

Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured covers/
Couverture de couleur
- Covers damaged/
Couverture endommagée
- Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- Cover title missing/
Le titre de couverture manque
- Coloured maps/
Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- Bound with other material/
Relié avec d'autres documents
- Tight binding may cause shadows or distortion along interior margin/
La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments:/
Commentaires supplémentaires:

- Coloured pages/
Pages de couleur
- Pages damaged/
Pages endommagées
- Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- Pages detached/
Pages détachées
- Showthrough/
Transparence
- Quality of print varies/
Qualité inégale de l'impression
- Continuous pagination/
Pagination continue
- Includes index(es)/
Comprend un (des) index
- Title on header taken from:/
Le titre de l'en-tête provient:
- Title page of issue/
Page de titre de la livraison
- Caption of issue/
Titre de départ de la livraison
- Masthead/
Générique (périodiques) de la livraison

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X		14X		18X		22X		26X		30X		
		12X		16X		20X		24X		28X		32X

The CANADIAN MINING REVIEW

Established 1882

Vol. XXVIII—No. 2.

MONTREAL, FEBRUARY, 1907.

Published monthly.
Two volumes a year.



THE CANADIAN RAND DRILL CO.

MONTREAL, QUE.

Branches: Montreal, Toronto, Halifax,
Kenora, Rossland, Vancouver



WE MAKE ALL KINDS OF

RUBBER GOODS FOR MINING PURPOSES

Steam and Air Hose
Rubber Bumpers and Springs
Fire Hose

Conveying Belts
Pulley Covering
Rubber Clothing and Boots, etc.

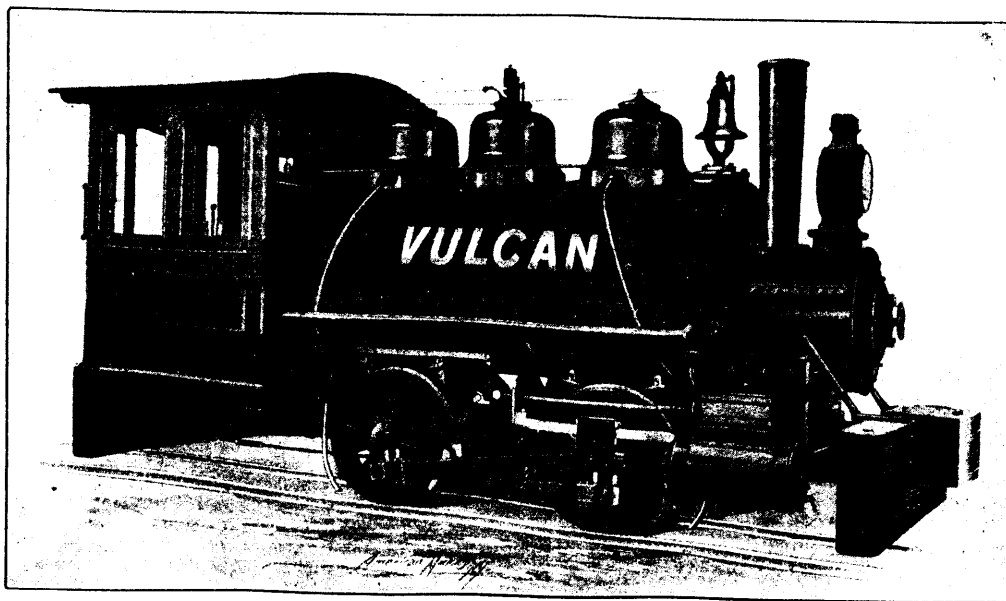
THE GUTTA PERCHA & RUBBER MFG. CO. OF TORONTO, Ltd.



LIGHT LOCOMOTIVES

For
All kinds
of service

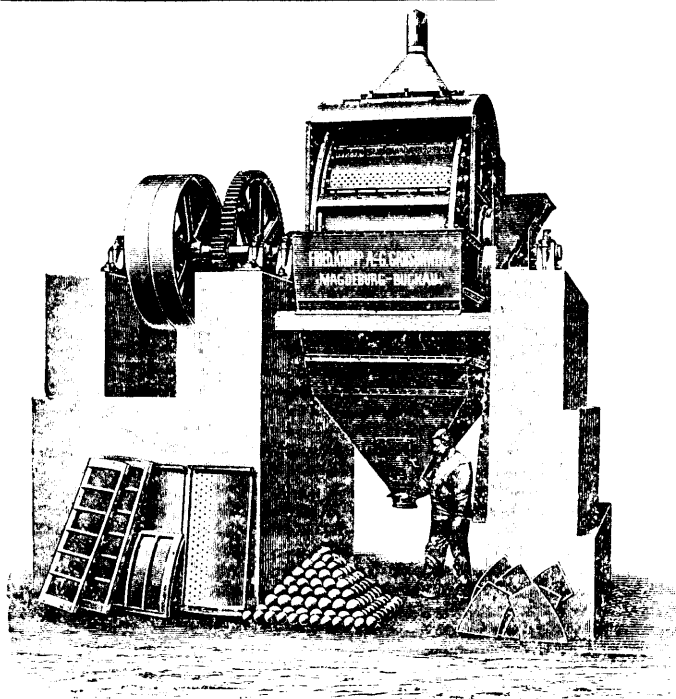
All sizes



If you want
the best,
get a
"VULCAN"
It is built
for hard
work

MUSSENS LIMITED (Formerly W.H.C. Mussen & Co.)
MONTREAL

FRIED. KRUPP A.-G. GRUSONWERK Magdeburg-Buckau (Germany)



SPECIALTY BALL MILLS

For Dry and Wet Crushing

ADVANTAGES:

Continuous working.
Immediate automatic discharge of the product as soon as the desired degree of fineness has been attained.

Exceedingly uniform product.

Hardest ores ground to any degree of fineness.
Minimum wear and tear.
Easy access to the interior of the large grinding drum.
Require little attention.

Moderate power, with high capacity.

Write for Catalogues.

SOLE REPRESENTATIVES FOR CANADA

JAS. W. PYKE & CO., Sovereign Bank Building, Montreal

"STEPHEN HUMBLE'S"

IMPROVED PATENT SAFETY DETACHING HOOK

With Automatic Lowering Arrangement.

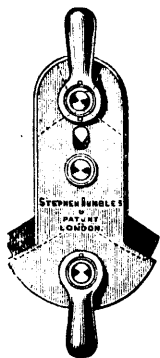
In use throughout the Mining World, owing to its Simplicity, Certainty of Action and Security. For the prevention of accidents by over-winding at Mine Shafts and Furnace Hoists.

7,000 IN USE

SOLE MANUFACTURER:

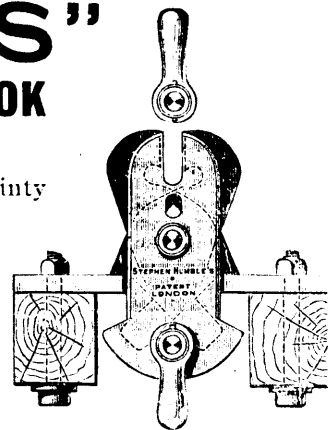
STEPHEN HUMBLE

Westminster Chamber, 9, Victoria Street, London, S. W.



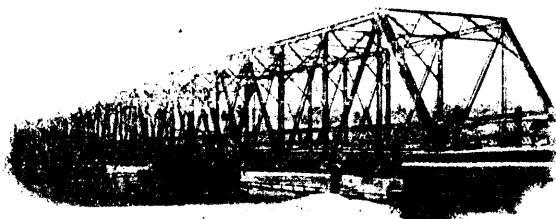
WORKING ORDER

Telegrams—"STEPHEN HUMBLE, WESTMINSTER."



DETACHED AND SUSPENDED

STEEL



Buildings,
Bridges,
Roof Trusses,
Viaducts, etc.

Designed, fabricated, and erected.

THE LOCOMOTIVE AND MACHINE COMPANY OF MONTREAL, LIMITED

IMPERIAL BANK BUILDING, MONTREAL, CANADA



DOMINION OF CANADA

SYNOPSIS OF CANADIAN NORTH-WEST MINING REGULATIONS.

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

A person 18 years of age or over having discovered mineral in place, may locate a claim 1,500 feet x 1,500 feet.

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 an acre.

The patent provides for the payment of a royalty of 2½ per cent. on the sales.

Placer mining claims generally are 100 feet square; entry fee \$5, renewable yearly.

A free miner may obtain two leases to dredge for gold of five miles each for a term of twenty years, renewable at the discretion of the Minister of the Interior.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles. Rental \$10 per annum for each mile of river leased. Royalty at the rate of 2½ per cent. collected on the output after it exceeds \$10,000.

W. W. CORY,

Deputy of the Minister of the Interior.

NOVA SCOTIA STEEL & COAL Co., Ltd.

PROPRIETORS, MINERS AND SHIPPERS OF

Sydney Mines Bituminous Coal

Unexcelled Fuel for Steamships and Locomotives,
Manufactories, Rolling Mills, Forges, Glass Works,
Brick and Lime Burning, Coke, Gas Works, and
for the manufacture of Steel, Iron, etc.

Collieries at Sydney Mines, Cape Breton

MANUFACTURERS OF

HAMMERED AND ROLLED STEEL

FOR MINING PURPOSES

Pit Rails, Tee Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel $\frac{3}{8}$ " to $\frac{1}{4}$ " Diameter, Steel Tub Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting $\frac{5}{8}$ " to 5" true to 2-1000 part of one inch.

A FULL STOCK OF

Mild Flat, Rivet-Round and Angle Steels

ALWAYS ON HAND

Special attention paid to Miners' Requirements.

CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, N.S.

COAL

DOMINION COAL CO., LTD.

GLACE BAY, C.B., CANADA

MINERS OF

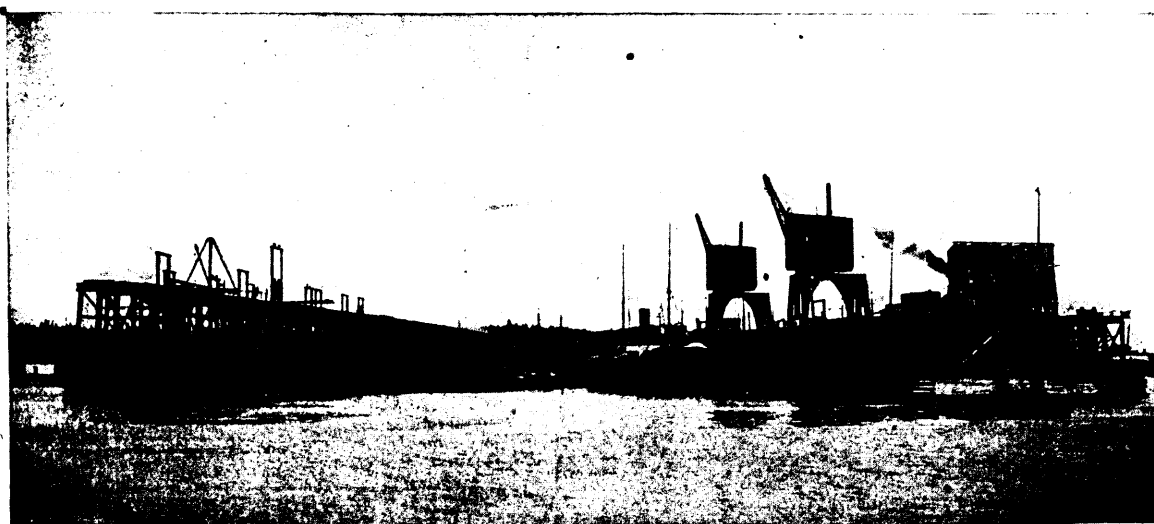
BITUMINOUS COALS

The celebrated "Reserve" coal for Household use.

"INTERNATIONAL" GAS COAL

And the best steam coal from its Collieries on the Phalen seam.

YEARLY OUTPUT 3,500,000 TONS



International Shipping Piers of the Dominion Coal Co., Limited, at Sydney, C.B.

Shipping facilities at Sydney and Louisburg, C.B., of most modern type. Steamers carrying 5,000 tons loaded in twenty-four hours. Special attention given to quick loading of sailing vessels. Small vessels loaded with quickest despatch.

BUNKER COAL

The Dominion Coal Company has provided unsurpassed facilities for bunkering ocean-going steamers with despatch. Special attention given to prompt loading. Steamers of any size are bunkered without detention.

By improved screening appliances, lump coal for domestic trade is supplied, of superior quality. Prices, terms, etc., may be obtained at the offices of the Company.

ALEXANDER DICK, General Sales Agent, Glace Bay, C.B.

DOMINION COAL COMPANY, Limited, 112 St. James Street, Montreal, Que.

DOMINION COAL COMPANY, Limited, 171 Lower Water Street, Halifax, N.S.

DOMINION COAL COMPANY, Limited, Quebec, Que.

and from the following agents :

R. P. & W. F. STARR, St. John, N.B.

PEAKE BROS. & CO., Charlottetown, P.E.I.

HULL, BLYTH & CO., 4 Fenchurch Ave., London, E.C.

