low or lower than the wooden hoop. These hoops are now successfully used on flour, sugar, salt and apple barrels and are coming into general use on other barrels.

A new colliery company, known as the Nova Scotia Collieries, Ltd., with a capital of £200,000 divided into 100,000 preferred shares bearing 6 per cent. interest and 100,000 ordinary shares of £1 each, has been formed with London and New York capital. The company has acquired 3,840 acres, or six square miles of coal lands in Cape Breton in the Chimney Corner field, and is acquiring an additional two square miles. Options are held on 18 additional square miles which may or may not be exercised. There have been 23,500 preference shares and 30,007 ordinary shares issued to the 1st of May, and boring operations have been carried on for some time. At present one new seam, 4 feet 1 inch thick, of a good quality of bituminous coal has been found, and three seams had been previously uncovered on the outcrop. These seams measure 5 feet, 6 feet 2 inches, and 7 feet in thickness, respectively. The directors of the corporation are: Major A. G. Spilsbury, Chairman, Baron Danvers, Mr. Fdmund Kimber, Mr. Arthur Morgan and Mr. Ira Taylor. The local directors in Nova Scotia are: Hon. Wm. Ross, M.P. of Cape Breton, and Hon. Wm. Roche, M.P., of Halifax. The quality of the Chimney Corner coal is most excellent and the chances are favorable for this concern.

The Allis-Chalmers Company of Milwaukee advise that they have appointed Mr. James W. Lyons, manager of their newly created Power Department. Mr. Lyons was formerly associated with the Allis-Chalmers Co. as engine salesman; his department now controls the sale of reciprocating steam engines, steam turbines (entire unite including turbo-generators), condensers, gas engines, pumping engines, blowing engines, hoisting engines, and air compressors.

The A. Leschen & Sons Rope Co., St. Louis, Mo. have been compelled to seek larger quarters in New York City and have taken the large offices at 163 and 165 Washington St. where they have increased facilities for carrying a very much larger stock than in the past and opened their new and commodious offices on the morning of May 2nd. This firm manufactures all grades and kinds of rope and are the sole manufacturers of Hercnles, and Patent Flattened Strand, Wire Rope.

The Macdonald Institute at the Ontario Agricultural College, Guelph, will provide a Summer School for teachers during the coming vacation. The term will extend from July 5th to July 29th. The classes will be under the direction of Dr. W. H. Muldrew of the Macdonald Institute, and Professor William Lochhead of the Biological Department in the Ontario Agricultural College, assisted by teaehers of special fitness in the various subjects of the course. The course will be thoroughly practical, involving daily excursions, lectures and laboratory work, the preparation of Nature Study collections and courses of reading in illustration of the subjects discussed.

NEW COMPANIES.

V.I. Exploration and Development Co., Ltd.—Incorporated 27th April, 1904. Authorised capital $100,000 divided into 100,000 shares of $1 each.

Washington Mine, Limited.—Incorporated 25th April, 1904. Authorised capital $200,000 in shares of $1 each.

New Monashee Mines, Limited.—Incorporated 26 April, 1904. Authorised capital $1,000,000 in shares of $1 each.

Royal Smelting and Refining Co., Ltd.—Incorporated 6th May, 1904. Authorised capital $100,000 in shares of $10 each.

South-East Kootenay Coal and Coke Co., Ltd.—Incorporated 5th May, 1904. Authorised capital $100,000 in shares of $1 each.

Berry Creek Mining Co., Ltd.—Incorporated 16th May, 1904. Authorised capital $150,000 in shares of $5 each.

Atlin Dredging Co., Ltd.—Incorporated 12th May, 1904 Authorised capital $25,000 in shares of $1 each.

Minnie Mining Co., Ltd.—Incorporated 13th May, 1904. Authorised capital $125,000 in shares of $1 each.

ONTARIO.

The St. Louis Reduction Co., Ltd.—Incorporated 20th April, 1904. Authorised capital $500,000 in shares of $1 each. Head office: Toronto, Ont. Provisional directors: Charles Bagot Jackes, barrister, Toronto; Robert Forbes, mining engineer, Duluth, Minn.; and George Edward Kingsley, St. Lonis, Missouri.

British American Development Co., Ltd.—Incorporated 20th April, 1904. Authorised capital $1,000,000 in shares of $1 each. Head office: Toronto, Ont. Provisional directors: James E. Haines, Brampton, Ont.; Alfred T. Haines, Cheltenham, Ont, Adam Linton, Jas. E. Carter, Wm. J. Armstrong, all of Guelph, Ont., and J. W. Cheeseworth, Toronto, Ont.

Montreal and Boston Consolidated Mining and Smelting Co., Ltd.—Incorporated 27th April, 1904; Authorised capital $7,500,000, in shares of $5.00 each. Head Office: Toronto, Ont. Provisional directors: Henry Jas. Wright, Joseph A. Thompson, John Payne, Richard Credicott, W. J. Gilchrist, all of Toronto, Ont.