J. E. HARLOW, 95 Milk Street, Boston, Mass.

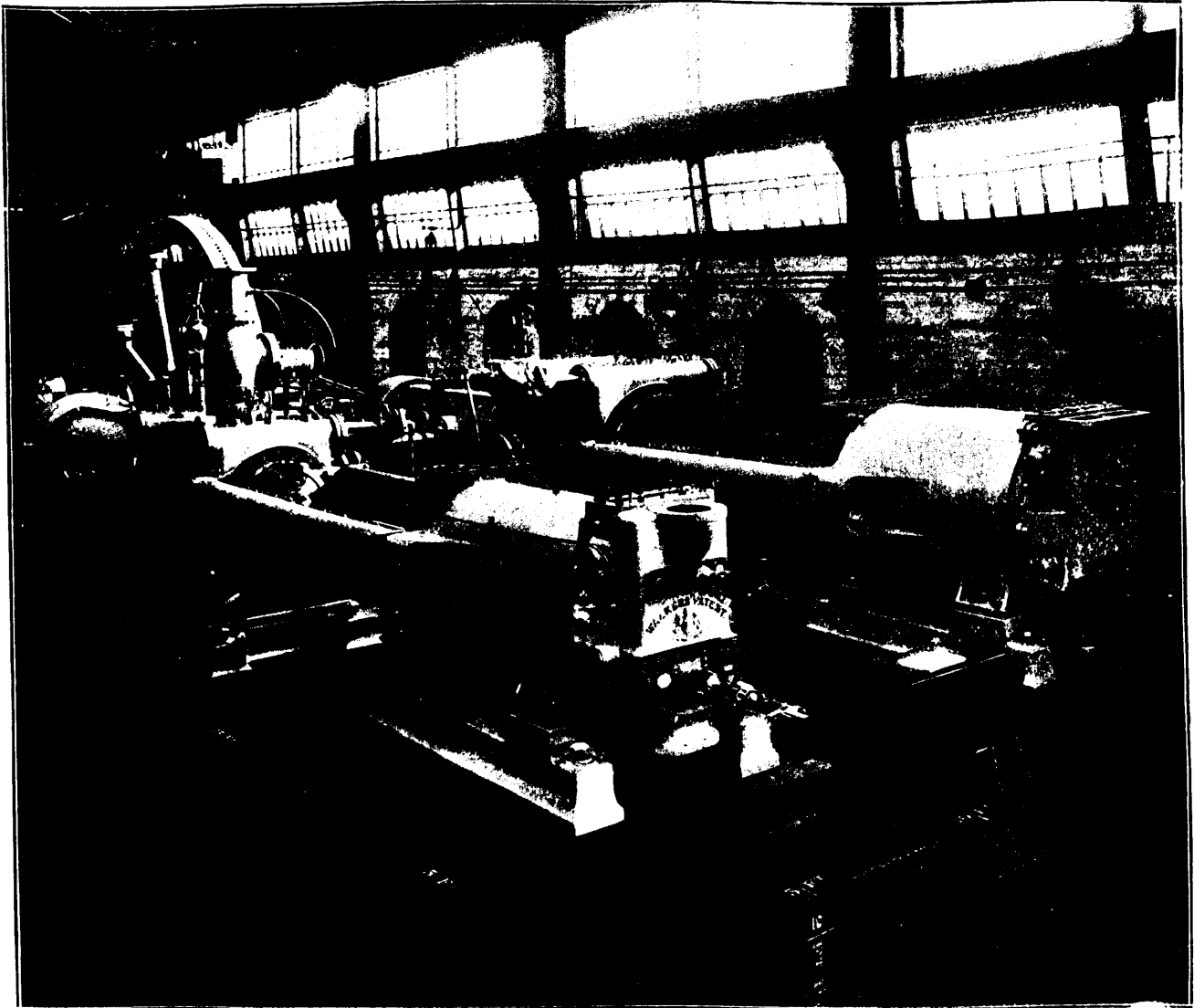
HARVEY & CO., St. John's, Newfoundland.

A. JOHNSON & CO., Stockholm, Sweden.

G. H. DUGGAN, Third Vice-President.

WALKER BROTHERS (WIGAN) LIMITED

WIGAN, ENGLAND



Largest Air Compressors in Canada

are of WALKER BROTHERS (Wigan) LIMITED manufacture.

THE FOLLOWING COMPANIES HAVE INSTALLED **WALKER BROTHERS** AIR COMPRESSORS, IN CAPACITIES RANGING UP TO 6300 CUBIC FEET OF FREE AIR PER MINUTE, ALL OF WHICH ARE PROVIDED WITH **WALKER PATENT AIR VALVES**.

Dominion Coal Company Ltd.

Nova Scotia Steel & Coal Company Ltd.

Dominion Iron & Steel Co. Ltd.

Belmont Gold Mine Ltd.

Intercolonial Coal Mining Co. Ltd.

Cape Breton Coal, Iron & Railway Co. Ltd

SOLE CANADIAN
REPRESENTATIVES

PEACOCK BROTHERS

CANADA LIFE BUILDING,
MONTREAL, P.Q.

BY THE LINES OF THE

Canadian Pacific Railway

All important points in Canada and the United States can be reached.

Fast Trains

To Quebec, the Laurentians, Eastern Townships, St. John, N. B., Halifax, Boston, Worcester, Springfield, Mass., New York, Portland, Me., and the principal Atlantic Seaside resorts, Kawartha Lakes, Toronto, Niagara Falls, Detroit, Chicago, Ottawa, the Timiskaming, Mississaga, French River, New Ontario, Sault St. Marie, St. Paul, Minneapolis, Winnipeg and the Western Prairies, the Kootenay Mining regions, the Mountains of British Columbia—unrivalled for scenic grandeur—Vancouver and the Pacific Coast.

Fast Steamship Service

On the Upper Lakes, Owen Sound to Fort William, on the inland waters of British Columbia, on the Pacific Coast to China, Japan, Australia, via Honolulu and Suva, and to Skagway *en route* to the Yukon. The fastest and most luxuriously furnished steamers between Victoria, Vancouver and Seattle, and on the Atlantic Ocean between Bristol, London, Liverpool, Montreal and Quebec, in summer, and St. John in winter

Double Daily Transcontinental Train Service

During summer months, and Daily Transcontinental Service during winter months.

For illustrated pamphlets apply to any Canadian Pacific Railway Agent, or to

C. E. McPHERSON, **WILLIAM STITT,**
General Passenger Agent, General Passenger Agent,
Western Lines, Eastern Lines,
WINNIPEG, MAN. MONTREAL.

O. E. E. USSHER, **ROBERT KERR,**
Asst. Pass. Traffic Mgr., Passenger Traffic Manager,
Western Lines, WINNIPEG, MAN. MONTREAL.

SCHOOL OF MINING

AFFILIATED TO
QUEEN'S UNIVERSITY

Kingston, Ontario

THE FOLLOWING COURSES ARE OFFERED

1. THREE YEARS' COURSE FOR A DIPLOMA IN

- (a) Mining Engineering and Metallurgy.
- (b) Chemistry and Mineralogy.
- (c) Mineralogy and Geology.
- (d) Chemical Engineering.
- (e) Civil Engineering.
- (f) Mechanical Engineering.
- (g) Electrical Engineering.
- (h) Biology and Public Health, and

2. FOUR YEARS' COURSE FOR A DEGREE (B.Sc.) in the same.

3. COURSES IN CHEMISTRY, MINERALOGY AND GEOLOGY for degrees of Bachelor of Arts (B.A.) and Master of Arts (M.A.)

For further information see the Calendar of Queen's University.

4. POST-GRADUATE COURSE FOR THE DEGREE OF Doctor of Science (D. Sc.)

For further information see the Calendar of Queen's University.

THE SCHOOL is provided with well equipped laboratories for the study of Chemical Analysis, Assaying, Blow-piping, Mineralogy, Petrography and Drawing. It has also a well equipped Mechanical Laboratory. The Engineering Building is provided with modern appliances for the study of mechanical and electrical engineering. The Mineralogy, Geology and Physics Building offers the best facilities for the theoretical and practical study of those subjects. The Mining Laboratory has been remodelled at a cost of some \$12,000, and the operations of crushing, cyaniding, etc., can be studied on a large scale.

The school is prepared to make a limited number of mill runs on gold ores in lots of 2 to 20 tons during the months of September, October and November, and will undertake concentrating test on large lots of ore from December to March.

For Calendar of the School and further information apply to

The Secretary, School of Mining,
Kingston, Ont.

The Bank of British North America

Established in 1836.

Incorporated by Royal Charter in 1840.

CAPITAL PAID UP - - - - - \$4,866,667
RESERVE FUND - - - - - 2,141,333

LONDON OFFICE: 5 GRACECHURCH STREET, E.C.

COURT OF DIRECTORS

J. H. Brodie R. H. Glyn F. Lubbock
J. J. Cater E. A. Hoare C. W. Tomkinson
H. R. Farrer H. J. B. Kendall Geo. D. Whatman
A. G. Wallis, Secretary. W. S. Goldby, Manager.

HEAD OFFICE IN CANADA: ST. JAMES STREET, MONTREAL.
H. Stikeman, Gen. Manager. J. Elmsly, Supt. of Branches.
J. Anderson, Inspector.

BRANCHES IN CANADA:

Montreal, A. E. Ellis, Manager	J. R. Ambrose, Sub. Mgr.
Alexander, Man. Halifax, N.S.	Ottawa, Ont.
Ashcroft, B.C. Hamilton, Ont.	Quebec, P.Q.
Battleford, Sask. " Barton St.	Reston, Man.
Belmont, Man. " Victoria Av.	Roseland, B.C.
Bobcaygeon, Ont. Hedley, B.C.	Rosthern, Sask.
Brandon, Man. Kaslo, B.C.	St. John, N.B.
Brantford, Ont. Kingston, Ont.	" Union St.
Calgary, Alta. Levis, P.Q.	Toronto, Ont.
Campbellford, Ont. London, Ont.	" King St.
Davidson, Sask. Market Square	Toronto Junction, Ont.
Dawson, Yukon Dis. Longueuil, Que.	Trall, B.C.
Duck Lake, Sask. Montreal, Que.	Vancouver, B.C.
Duncans, B.C. " St. James St.	Victoria, B.C.
Eatevan, Sask. " St. Catherine St.	Weston, Ont.
Fenelon Falls, Ont. Midland, Ont.	Winnipeg, Man.
Fredericton, N.B. North Vancouver, B.C.	Yorkton, Sask.
Greenwood, B.C. Oak River, Man.	

AGENCIES IN THE UNITED STATES.

New York (52 Wall St.)—W. Lawson, H. M. J. McMichael and W. T. Oliver, Agents.
San Francisco (120 Sansome St.)—J. C. Welsh and A. S. Ireland, Agents.
Chicago—Merchants Loan & Trust Co.
London Bankers—The Bank of England and Messrs. Glyn & Co.
Foreign Agents—Liverpool—Bank of Liverpool. Scotland—National Bank of Scotland, Limited, and Branches. Ireland—Provincial Bank of Ireland Limited, and Branches. National Bank, Limited, and Branches. Australia—Union Bank of Australia, Limited. New Zealand—Union Bank of Australia, Limited. India, China and Japan—Mercantile Bank of India, Limited. West Indies—Colonial Bank. Paris—Credit Lyonnais. Lyons—Credit Lyonnais, Agents in Canada for the Colonial Bank, London, and West Indies.

Issues Circular Notes for Travellers, available in all parts of the World. Drafts on South Africa and West Indies may be obtained at the Bank's Branches.

The Canadian Bank of Commerce

PAID UP CAPITAL \$10,000,000

REST \$5,000,000

Head Office: TORONTO

B. E. WALKER, GENERAL MANAGER

ALEX. LAIRD, ASS'T GEN'L MANAGER.

Branches throughout Canada and in the United States and England, including the following:

ATLIN	NANAIMO	SAULT STE. MARIE
COBALT	NELSON	SEATTLE
CRANBROOK	NEW GLASGOW	SKAGWAY
DAWSON	OTTAWA	SPRINGHILL
FERNIE	PARRY SOUND	SYDNEY
GREENWOOD	PENTICTON	TORONTO
HALIFAX	PORT ARTHUR	VANCOUVER
LADYSMITH	PORTLAND, ORE.	VICTORIA
LATCHFORD	PRINCETON	WHITE HORSE
MONTREAL	SAN FRANCISCO	WINNIPEG

NEW YORK: 16 Exchange Place

LONDON, England: 60 Lombard St., E.C.

Branches at COBALT and LATCHFORD, in the silver mining camp of New Ontario.

Are the Canadian Winters Too Severe for You?

IF SO

Why Don't You Take a Trip to the Sunny South

BY THE

ELDER, DEMPSTER LINE?

Our March sailing will be the SS. "Sokoto," from Halifax, on the fifteenth, for the Bahamas, Cuba and Mexico.

Write for our illustrated booklet, "A Tour to the Bahamas, Cuba and Mexico"; also for particulars of our special 42-day Yachting Trip by the magnificent new R.M.S. "Sokoto," sailing from Halifax on March 15th.