Syndicate Mining Co., Ltd.—Incorporated 15th April, 1904. Authorised capital $50,000 in seares of $1.00 each. Head office: Toronto, Ont. Provisional directors: S. P. Kineon, L. E. Ziegle, George Kinsey, E. J. Gardner, of Cincinnati, Ohio, F. W. Whitaker and O. M. Bake, Hamilton, Ont., and R. C. LeVesconte, Barrister, Toronto, Ont.

St. Anthony Gold Mining Co., Ltd.—Incorporated 29th April, 1904. Authorised capital $1,000,000 in shares of $1.00 each. Head office: Ignace, Thunder Bay District, Ont. Provisional directors: Benton Hanchett, Geo. W. Eadock and Arthur Hill, Sagniaw, Michigan.

South Essex Oil and Gas Co., Ltd.—Incorporated 11th May, 1904. Authorised capital $500,000 in shares of $1.00 each. Head office: Leamington Ont. Provisional directors: John A. Auld, Amherstsburg, Ont., Darius Wigle, B. Jasperson, S. L McKay, of Kingsville, Ont., Edward Winter, H. R. Whaley, J. H. Conover and B G. Westcott of Leamington, Ont.

Detroit and Parry Sound Mining Co., Ltd.—Licensed under the laws of Ontario as an extra-provincial company 11th May, 1904. Authorized capital for Ontario $50,000. Head office: Frank H. Macpherson, Windsor Ont.

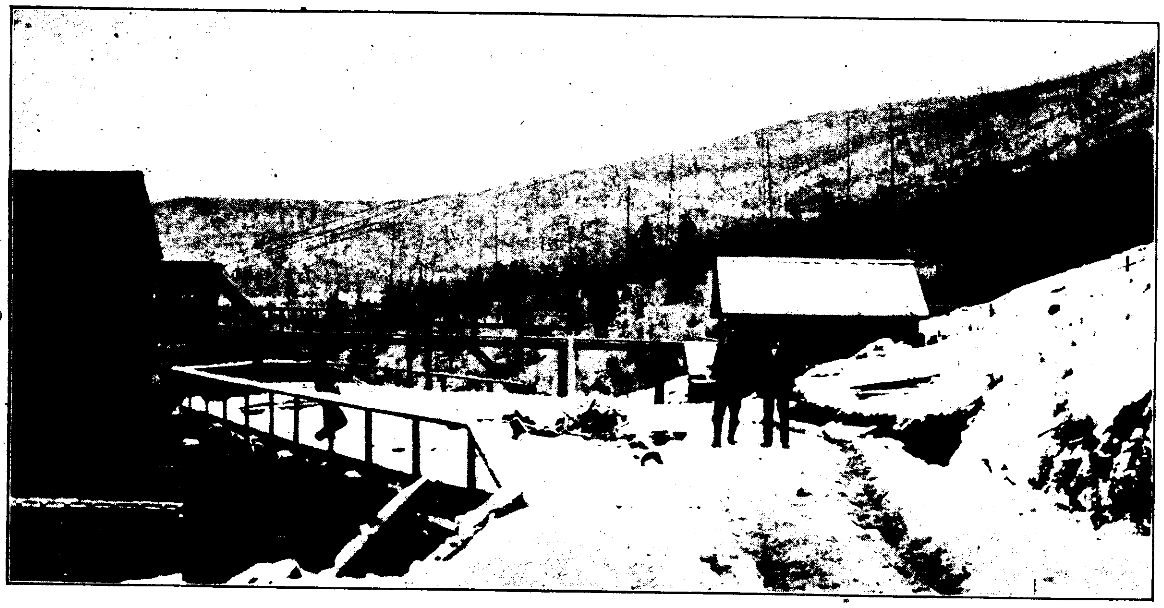
Ursa Major Co., Ltd.—Incorporated 6th May, 1904. Authorised capital $1,000,000 in shares of $1.00 each. Head office: Toronto, Ont. Provisional directors: J. G. Harris, J. A. Keyes, Robt. Forbes, Mining Engineer, Albert J. Milner, of Duluth, Minn., and Chas. B. Jackes, Barrister, Toronto, Ont.