For further particulars and to book passage, apply to

NORMAN L. LUSHER, 178 St. James Street, MONTREAL.
W. H. HENRY, Temple Building, MONTREAL.

or to ELDER, DEMPSTER & CO., 319 Board of Trade Building, MONTREAL.

DRUMMOND COAL

The standard of excellence in Bituminous Coal and Coke for Blast Furnaces, Foundries, Manufacturing and Domestic Use.

RELIABLE, UNIFORM and STRICTLY HIGH GRADE

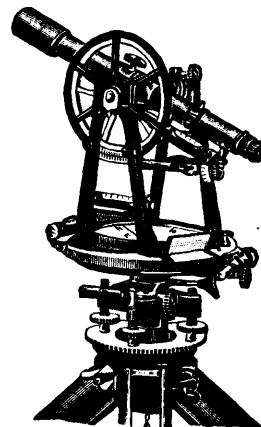
Shipped from Pictou Harbour, Halifax, and all points on Intercolonial Railway and connections by the

INTERCOLONIAL COAL MINING CO. LIMITED

WORKS, WESTVILLE, N.S.
JAMES FLOYD, Superintendent.

HEAD OFFICE, MONTREAL, QUE.

JAS. P. CLEGHORN, President. D. FORBES, ANGUS, Sec.-Treas.



SEND FOR CATALOGUE

G. L. BERGER & SONS

37 William Street

BOSTON, Mass.

Successors to BUFF & BERGER.

SPECIALTIES:

Standard Instruments and Appliances for

Mining, Subway,
Sewer, Tunnel,

And all kinds of

Underground Work

GRAND TRUNK RAILWAY SYSTEM

THE SHORT FAVORITE ROUTE

BETWEEN Ottawa and Montreal.

Sunday Train Both Directions

PULLMAN BUFFET PARLOR CARS

Close Connections at Montreal with Trains for

Quebec, Halifax, Portland

And all Points EAST and SOUTH.

FAST THROUGH SERVICE BETWEEN

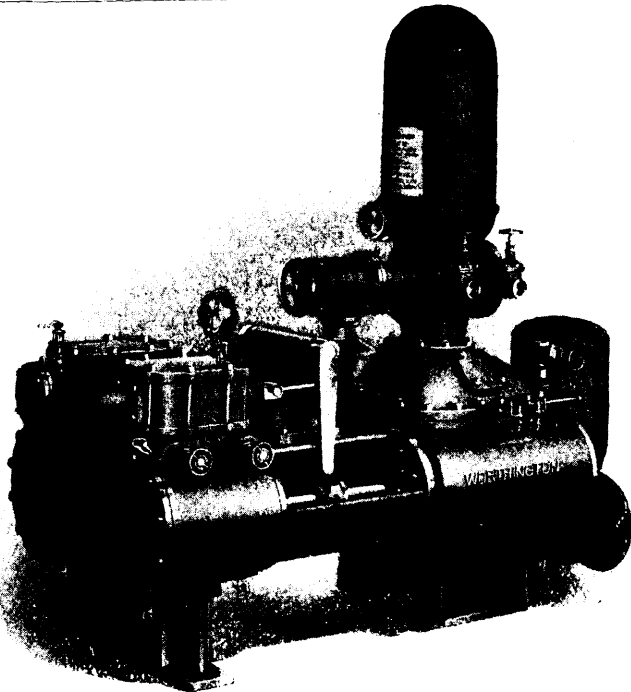
Ottawa, New York and Boston

And all NEW ENGLAND POINTS.

Through Buffet Sleeping Cars between Ottawa and New York.

Baggage checked to all points and passed by customs in transit. For tickets, time tables and information, apply to nearest ticket agent of this company or connecting lines.

C. T. BELL, Gen'l Pass. & Ticket Agent.



WORTHINGTON

1,000-GALLONS UNDERWRITER 1904 PATTERN

FIRE PUMP

The Underwriters can only outline the design, the quality of the Pump remains with the makers, depending upon their experience and shop facilities, also reputation.

The John McDougall Caledonian Iron Works Co. Ltd.

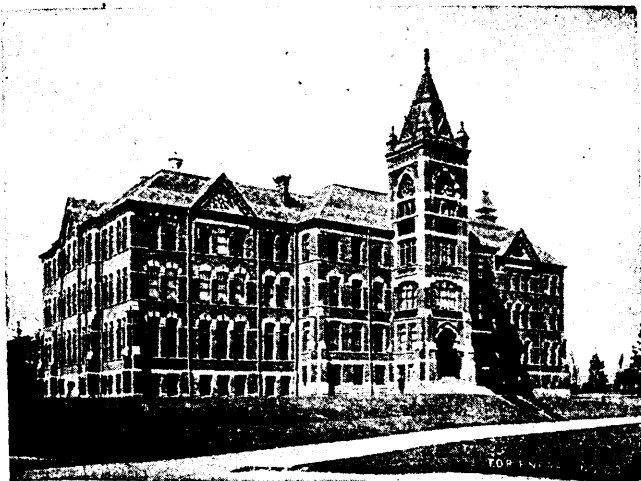
BUILDERS IN CANADA OF WORTHINGTON PUMPS FOR WATER WORKS SERVICES; ALSO WORTHINGTON TURBINE PUMPS ..

MONTREAL, P.Q.

SCHOOL OF PRACTICAL SCIENCE TORONTO

ESTABLISHED 1878

The Faculty of Applied Science and Engineering
of the University of Toronto.



DEPARTMENTS OF INSTRUCTION :

- | | |
|--|-------------------------------------|
| 1—Civil Engineering. | 4—Architecture. |
| 2—Mining Engineering. | 5—Analytical and Applied Chemistry. |
| 3—Mechanical and Electrical Engineering. | 6—Chemical Engineering. |

Special attention is directed to the facilities possessed by the school for giving instruction in Mining Engineering.

LABORATORIES :

- | | | | |
|--------------------------|------------------|------------|---------------|
| 1—Chemical. | 3—Milling and | 4—Steam. | 6—Electrical. |
| 2—Assaying Ore Treatment | 5—Meteorological | 7—Testing. | |

A Calendar giving full information and including a list showing the positions held by graduates, sent on application

A. T. LAING, Registrar.

CANADIAN MINING INSTITUTE

Incorporated by Act of Parliament 1898.

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications

(B) The establishment of a central reference library and a headquarters for the purpose of this organization.

(C) To take concerted action upon such matters as affect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

MEMBERSHIP.

MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works, mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years, who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student members shall be eligible for election as Members after the age of 25 years.

SUBSCRIPTION.

Member's yearly, subscription..... \$10.00
Student Member's do 2.00

PUBLICATIONS

Vol. I, 1898, 66 pp., out of print	Vol. V, 1902, 700 pp., bound
Vol. II, 1899, 285 pp., bound red cloth	Vol. VI, 1903, 520 pp., bound
Vol. III, 1900, 270 pp., bound red cloth	Vol. VII, 1904, 530 pp., bound
Vol. IV, 1901, 333 pp., bound.	

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restriction.

Forms of application for membership, and copies of the Journal of the Institute, etc., may be obtained upon application to

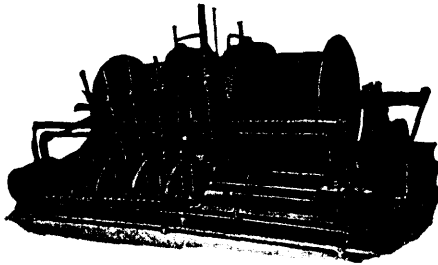
H. MORTIMER LAMB, Secretary, Montreal

FLORY HOISTING ENGINES

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractors work. Such as Pile Driving, Bridge Building, and general Construction work.

The FLORY CABLEWAY SYSTEM is Superior to any on the Market



ASK FOR OUR CATALOGUES.

Slate Mining and Working Machinery

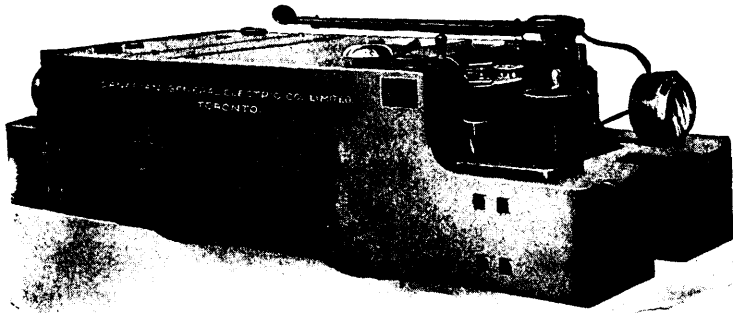
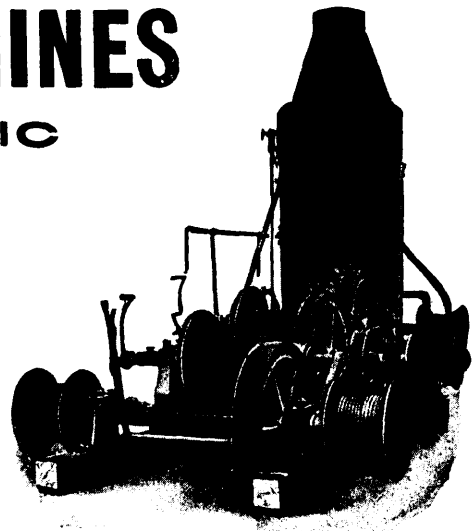
SALES AGENTS:

I. MATHESON & CO.,
New Glasgow, N.S.

W. H. C. MUSSEN & CO.,
Montreal, Que.

S. Flory Mfg. Co.

Office and Works: BANGOR, Pa., U.S.A.



Electric Locomotives
for Mines
Electrically-Driven
Hoists
Motor-Operated
Air Compressors
Complete Electric
Installations

WRITE US YOUR REQUIREMENTS.

CANADIAN GENERAL ELECTRIC COMPANY, LIMITED

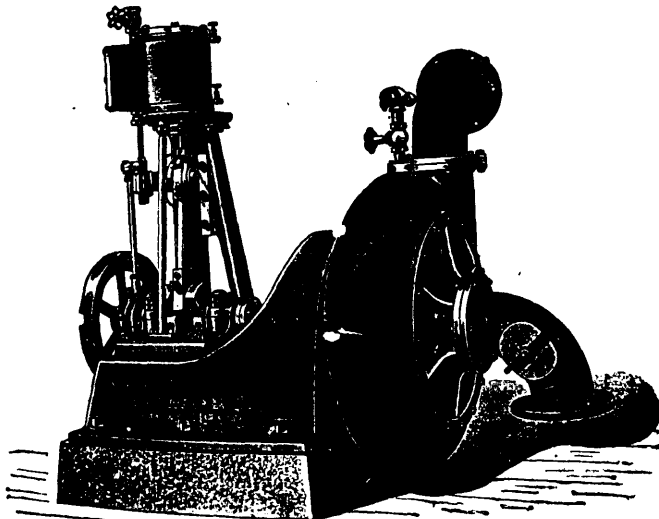
District Offices—Montreal, Halifax, Ottawa, Winnipeg, Vancouver, Rossland.

Head Office—TORONTO, ONT.

MORRIS MACHINE WORKS

BALDWINVILLE, N.Y.

Centrifugal Pumping Machinery for Various Industrial Purposes.



We are building a special solid steel lined pump for handling tailings or slimes in gold mining. Estimates furnished upon application for pumping outfits for special purposes. Write for catalogue.

New York office—39-41 Cortlandt St.

AGENCIES

Henion & Hubbell, 61-69 North Jefferson Street, Chicago, Ill.

Harron, Rickard & McCone, San Francisco, Cal. Zimmerman-Wells-Brown Co., Portland, Ore.

H. W. Petrie, Toronto, Ont.

DAN'L SMITH,
President.

ONTARIO POWDER CO. LTD.

C. E. MACPHERSON,
Sec.-Treas.

115 Brock Street, KINGSTON, ONT.

MANUFACTURERS AND DEALERS IN

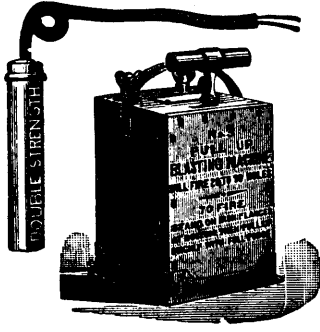
For
MINERS
PIT-SINKERS

DYNAMITE, EXPLOSIVES

For
QUARRYMEN
CONTRACTORS

ELECTRIC BLASTING APPARATUS, FUSE, CAPS, &c.

ELECTRIC BLASTING APPARATUS Adapted for Firing all kinds of Explosives used in Blasting.



Victor Electric Platinum Fuses.

Superior to all others for exploding any make of dynamite or blasting powder. Each Fuse folded separately and packed in neat paper boxes of 50 each. All tested and warranted. Single and double strength with any length of wires.

Blasting Machines.

The strongest and most powerful machines ever made for Electric Blasting. They are especially adapted for submarine blasting, large railroad quarrying, and mining works.

Victor Blasting Machine.

Fires 5 to 8 holes; weighs 15 lbs.; adapted for prospecting, etc.

Insulated Wires and Tapes, Blasting Caps, Fuse, etc

SEND FOR CATALOGUE.
MANUFACTURED ONLY BY

MACBETH FUSE WORKS
POMPTON LAKES, NEW JERSEY.



Hamilton Powder Company

Manufacturers of Explosives

Office: 4 Hospital Street, Montreal.

Branch Offices throughout Canada.

W. T. RODDEN, Managing Director.

J. F. JOHNSON, Secretary-Treasurer.

STANDARD EXPLOSIVES

LIMITED

Manufacturers of High Explosives, and Dealers
in Blasting Powder, Safety Fuse Detonators,
Batteries, Electrical Fuses, etc.

OFFICE:

Board of Trade Building, Montreal.

WORKS:

11e Perrot, near Vaudreuil, P.Q.

IMPERIAL BANK OF CANADA

Head Office - TORONTO

CAPITAL PAID UP - - - \$4,250,000.00
 RESERVE FUND - - - 4,250,000.00

BRANCHES

IN THE PROVINCES OF

QUEBEC
 ONTARIO
 MANITOBA
 SASKATCHEWAN
 ALBERTA AND
 BRITISH COLUMBIA

SAVINGS BANK DEPARTMENT

Interest allowed on deposits from date of opening of account and compounded half-yearly.

NEW LISKEARD BRANCH - A P. NASMITH, Manager
 COBALT BRANCH - - - F. H. MARSH, Manager

CHROME STEEL WORKS

CHROME, N. J., U. S. A.

Longest Service—Most Economical

— TRADE — ADAMANTINE — MARK — CHROME STEEL SHOES AND DIES

(HYDRAULIC COMPRESSED)

FOR STAMP MILLS



CANDA SELF-LOCKING CAMS
 TAPPETS: BOSSHEADS
 CAM SHAFTS: STAMP STEMS

REPRESENTED BY
 J. F. SPELLMAN
 222 EAST 10TH AVENUE
 DENVER, COLO.

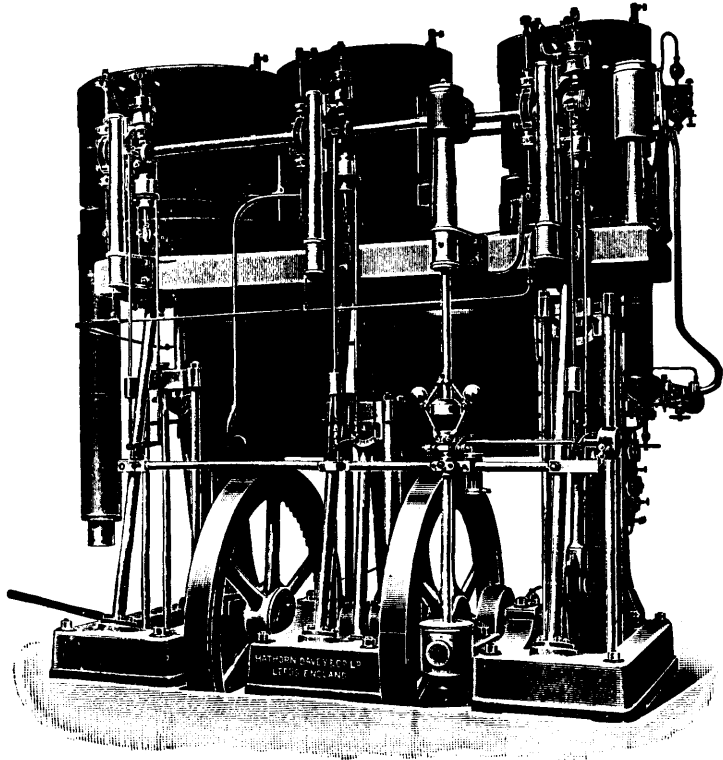
Send for Illustrated
 Pamphlet
 "Chrome Steel Stamp"
 Mill Parts.

ADMITTED BY
 GEORGE W. MYERS
 512 HAYWARD BUILDING
 SAN FRANCISCO, CAL.

BOOKS ON PROFESSIONAL SUBJECTS

Any work on Mining, Metallurgy, or associated industries, may be obtained through the **CANADIAN MINING REVIEW**, usually at a somewhat lower price than private individuals can buy it for.

PUMPING MACHINERY



Melbourne and Metropolitan
Board of Works.

Triple Expansion Sewage Pumping
Engine.

OFFICIAL TRIAL.

ENGINE DIMENSIONS.

Diameter of Cylinders, 20 in., 36 in., 54 in.
Rams, 3 Single Acting, each 30 in., in Diameter
Stroke of Engine and Pump, 3 ft. 6 in.
Steam Pressure, 150 lbs.

ENGINE RESULTS.

Pump Horse-Power, 274.55.
Saturated Steam per Indicated Horse-Power, per
Hour 12.4 lb.
Mechanical Efficiency, 92.8 per cent.

Contract Duty to raise 6240 Imperial gall. of sewage per minute 125 ft. high

Hathorn Davey & Co., Ltd. LEEDS, ENGLAND.

Sole Canadian
Representatives

PEACOCK BROTHERS

Canada Life Building,
MONTREAL

ROBERT MEREDITH & CO.

57 St. Francois Xavier St., MONTREAL

Stock Brokers. Dealers in Mining and Industrial Shares. Companies Formed and Floated.

NEW YORK CORRESPONDENTS—

GEORGE B. HOPKINS & CO.

ARE YOU CONFRONTED WITH A DIFFICULT ORE-SEPARATING PROBLEM?
THE WETHERILL MAGNETIC SEPARATING PROCESS

May Prove the Solution.

For information and for Illustrated Pamphlet, apply to
WETHERILL SEPARATING CO., 52 BROADWAY, NEW YORK.
GOLD MEDAL awarded at the WORLD'S FAIR, ST. LOUIS, MO.
Mfg. Agents for Canada: ROBERT GARDNER & SON, Montreal, P.Q.

CYANIDE PLANTS.

Canadian Patents 81954 and 86862.

BLAISDELL MACHINERY effects a saving of from 50 to 90% in operative expenses.

WRITE FOR CATALOGUE TO

THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO. LTD., Montreal
BUILDERS FOR CANADA.

THE CROW'S NEST PASS COAL CO.
LIMITED

OFFICES
Manning Arcade, Toronto
Fernie, British Columbia

Gold Medal—Coal and Coke—Lewis & Clark Exposition, 1905.
Silver Medal—Coal and Coke—Paris Universal Exposition, 1900.

Mines and Coke Ovens at Fernie, Coal Creek, Michel and Carbonado.

Annual Capacity of Mines, 2,000,000 tons. Coke Ovens, 500,000 tons.

We are shipping domestic coal to points in Manitoba, Alberta, Saskatchewan, British Columbia, Montana, Washington and Idaho, a territory of over 400,000 square miles, and WE ARE GIVING SATISFACTION.

We are shipping steam coal from Winnipeg to the Pacific Coast, and not only is it used in that vast area by the Railways and the largest firms, but also by the Great Northern Steamship Company's liners plying between Seattle and the Orient.

Our Michel Blacksmith coal is used in Railway forging shops in Winnipeg, seven hundred miles East, and in Vancouver, four hundred miles West.

Ask a British Columbia smelter Superintendent what coke he uses and what coke gives him best satisfaction.

Our Analyses Speak for Themselves.

R. G. DRINNEN,
Superintendent.

G. G. S. LINDSEY,
General Manager

LUDWIG NAUEN

Hamburg, Germany

Continental Agent and Buyer for

Asbestos Crude and Fibre all Grades
Actinolite, Talc, Corundum,
Mica, Molybdenite
and other minerals.

SPRINGHILL COAL

The Cumberland Railway & Coal Company

Are prepared to deliver this well known
Steam Coal at all points on the lines of
G. T. R., C. P. R., and I. C. Railway.

Head Office: 107 St. James St., Montreal

Address, P.O. Box 396.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, Steam
Pumps, Chilled Car Wheels and Car Castings. Brass and Iron
Castings of Every Description. Light and Heavy Forgings.

ALEX. FLECK LTD., OTTAWA

Directory of Mining Engineers, Chemists, Assayers, Etc.

<p>JOHN E. HARDMAN, CONSULTING MINING ENGINEER ROOM 10 171 ST. JAMES STREET MONTREAL</p>	<p>FRITZ CIRKEL, CONSULTING MINING ENGINEER Twenty years' experience in Exploratory Work and Mining in Germany, Eastern and Central Canada, British Columbia and the Pacific States. EXAMINATION OF MINES. Office, 80 Stanley St., MONTREAL, CAN.</p>	<p>A card in this space would cost only \$15 a year.</p>
<p>MILTON L. HERSEY, M.Sc. CONSULTING CHEMIST OF THE C.P.R. OFFICIAL ASSAYER APPOINTED FOR PROVINCE OF QUEBEC. 171 St. James Street, MONTREAL ASSAYS OF ORES CHEMICAL AND PHYSICAL TESTS OF ALL MATERIALS MINERAL PROPERTIES EXAMINED</p>	<p>F. HILLE, MINING ENGINEER Mines and Mineral Lands examined and reported on. Plans and Estimates on Concentrating Mills after the Krupp-Bilharz system. PORT ARTHUR, ONT. CANADA.</p>	<p>L. VOGELSTEIN & CO., 90-96 WALL STREET, NEW YORK REPRESENTING ARON HIRSH & SOHN Halberstadt, Germany. Copper, Argentiferous and Auriferous Copper Ores, Mattes and Bullion, Lead, Tin, Antimony Spelter. Copper and Brass Rolling and Tubing Mills in Europe. AGENTS OF THE UNITED STATES METALS REFINING Co., Chrome, N.J. Grasselli, Ind.</p>
<p>DR. J. T. DONALD, <i>[Official Analyst to the Dominion Government.]</i> ANALYTICAL CHEMIST & ASSAYER 112 ST. FRANCOIS-XAVIER STREET MONTREAL Analysis, Assaying, Cement Testing, etc. Mining Properties Examined. DIRECTOR OF LABORATORIES: R. H. D. BENN, F.C.S.</p>	<p>EDWARD A. HAGGEN, MINING ENGINEER REVELSTOKE, - - BRITISH COLUMBIA EXAMINATIONS AND REPORTS.</p>	<p>A. F. DUNLOP, R.C.A., ARCHITECT . . . AND . . . VALUATOR 185 ST. JAMES STREET - MONTREAL</p>
<p>J. N. GREENSHIELDS, K.C. R. A. E. GREENSHIELDS, K.C. ERROL LANGUEDOC. GREENSHIELDS, GREENSHIELDS & LANGUEDOC, ADVOCATES . . . AND . . . BARRISTERS 86 NOTRE DAME ST. WEST, MONTREAL CABLE ADDRESS: "SHIELDS."</p>	<p>C. J. FLEET, K.C. ALEX. FALCONER, K.C. H. S. WILLIAMS. FLEET & FALCONER, ADVOCATES, BARRISTERS . . . AND . . . SOLICITORS. STANDARD BLDG., 157 ST. JAMES STREET MONTREAL</p>	<p>H. C. STONE, ARCHITECT 84 ST. FRANCOIS XAVIER STREET, MONTREAL AND 363 MAIN STREET, WINNIPEG, MANITOBA</p>
<p>D. H. HAIGHT, MINING PROPERTIES EXAMINED. TIMBER LANDS ESTIMATED. Four years in charge of Exploration Work for the Canadian Copper Co. Can furnish any information you wish regarding Sudbury and Cobalt Districts. ADDRESS: SUDBURY - - - ONTARIO</p>	<p>A. W. ROBINSON, M. Am. Soc. C.E., M. Am. Soc. M.E. MECHANICAL ENGINEER DREDGING MACHINERY. PLANT FOR PUBLIC WORKS. GOLD DREDGES. 14 PHILLIPS SQUARE, MONTREAL, CANADA.</p>	

WALPOLE ROLAND,
 MINING AND CIVIL ENGINEER,
 CONSULTING ENGINEER,
 PORT ARTHUR, ONT.
 (Late Inspector L. Dept., Canadian Pacific Ry.)
 Cable Address, "Roland,"
 Moreing & Neill's Code.

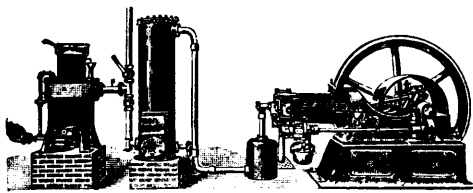
REPORTS AND SURVEYS,
 ESTIMATES AND UNDERGROUND
 PLANS, A SPECIALTY

REFERENCES:
 Prof. R. Bell, Chief Geologist Dominion Geological Survey, Ottawa.
 The Molsons Bank, Port Arthur, Ont.
 The Mayor, Port Arthur, Ont.
 Prof. R. Carr-Harris, Royal Military College, Kingston, Ont.
 Board of Trade, Port Arthur, Ont.
 Board of Trade, Fort William, Ont.

DAVID R. BROWN,
HUGH VALLANCE,
 ARCHITECTS

CANADA LIFE BUILDING, - MONTREAL

Telephone Main 136.