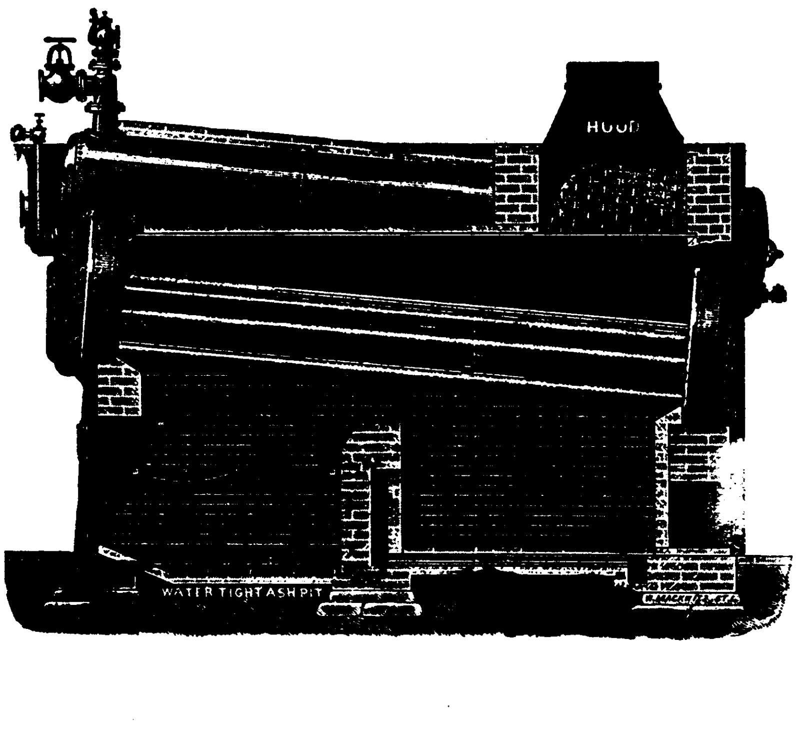
Notice.

Chemists, metallurgists and assayers in Colorado have joined in an attempt to form an association of technical men who are interested in the chemistry of reduction processes, and an attractive introductory letter has been issued by the Committee in charge. The objects of the association are to improve and standardize methods of work, to communicate experiences and opinions on matters of chemico-metallurgical interest, and to increase the exchange of opinions and personal intercourse and knowledge.

The temporary organization proposes affiliation with the American Chemical Society and the Society of Chemical Industry (London) and also to include all persons interested in the subjects of chemistry and metallurgy west of the Mississippi river, including British Columbia and Mexico.

The secretary, pro tem, is Mr. H. C. Parmalee, of Denver, Colo., whose address is P.O. Box 1421, who would be glad to receive communications from intending members and to answer all enquiries. The REVIEW wishes the Society all good luck.

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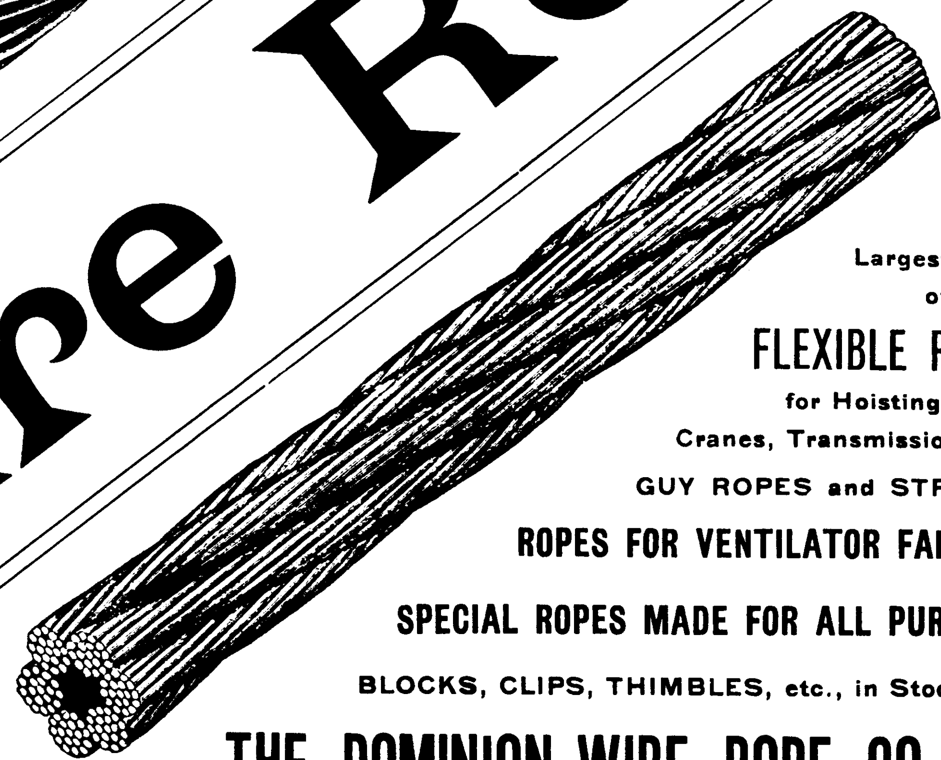

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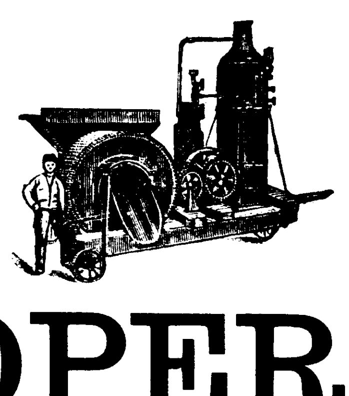

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