CHEAPEST
 POWER.
 60% Saving
 in Fuel

SUCTION GAS
 PRODUCERS
 FOR GAS
 ENGINES

1 lb. of Coal per h.p. hour. Cost ¼ to ½ cent per horse-power hour. Built for any capacity required. No Boiler or Gas Holder required. Automatic Work. Contracts undertaken for complete Power Plants and results guaranteed.

Dr. OSKAR NAGLE, CHEMICAL ENGINEER,
 90-96 Wall Street, NEW YORK CITY

HENRY BATH & SON, BROKERS.
 London, Liverpool and Swansea

All description of **METALS, MATTES, ETC.**
 Warehouses, LIVERPOOL and SWANSEA.

Warrants issued under their Special Act of Parliament.

NITRATE OF SODA Cable Address BATHOTA, LONDON

OLDEST EXPERTS IN

Molybdenite,
 Scheelite,
 Wolframite,
 Chrome Ore,
 Nickel Ore,
 Cobalt Ore,
 Cerium, and
 all Ores
 and
 Minerals.

Talc,
 Mica,
 Barytes,
 Graphite,
 Blende,
 Corundum,
 Fluorspar,
 Feldspar.

LARGEST BUYERS,
 BEST FIGURES,
 ADVANCES ON SHIPMENTS,
 CORRESPONDENCE SOLICITED

CABLES—Blackwell, Liverpool, ABC
 Code, Moreing & Neal Mining and
 General Code, Lieber's Code and Mul-
 ler's Code.

ESTABLISHED BY GEO. G. BLACKWELL, 1869.

GEO. G. BLACKWELL, SONS & CO., LTD.
 METALLURGISTS, MINE OWNERS, MERCHANTS, MANUFACTURERS
 THE ALBANY, LIVERPOOL, ENGLAND.

Dr. Goldschmidt's ALUMINO-THERMICS

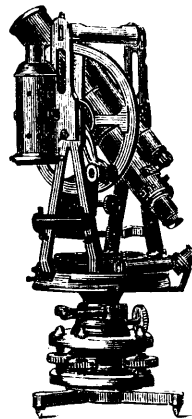
"THERMIT" Steel for Repair Work, Welding of Street Rails, Shafting and Machinery.

"TITAN THERMIT" for foundry work.

"NOVO" AIR HARDENING STEEL

Twist Drills, Milling Cutters, Blanks.
 High Speed and Durability.

WILLIAM ABBOTT, Sole Agent for Canada,
 334 St. James Street, MONTREAL.



Established in 1857

HEARN & HARRISON

Notre Dame St. East
 MONTREAL, CANADA

Mathematical, Engineering,
 Optical, Instruments, etc.

REPAIRS A SPECIALTY.

Catalogue on application.

LEDOUX & CO. 99 JOHN STREET NEW YORK
 SAMPLES AND ASSAY ORES AND METALS

Independent Ore Sampling Works at the Port of New York. Only two such on the Atlantic seaboard.

We are not Dealers or Refiners, but receive Consignments. Weigh, Sample and Assay them, selling to the highest bidders, obtaining advances when desired, and the buyers of two continents pay the highest market price, in New York Funds, cash against our certificates.

Mines Examined and Sampled. Also Analyze everything.

FARNLEY IRON FOR STAYBOLTS,
 RIVETS, ETC.

In stock and for sale by

HOMER TAYLOR

Temple Building, 185 St. James Street, MONTREAL.

The Miners' Road
 TO
CHIBOUGAMAU



ALEX. HARDY,
 G. P. A.,
 Quebec.
J. G. SCOTT,
 Gen. Mgr.,
 Quebec.

DIAMOND DRILLS

We manufacture the most complete line of Diamond Drills of any concern in the world. 20 varieties, 350 to 6000 ft., \$400 to \$10,000. Hydraulic Feed, Screw Feed, Hand Power, Horse Power, Gasoline, Steam, Air, and Electricity.

Send for Catalogue.

STANDARD DIAMOND DRILL CO.

Chamber of Commerce, Chicago, U.S.A.

THE BENNETT FUSE

CROWN BRAND



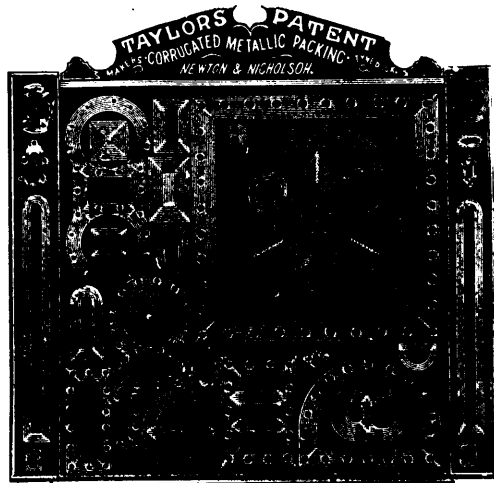
Manufactured by

WILLIAM BENNETT, SONS & CO.
Camborne, Cornwall,
England

CANADIAN OFFICE :

**BENNETT FUSE CO., YATES ST.,
VICTORIA, B.C.**

AND AGENCIES
THROUGHOUT
THE DOMINION



CORRUGATED METALLIC PACKING for joints of any Size or Shape

NEWTON & NICHOLSON

Tyne Dock Corrugated Metallic Packing Works,

South Shields, ENGLAND.

Telegraphic Address: "CORRUGATE," Tyne Dock.



FORTY-SIXTH YEAR.

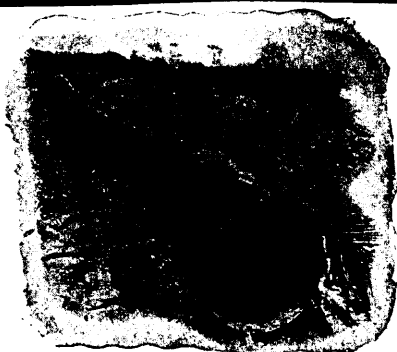
56 PAGES : WEEKLY : ILLUSTRATED.

INDISPENSABLE TO MINING MEN

\$3 PER YEAR POSTPAID.
SEND FOR SAMPLE COPY.

Mining and Scientific Press

330 MARKET ST., SAN FRANCISCO, CALIF.



Erecting 18 ft. Steel Penstock at Niagara Falls.

Steel Plate Work

STEEL PENSTOCKS, STEEL SMOKE-STACKS, SMOKE CONNECTIONS, STEEL TANKS, REFUSE BURNERS, AND ALL MANNER OF STEEL PLATE WORK

We furnish estimates cheerfully and promptly.

THE JENCKES MACHINE CO., LIMITED

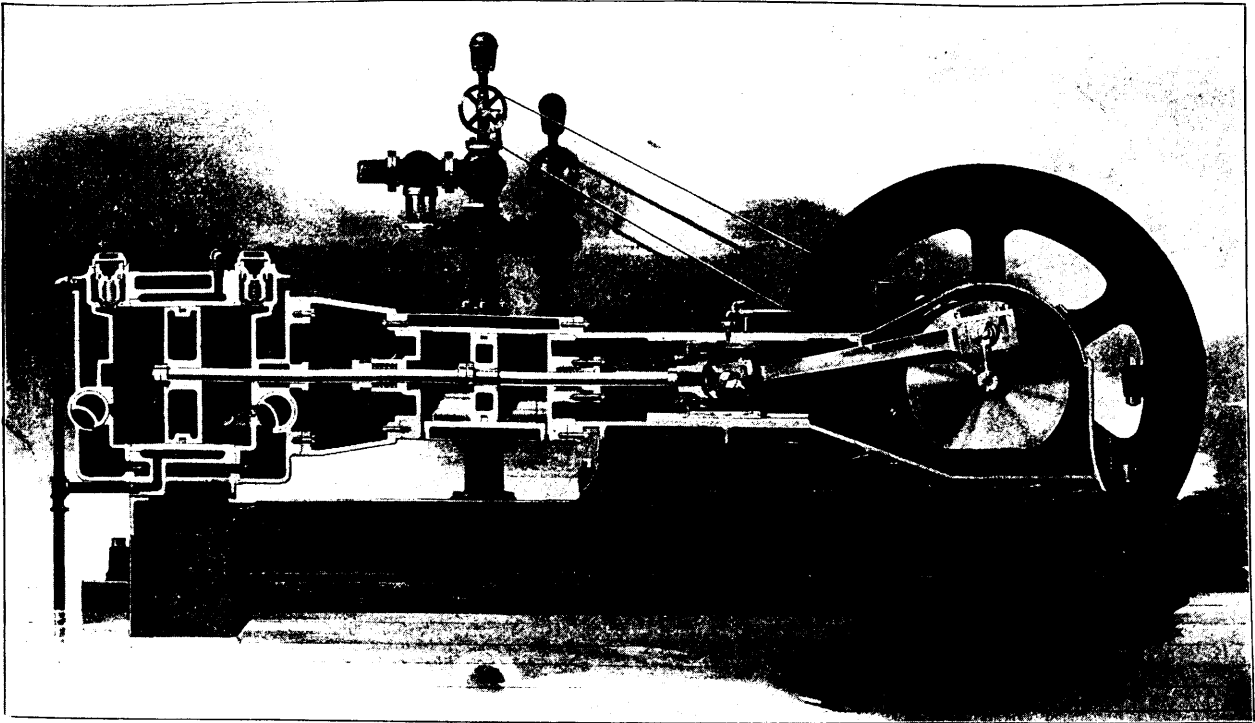
SALES OFFICES: ROSSLAND ST. CATHARINES
VANCOUVER HALIFAX

EXECUTIVE OFFICE:
56 LANSDOWNE ST., SHERBROOKE, QUE.

PLANTS: SHERBROOKE, QUE.
ST. CATHARINES, ONT.

A New Air Compressor

For Mines, Quarries and Contractors



This is a sectional view of the new Sullivan Duplex Air Compressor. This type is built in several classes, with simple or two-stage air ends, for steam, belt or power drive; capacities, 100 to 2600 cubic feet of free air per minute. These machines are intended for continuous, economical service. Salient features are COMPACT DESIGN, HEAVY DUTY CONSTRUCTION, ENCLOSURE OF OUTSIDE WORKING PARTS IN A TIGHT HOUSING, for SELF-LUBRICATION; Meyer steam valve gear; Corliss inlet and automatic poppet air discharge valves; thorough water-cooling of air during compression.

Bulletin 53-C gives the details.

ROCK DRILLS
DIAMOND DRILLS

COAL CUTTERS
HOISTING ENGINES

SULLIVAN MACHINERY CO.

Claremont, N.H.
New York
Pittsburg
Knoxville

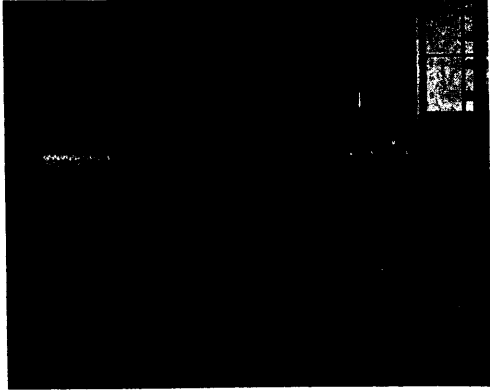
St. Louis
Joplin, Mo.
Denver
Butte

**Railway Exchange
Chicago, Ill.**

El Paso
Salt Lake
Paris, France
Johannesburg

San Francisco
Rossland
Spokane
Mexico

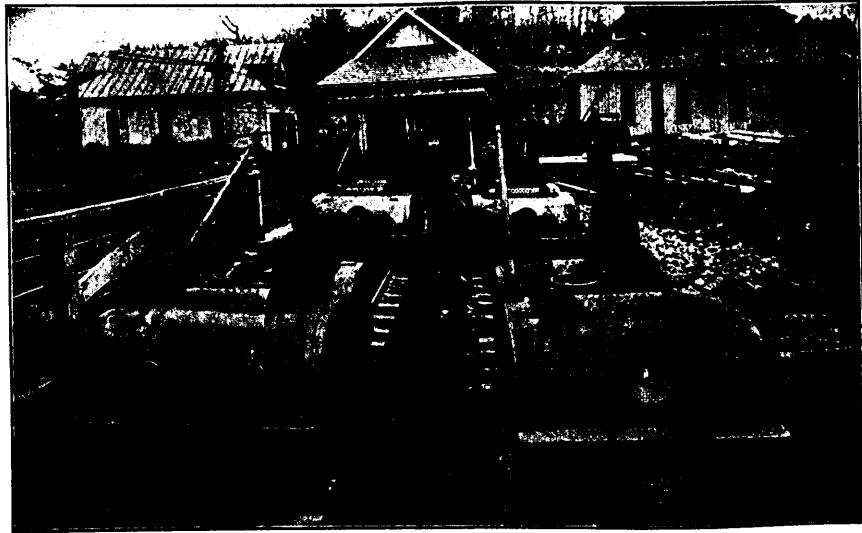
JEFFREY COAL MINE EQUIPMENT



GENERATORS.



HOISTING MACHINERY.



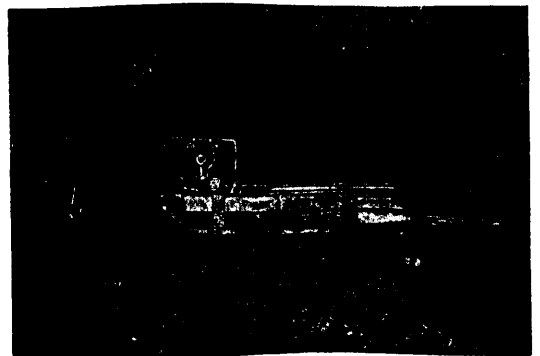
JEFFREY ELECTRIC LOCOMOTIVES.



CONVEYERS FOR COAL.



JEFFREY DRILLS FOR MINES
AND QUARRIES.
Catalog 76.



ELECTRIC COAL MINING MACHINES.

Coal Mining Machines, Bulletin No. 11. Electric Locomotives, Bulletin No. 10.

Coal Drilling, Screening, Crushing, Elevating and Conveying Machinery.

THE JEFFREY MANUFACTURING COMPANY COLUMBUS, OHIO, U.S.A.

NEW YORK
CHICAGO

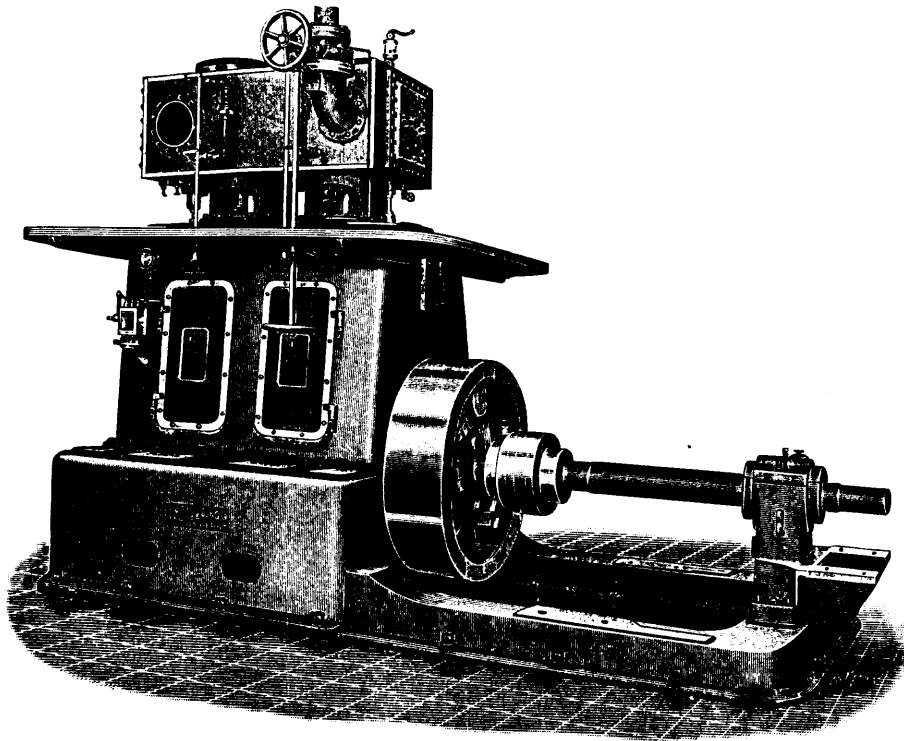
BOSTON
ST. LOUIS

PITTSBURGH
KNOXVILLE

DENVER
CHARLESTON, W. VA.

MONTREAL, CAN

VERTICAL ENCLOSED ENGINES



We are prepared to supply High Speed Vertical Enclosed Engines of the English type, up to 750 horse power.

The oiling system of these engines is under a pressure of 15 lbs. to the square inch, ensuring a copious supply of oil to all bearings.

They have Robb-Armstrong Automatic Governors and Sweet Balanced Valves, giving the best regulation and highest economy.

ROBB ENGINEERING CO., LTD., AMHERST, N.S.

DISTRICT OFFICES

320 Ossington Avenue, Toronto, WILLIAM McKAY, Manager.

Bell Telephone Building, Montreal, WATSON JACK, Manager.

355 Carlton Street, Winnipeg, J. F. PORTER, Manager.

THE RAND ROCK DRILL

will do more work, day in and day out,
than any other drill on the market. It
also requires fewer repairs.

This is our standing guarantee.



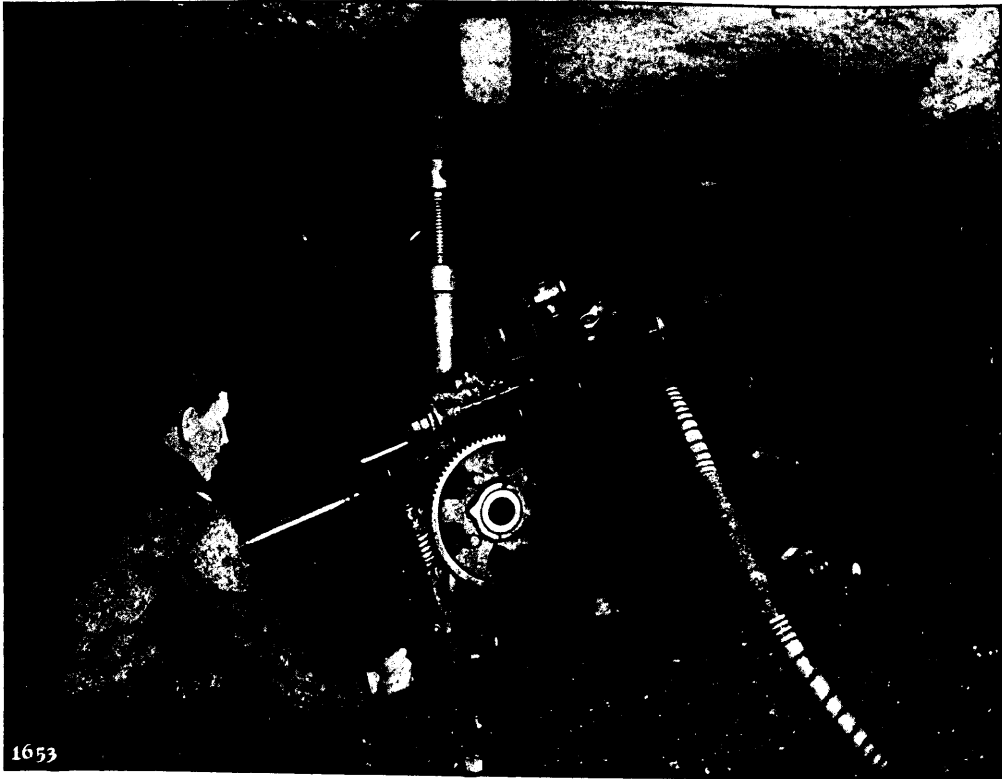
The "Little Giant" on G. T. P. Excavation Work

THE CANADIAN RAND DRILL CO.
MONTREAL, QUE.

Toronto, Halifax, Kenora, Rossland, Vancouver

ALLIS-CHALMERS-BULLOCK

LIMITED



“RADIALAX” COAL CUTTER

The “Radialax” here shown shearing vertically is especially designed for shearing and entry-cutting, subjects on which very little is said in any of the catalogues on mining machinery. We have them in successful operation in Nova Scotia, Alberta and British Columbia.

COMPLETE MINING EQUIPMENT

AIR COMPRESSORS	GYRATORY BREAKERS	ROCK AND ORE BREAKERS
COAL CUTTERS	HANCOCK JIGS	ROCK DRILLS
CONCENTRATING PLANTS	HOISTING ENGINES	ROASTING FURNACES
CRUSHING PLANTS	HUNTINGTON MILLS	SMELTING MACHINERY
CYANIDE PLANTS	JAW CRUSHERS	STAMPS
ENGINES	OVERSTROM TABLES	TUBE MILLS
GOLD AND SILVER MILLS	PROSPECTING MILLS	TURBINES, STEAM
GOLD DREDGES	PUMPS	TURBINES, WATER
	ELECTRIC MOTORS AND GENERATORS	

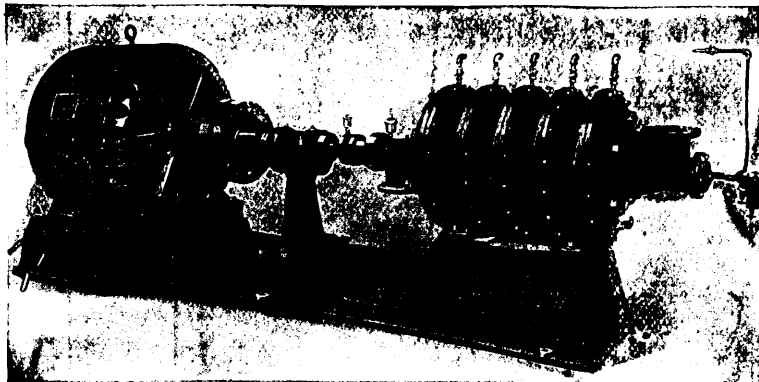
Head Office and Works - Montreal

DISTRICT OFFICES

New Glasgow, N.S., Telephone Bldg.
 Montreal, Sovereign Bank Bldg.
 Toronto, Traders Bank Bldg.

Winnipeg, 251 Notre Dame Ave.
 Nelson, Josephine St.
 Vancouver, 416 Seymour St.

Westinghouse Motors For Mine Work



Westinghouse Induction Motor Driving Byron-Jackson 5-Stage Centrifugal Pump.

Common Sense

tells you that a common motor can only give common service. To secure uncommon service a motor of uncommon quality is required.

"Westinghouse Quality"

We make all kinds of motors for all kinds of work.

Canadian Westinghouse Co., Limited

General Office and Works: HAMILTON, ONT.

Traders Bank Building
Toronto
152 Hastings Street
Vancouver

For particulars address nearest office
Hamilton
922-923 Union Bank Bldg.
Winnipeg

Sovereign Bank of Canada Bldg.
Montreal
134 Granville Street
Halifax



WIRE ROPE

"ACME" Brand. Highest grade of hoisting rope made. Extra tensile strength for heavy work.

Use Greening's Rope Grease for Lubrication

THE B. GREENING WIRE CO., LIMITED

HAMILTON, Ont.

MONTREAL, Que.

THE HEROULT PROCESS OF ELECTRIC SMELTING

For particulars apply to **R. TURNBULL**, General Agent for Canada, Sault Ste. Marie, Ont.

MONTREAL STEEL WORKS, LTD.

Steel Castings
Forgings
Springs
Frogs
Crossings

We make a specialty of Cast Steel WHEELS and other Steel Castings

FOR MINING PURPOSES

INTERLOCKING SWITCH AND SIGNAL PLANTS

(under the patents of Saxby & Farmer, Limited, of London, Eng.)

CANAL BANK, POINT ST. CHARLES, - - - MONTREAL

MICHIGAN COLLEGE OF MINES

F. W. McNAIR, President

Located in Lake Superior District. Mines and Mills accessible or practice. For Yearbook and Record of Graduates apply to President or Secretary. Houghton, Michigan.

CHEMICAL AND ASSAY APPARATUS

ZINC, CYANIDE and SULPHURIC ACID for CYANIDE PROCESS

Complete Assay Outfits

The Hamilton-Merrit Prospector's Outfits
Becker's Balances and Weights
Battersea Crucibles and Muff
Hoskins' Gasoline Furnaces
Kavalier's Bohemian Glassware
Munktell's Swedish Filters



LYMAN, SONS & COMPANY

Our Catalogue on application.

380, 382, 384 & 386 ST. PAUL STREET, MONTREAL

The CANADIAN MINING REVIEW

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING JOURNAL PUBLISHED IN CANADA.

Published by The Review Publishing Co., Ltd.

PUBLISHED MONTHLY.

171 St. James St., MONTREAL.

VOL. XXVIII—No. 2.

MONTREAL, FEBRUARY, 1907.

Two volumes a year.
Jan.-June; July-Dec.

THE CANADIAN MINING REVIEW.

Published by THE REVIEW PUBLISHING COMPANY, Limited, P.O. Box 2187, Montreal, Canada. Subscription, payable in advance, \$3.00 per year, including postage.

The REVIEW'S columns are always open for the discussion of questions cognate to the mining industry.

Advertising rates on application.

All cheques, drafts, and Post Office orders, should be made payable to The Review Publishing Company, Limited.

EDITOR:

Charles A. Bramble.

SPECIAL CONTRIBUTORS.

NOVA SCOTIA:

Charles Fergie, M.E., Manager Dominion Coal Co., Ltd.

Graham Fraser, Sydney Mines, Cape Breton.

G. H. Duggan, Vice-President Dominion Coal Co., Glace Bay, C.B.

QUEBEC:

J. Obalski, Supt. of Mines, Province of Quebec.

Prof. Frank D. Adams, Professor of Geology, McGill University.

John E. Hardman, M.E., Montreal.

ONTARIO:

A. P. Low, B.Sc., R.G.S., Director, Geological Survey of Canada.

Thos. W. Gibson, Deputy-Minister of Mines, Ontario.

Dr. Alfred E. Barlow, Geological Survey of Canada.

W. G. Miller, Provincial Geologist, Ontario.

H. W. Hixon, Victoria Mines, Sudbury.

BRITISH COLUMBIA:

Arthur Wheeling, Jr., Vancouver.

CONTENTS.

	PAGE
Editorial Comment.....	37
Summary Report of the Geological Survey for 1906.....	38
Our Chief Geologist.....	38
Tinstone in Canada.....	39
The Southern Yukon.....	40
Our Mining Industry in 1906.....	41
Concentration.....	43
Clay and the Clay Industry in Ontario.....	48
British Columbia in 1906.....	49
The Canadian Rockies.....	55
The Treatment of Arsenical Ores.....	56
From the Antipodes.....	57
Experiments with Cobalt Ores.....	57
A New Mining Association.....	59
Quebec's Mining Area.....	61
The Cobalt Camp Output.....	61
Canadian Mining Institute, Annual Meeting.....	62
Book Reviews.....	62
Personals.....	63
Mining Notes.....	64
Coal Notes.....	67
The Mining and Industrial Share Market.....	67
Industrial Notes.....	67
Mining Incorporations.....	69
Catalogues.....	70

In his speech from the throne His Honour, Lieutenant-Governor Clark of Ontario, made the following reference to Ontario mining:—

The great value of the mineral deposits in the Cobalt district is becoming more and more evident and the future is full of promise both to the investor in mining properties and the people of the Province. The rights of the Province in these deposits have been kept steadily in view by my Ministers, and accordingly a measure providing for the taxation of mining properties will be submitted to you for consideration. I think it well to draw to your attention the fact that a tendency to hasty and reckless investment and speculation is abroad, and, it is to be hoped, will be kept in check by the good sense of our people.

The report of the Berry Creek Mining Company, Limited, of Victoria, B.C., for 1906, has been made public. This mine is situated in Cassiar Mining Division, British Columbia, reached by way of Wrangel, Alaska, and Telegraph Creek, B.C.

This new district was made famous in the '70s by the rush to Cassiar, when Dease, Thibert and McDame Creeks yielded \$5,000,000 in placer gold. The British Columbia Mining Company has 10 hydraulic leases, 8,000 acres in all, fronting on Thibert Creek, 1,500 feet. From previous mining operations it had been learned that the average values of the ground since the company came into existence has been about $9\frac{3}{4}$ cents of gold to the cubic yard, from the top gravel, but when the bottom gravel was washed with the top gravel the average has been about 13 cents a cubic yard.

The conditions of mining at the end of last season's work were considered better than at any previous time. The paystreak shows for 1,100 feet, and it is estimated that there is in sight 400,000 cubic yards of material, having a value of from \$50,000 to \$55,000.

The most remarkable fact about the Berry Creek deposit is the large values in platinum, osmium and iridium. These have, heretofore, been going to

waste, but it is proposed to employ an expert this year to erect a plant that shall save a large percentage of the metals of the platinum group.

According to the Latchford correspondent of a Toronto paper, it is proposed to give transportation facilities to the new camp that will no doubt be developed this spring upon the Lady Evelyn River, through a line of steamers that is to run from Latchford with certain breaks to Sucker Gut. This would be very nice for Latchford if it should turn out to be feasible.

We have spent the better part of a summer upon these waters, and we are of the opinion that a line of steamers between Latchford and Lady Evelyn will not run for some years, if ever. It is hard work to take a canoe either up, or down, many of the rapids of the Montreal River. There are the Pork Rapids, at the head of Bay Lake, and then Mattawabika Falls, which, although not so high as Niagara, would be too formidable for a steamer to negotiate, and we hardly think it would pay to build locks as suggested, seeing that the river in so many places is hardly deep enough to carry a canoe. The way to take freight into the new camp would seem to be as follows: A line of small steamers at the head of the north-eastern arm of Timagami to Stoney Portage at the north end of the lake. Here a tramway could be installed and a small light draft steamer could carry the freight across Diamond Lake, whence a road or tramway, of about one mile and a half in length, would land cargoes at Lady Evelyn River at the very head of Sucker Gut.

SUMMARY REPORT OF THE GEOLOGICAL SURVEY FOR 1906.

The issue of the Summary Report of the Geological Survey Department for the calendar year 1906 within two weeks of the close of the year is a matter of congratulation to the Hon. Mr. Templeman and to all concerned in the production of the report.

The value of this publication has been greatly enhanced by the insertion of a concise table of contents and an extended index by the use of which any reference to the mass of information contained in the report is easily found.

The report contains the Directors' statements regarding the work and administration of the Department, prominence being given to the efforts being made to increase the efficiency of the department, especially in regard to the early publication of the information collected by the different field parties; and attention is drawn to the great increase in the value of the mineral production of the Dominion during the past twenty years, from \$10,221,000 in 1886 to \$63,574,000 in 1905. During this period the aids towards mining given by the Dominion gov-

ernment as appropriations to the Geological Survey and the Mines Branch of the Department of the Interior have only increased from \$115,055 to \$173,555. The necessity of an increase of trained geologists to the staff is pointed out and the best method of procuring such officers is suggested.

A concise statement is given of the progress in the mining industries of the Dominion during 1906 which shows a healthy state of development throughout, owing to the enhanced prices of the metals and to the more economical methods of mining and smelting. The second part of the report deals with the work of the field parties under different officers of the department. These include the following:

Messrs. McConnell, Keele, Maclaren and O'Farrell engaged in the estimation of the value and volume of the Yukon gold-bearing gravels. Mr. Cairnes in examination of the mineral deposits of southern Yukon. Mr. LeRoy on the geology and economic minerals of the southern part of British Columbia along the Pacific coast. Mr. Leach on the important coal and copper areas of the Bulkley Valley, Skeena River. Mr. McConnell on a geological investigation of the Similkameen Valley in southern British Columbia. Messrs. Brock, Young and Boyd on an extensive study of Rossland camp. Mr. Dowling on the northern extension of the valuable coal beds in the Rocky Mountains. Dr. Chalmers and Prof. Macoun on the geology and soil along the line of the Grand Trunk Pacific railway in Saskatchewan and Alberta. Mr. Denis on the coal, oil and gas resources of Alberta and British Columbia. Messrs. McInnes and O'Sullivan on the geology and natural resources of the country on the proposed line of railway to Churchill on Hudson Bay. Mr. Ingall on the copper deposits of eastern Canada. Messrs. Collins and Wilson on portions of the country along the line of the National Transcontinental Railway in northern Ontario and Quebec. Dr. Bell on the Cobalt silver district. Dr. Barlow on the country east of Lake Timiskaming. Messrs. Johnston and Ellis on surveys in New Brunswick, and Messrs. Fletcher and Faribault on surveys in Nova Scotia.

These various reports, all of which are stuffed with facts, and many with information quite lately obtained, are condensed into one hundred and fifty-one pages and should go far to satisfying the mining community of all parts of the Dominion.

OUR CHIEF GEOLOGIST.

It is with much pleasure that we note that one of our best known geologists, a man who has been in the firing line for half a century, Dr. Robert Bell, F.R.S., Chief Geologist of the Canadian Survey, has been awarded the Cullom medal for the year 1906. The medal is given by the American Geographical Society, and this is the first time it

has been awarded to any other than an American citizen.

The prize is a magnificent gold medallion, purchased out of monies left by the late Gen. T. W. Cullom of the United States Army. His will directs that the prize be given annually to such as distinguish themselves by remarkable geographical discoveries, or by their labors in the advancement of geographical science. When of equal merit, citizens of the United States were to have the preference. It speaks well for the honesty and straightforwardness of the Council, that the necessary two-thirds vote was received by a Canadian geologist.

The American Geographical Society's headquarters are in New York. They occupy a very fine and commodious building on 81st street, in which are stored the Society's large and valuable library, collections of maps, charts, etc. The Society was incorporated in 1852, or fifty-five years ago, and it has always been the principal geographical society of the great Republic. It commenced, immediately, the publication of its monthly Journal, the name of which was changed at the end of fifty years to the Bulletin, which is one of the leading geographical periodicals of the world. The Hon. Charles P. Daly, LL.D., Chief Justice of the Court of Common Pleas of New York, and a devoted geographer, was continuously president of the society from 1864 till his death in September, 1890, a period of thirty-five years.

The American Geographical Society, in awarding the Cullom Gold Medal to Dr. Bell, has conferred on him a truly substantial honor, of which he may, indeed, be proud, but this is not the only conspicuous honor for geographical work which came to Dr. Bell in 1906. Earlier in the year, the Patron's Gold Medal, the chief prize of the other great geographical body of the world, namely, the Royal Geographical Society, was awarded to him by the unanimous vote of its council, and with the cordial approval of King Edward, who pays for the medal and also takes a great interest in its award and in the work of the society in general. At one of its meetings which he attended recently, upon the conclusion of the lecture of the evening, he reviewed the subject which had been treated of and moved a vote of thanks to the lecturer.

The Patron's or King's Medal, a beautiful work of art was founded when the society was first established, in 1830. Some of its recipients in the earlier days were Endersley, Burns, Chesney, Carl Ritter, Fitzroy, and later Sir George Nares, for geographical services in various parts of the world. Among those who have won the Patron's Medal for their explorations and surveys in North America were Thos. Simpson, Dr. Rae, Captain Back, John Ross, Captain Palliser, Sir Robert McClure and Sir Leopold McClintock. This medal or other awards of the Royal Geographical Society have been bestowed upon the more noted African explorers, such as Dr.

Livingston, Captains Speke, Grant and Burton, Sir Samuel Baker and Sir Henry M. Stanley.

Dr. Bell has been fortunate in his opportunities for making extensive surveys of two kinds, the work having been done for the Government of old Canada, and since 1867 for the Dominion Government. The geographical part was done as being essential to the geological, which was the principal object. It is well known that the former has been much appreciated for many years, wherever geography is studied, but the latter has really been the more important service to Canada from a utilitarian or economic point of view, and it will be found to be of the highest value as the information acquired comes to be more and more needed in the progress of mining and practical geology in the Dominion.

TINSTONE IN CANADA.

Tinstone has at last been discovered in a solid vein in Canada. Samples were received at the end of last month by the Geological Survey from Mr. Harry Piers, curator of the provincial museum, at Halifax, and they proved on being assayed to be cassiterite, the most valuable of tin ores, containing 78 per cent. of tin and 22 per cent. oxygen. The discovery was made by Mr. John Keddy, at Lake Ramsay, on John Reeve's farm, three miles west of New Ross, Lunenburg County, N.S. The ore is found in semi-crystalline forms disseminated through a vein of decomposed, kaolinized pegmatite in granite.

As early as 1868 tin ore is reported by Prof. How to have been found in Nova Scotia in granite at Tangier and Shelburne, and latterly it has also been found in granite drift at Tangier and Country Harbour, and in the tailings at Malaga gold district. Still the granite rocks which form the backbone of the peninsula of Nova Scotia have always been regarded as barren of minerals of economic value by the prospector.

In 1903, Mr. E. R. Faribault, of the Geological Survey, examined geologically the New Ross region, and reported in the Summary Report for that year, the occurrence of ores of molybdenite, zinc, iron, manganese, copper, lead and silver, and other less important minerals, and he recommended the locality as a promising field for prospecting. In the Summary Report for 1906 a reference is again made to the ore-bearing character of the granites of that region and to the rumor of tin ore having been found at Lake Ramsay. Specimens brought then from that locality were examined for tin, but they only proved to be zinc blende, a mineral which much resembles cassiterite. The vein has only been opened 12 feet in depth and it requires to be developed considerably more to prove the economic value of the deposits. Still the fact is established that the granites of Nova Scotia contain valuable minerals, and chief amongst them is tinstone. More

exploratory work should be done in that region by panning for tinstone along the streams and developing the numerous pegmatite veins which cut the granite. In the reports of the Geological Survey tin ore is reported to have been found in drift at several places in Canada. It was found in New Brunswick on the Pokiok river, York county; in Quebec, on the sixth lot of the eleventh range of Whitton, Compton county; and in the gneiss of Buckingham, Labelle county; in Ontario in minute quantity at Sudbury, and the Vermillion mine, in the county of Denison, district of Algoma; in British Columbia in a three feet vein of pegmatite cutting granite near Osoyoos lake, also in Cariboo and Boundary Creek districts; and in the Yukon in several tributaries of the Klondike river, but so far, most frequently in Bonanza, Hunker and Sulphur creeks, where it occurs as stream tin in smooth rounded pebbles up to two inches in diameter, which remain with the gold in the sluice boxes, on account of their weight. The discovery of tinstone in the Laurentian rocks of Greenland constitutes a claim to attention in the fundamental strata of Baffinland where commercially valuable deposits may be expected.

Tinstone is a rare mineral all the world over, and has been found in paying quantities only in very few places, and generally in pegmatite veins in the granite. The world's output of tin in 1905 was 92,607 tons, produced by only six localities: the Malay peninsula producing 58,547 tons, or 60 per cent. of the whole. Bolivia, 12,500 tons, Billiton and Banka Islands in the Dutch East Indies, 12,615; Australia, 5,028, and England, 3,857 tons. In the United States tin ore was found in several states, including Maine, New Hampshire and Massachusetts, where it occurs in granite much similar to that of Nova Scotia, but not in paying quantities. No tin was produced in the United States before 1903; in that year nineteen tons of high grade concentrates were extracted from South Carolina and shipped to England; in 1904 about 142 tons of concentrates from South Carolina, South Dakota and Alaska were shipped to England, but no production is reported for 1905.

The price of tin has increased greatly during the last few years, and as the demand is greater than the supply it will certainly keep on increasing. In 1905 the price per pound increased from twenty-nine cents to thirty-five cents; in April, 1906, it reached 38.6 cents, and at present it is forty-two cents. The high price of tin is naturally stimulating developments in all parts of the world, especially in Australia and Bolivia. The cost of production has increased in the Malay peninsula on account of the exhaustion of the richer and more easily worked alluvial deposits, and also on account of the rise in wages.

Mr. Faribault will be in Nova Scotia again next summer to complete the geological survey of the

gold-bearing and granite rocks lying to the west of Halifax in Lunenburg County, and will devote some time to a study of the mode of occurrence of the mineral veins at New Ross, so as to assist if possible in the development of this promising new district.

THE SOUTHERN YUKON.

Until recently it has been generally supposed that the mineral wealth of the Yukon existed entirely in its placer deposits, and as these are mostly in the northern part of the territory, the southern part was considered of little value. The days of the individual placer miners appears to be almost a thing of the past, as none of the fabulously rich deposits such as caused the early Klondike excitements have recently been found, and the work of washing the sands and gravels is now chiefly carried on by large concerns, so the life of the Yukon, to some, appeared to be measured by the life of the gold sands to the north. However, quartz mining has recently become of such importance and promise as to practically dispel this former idea.

To reach this country the usual route is to go by boat from Vancouver or Seattle to Skagway, Alaska, a distance of about 865 or 1,000 miles, respectively, thence via the W. P. and Y. Railway to Whitehorse, Yukon, a distance of 111 miles. From here steamers run down the river to Dawson, about 460 miles.

A few years ago a number of copper claims were staked just west of Whitehorse and some very encouraging development work was accomplished, but for a number of reasons the camp has been, until this last season, practically at a standstill. A few trial shipments of about ten tons of ore were made. Three such samples from the Copper King gave returns of 46 per cent., 31 per cent. and 29 per cent. copper, and there appears to be plenty such ore. This last season, Byron N. White, of Spokane, commenced work on the "Pueblo" and by surface stripping uncovered a body of almost solid ore about 270 by 250 feet, and a shaft was sunk in one place over 100 feet, and neither wall had at this time yet been found. The ore is hematite iron strongly impregnated with copper. The whole deposit seen would average at least 4 per cent. copper, and carries some gold values, and by hand sorting very high grade shipments could be made. The contact along which the copper properties are located can be traced over fourteen miles, and is mineralized throughout the entire distance.

With this exception no quartz mining, except a few assessments done by prospectors in different places, had been done in this southern Yukon until about a year ago this last summer, when Col. J. H. Conrad commenced work on a number of properties in the Windy Arm district, which is along the railway, and about forty miles south of Whitehorse.

Since then considerable development work has been done on a number of properties both by the Conrad Consolidated and the Anglo-American companies. The ores consist chiefly of high grade silver minerals and gold in quartz veins, which are in true fissures, and vary from a few inches in width to over twenty feet. Argentiferous galena is the chief mineral, often associated with rich silver minerals, such as argentite, ruby silver, and stephanite, and accompanied by pyrite and arsenopyrite.

The Conrad Consolidated has three Riblet aerial tramways in operation for carrying the ores of the different properties to the shores of Windy Arm, the longest being 18,697 feet in length, with its upper terminal 3,469 feet above the lower, cost over \$90,000 to install. The others are much shorter.

Some shipments of ore have been made, but these were mostly trial shipments. The properties are as yet in the prospect stage, but for the amount of work done look very promising.

The success of the Windy Arm properties encouraged prospectors to prospect more carefully this season, with the result that a number of valuable finds have been made. About the middle of June quartz carrying free gold and telluride minerals was found between the Watson and Wheaton rivers, about eighteen miles southwest of Robinson Siding. These quartz veins were traced in a belt about two miles wide for about twenty miles in a southeasterly direction, and, over seven hundred locations were made. The quartz is quite well mineralized in places, carrying gold and silver values chiefly. However, no work has been done as yet to see what values the veins really carry. The telluride ores from the original discovery on Gold Hill assayed into thousands of dollars per ton, but only a small amount of this was found. The average surface assays which were made in the district were, however, encouraging.

A large body of stibnite carrying mercury was also discovered towards the end of the season, to the west of the other properties.

So considering that there were only a few men in the country and these were only prospecting a very short time, the results go to show over what wide areas the valuable ore deposits of the Yukon are distributed.

Added to this there is plenty of coal in the district. Quite an extensive basin of anthracite coal lies just to the south of the Whitehorse copper deposits, and is easily accessible from the railway. Also coal is being mined down the river north from Whitehorse in different places, and will probably be found much closer to Whitehorse. The samples taken from Tantalus and Five Fingers mines gives in the laboratory a good firm coherent coke. So that a smelter at Whitehorse, to treat the copper ores there, is one of the probabilities in the very near future, as there is plenty of water power in the vicinity.

OUR MINING INDUSTRY IN 1906.

The Director of the Geological Survey has introduced into his summary report for 1906 a new feature which will appeal to all those interested in the mining industry of this country. In a few words he sums up the principal items of the mineral production and shows that the mining industry has never yet been in so healthy a condition. He writes, "It can be said without fear of exaggeration that the condition of the mining industry in Canada in 1906 has been one of large prosperity, that it has, in fact, achieved greater progress and given bigger returns than during any previous year on record. In the year 1905 the total mineral output reached almost \$70,000,000, as compared with but a little over \$60,000,000 in 1904, and while actual figures of production are not yet available for 1906, the activity evidenced in both the metalliferous and non-metalliferous mining will, no doubt, result in another large increase being shown. There has been during the year an active demand for nearly all mining products, and the higher prices realized, especially for the metals and their ores, has not only helped to increase the actual output, but have stimulated development and prospecting throughout the country.

Metallic.—The increase in prices of metals during 1906 is distinctly shown by the following quotations. The average price of the metals for 1905 was as follows: Silver, 60.35 cents per ounce; copper, 15.59 cents per pound; lead, 4.7 cents per pound; spelter, 5.82 cents per pound; nickel, 40 cents per pound. During 1906 the prices of all these metals had increased, and in December, 1906, the quotations were as follows: Silver over 70 cents per ounce; copper, over 22 cents per pound; lead, 5.75 cents per pound; spelter, 6.4 cents per pound; and nickel from 45 to 50 cents per pound.

Nickel.—The nickel-copper mines at Sudbury have been actively worked throughout the year and will show an increased output. Electric power has been introduced and the general efficiency of the works greatly improved.

Copper.—The actual output of copper in eastern Canada, outside of the metal obtained from the nickel ores above mentioned, is comparatively small, but a great deal of work has been done during the year in the exploration and development of copper properties.

British Columbia is now Canada's great copper-producing province and more particularly the great bodies of low grade, but easily mined, ores of the Boundary district. The shipments from this district during ten months of 1906 are estimated at close on a million tons or greater than the total output of 1905. The smelting capacity of three furnaces in the district was considerably increased during the year. Dividends were declared by one company aggregating \$1,215,000.

The copper mines of the Coast district in this province have been actively worked during the year,

as were also in the ores of the Rossland district, which are further mentioned under the heading "Gold."

Gold.—The gold output in Canada has been showing a yearly decrease since 1900 due to a regular falling off in the Yukon placer production, and this decrease has, in all probability, continued in 1906. In eastern Canada the output has never been large, but Nova Scotia seems to make a better showing in 1906 than in the immediately preceding years. In British Columbia the gold production has shown a slow but steady increase which has to some extent counterbalanced the decrease in the Yukon output. In Rossland an important amalgamation of interests took place in the early part of the year. The War Eagle and Centre Star mines, the smelting works of Trail, with the St. Eugene silver-lead mines of East Kootenay, and other interests, were united under one management known as the Consolidated Mining and Smelting Company of Canada. The consolidation is one which will, no doubt, tend to much greater stability in the mining industry.

The discovery of new ore shoots in the Centre Star and other mines, the payment of dividends by the Le Roi, the Le Roi No. 2, and the Consolidated Mining and Smelting Company, and the encouraging detailed geological work done by the Geological Survey under Mr. Brock, have all tended to put new life into the district and a bright future is looked forward to. The total ore shipments for 1906 may possibly not exceed or even equal those of 1905 owing to the unfortunate strike of coal miners at Fernie having caused the smelters to close down for some months in the latter part of the year for want of coke.

In Cariboo several properties, including that of the celebrated Consolidated Cariboo Hydraulic Mining Company, were acquired by the Guggenheim Exploration Company, and a large investment of capital is being made in the construction of many miles of new ditches, which will supply a more regular and larger supply of water for the working of the huge areas of gold-bearing gravels this company possesses.

The Atlin placer deposits were worked about as usual, although a shortage of water had to be contended with.

The gold output of the Yukon will again apparently show a decrease. Official figures are not yet available, but from current reports apparently not more than \$6,000,000 is to be expected this year. In this district the large corporations are absorbing the smaller operators and the Guggenheim Exploration Company under the name of the Yukon Consolidated Gold Fields Company has entered the field buying up numerous claims. The company has already commenced the construction of ditches and flumes to provide water for operating their claims. Other large work are to be undertaken, such as the construction of reservoirs, a power plant, etc., and

altogether a large number of men will be employed this winter.

Iron.—The iron industry has been active throughout the year, a good demand for all classes of iron products having been experienced and the iron furnaces have been operated probably more extensively than ever before. A new furnace plant is in course of erection at Port Arthur intended to utilize the ores of the Atikokan areas. The output of pig is likely to be larger than in 1905, and would probably have been still greater but for an unfortunate dispute between the Dominion Iron and Steel Company and the Dominion Coal Company in November regarding their coal contract.

Lead and Silver.—The argentiferous galenas of the Kootenay districts are again being worked on a large scale, the East Kootenay mines, St. Eugene and others, being large shippers during 1906.

The Cobalt district of Ontario has attracted world wide attention during the year and is rapidly becoming an important silver producing district.

Zinc.—The concentrating of zinc ores in British Columbia has continued with considerable success. The large zinc smelter at Frank, Alta., was sufficiently advanced for the first metal to be turned out in June. It is understood, however, that some further changes and improvements were found necessary before regular smelting could be undertaken.

Non-metallic.—Amongst the non-metallic class of minerals mined in Canada, the more important are mica, chromite, coal, corundum, gypsum, mica natural gas, petroleum and salt, besides the structural materials including the clay products, stone and lime and cement. The mining of all these products and others of lesser importance has actively progressed during the year. The coal mining industry especially has made good progress in the various fields exploited, Nova Scotia, Alberta and Saskatchewan and the Crowsnest Pass and Vancouver Island fields of British Columbia. In Alberta a rapidly growing population has created such a demand for coal that new mines are yearly opened up and a much larger output made. Nearly one-half the coal mined at the Crowsnest Pass is converted into coke to supply the rapidly growing demands of the smelting industry in British Columbia and for export. Labor difficulties have interfered to some extent with the operations at Fernie and at Lethbridge, the latter causing a shortage of coal at certain points in Saskatchewan which threatened to become serious. These difficulties have, however, been happily settled before the close of the year and no doubt in time to avoid any further serious trouble.

The asbestos mining in the eastern townships of Quebec has been particularly active during the year, prices have been good and a large increase in mill capacity to handle the mineral is contemplated.

The chromite ores of this district have also been mined about as usual.

Gypsum mining in Nova Scotia and New Brunswick and to a lesser extent in Ontario and in Manitoba has been carried on with increased output. Higher prices have also been obtained in this industry.

The corundum of Ontario finds a ready market; mica has been in good demand and at higher prices, while natural gas, petroleum and salt industries of the Ontario peninsula have been worked as usual.

In the structural material class the production of clay products such as bricks, tiles, etc., stone and lime, has to keep pace with the growth of the population. The increased use of cement in all kinds of structural work such as buildings, sidewalks, and roadwork, bridges and monolithic work, etc., has caused a great demand for this product and a largely increased output is being made.

CONCENTRATION.*

Since the world became highly civilized, there have been eras, or ages, when some one great industry has flourished to a much greater extent than the rest during that period, such conditions lasting, perhaps, for several decades and even centuries. The present age might appropriately be called the age of mining. At no previous time in the history of the world has the mining industry taken such a strong hold on the people as at present. Mining in nearly every civilized country has forged to the front with great rapidity. New discoveries are being made every day, and new concentration, or reduction, plants installed.

Canada, as we are all convinced now, is a country of great mining possibilities. Events are transpiring from day to day which demonstrate, as Dr. Adams has pointed out, that we have scratched or prospected only a very small percentage of the great territory allotted to us for exploration, and that we may reasonably expect such great and almost bewildering discoveries, as the world has never yet witnessed. But, right here, another aspect of the subject presents itself, and this may be best put into the form of the following questions. Are we aware that many ore deposits, of various natures, whose existence has been known to us for years, have not been developed, nor has there been any attempt made to make them economically useful? Do we realize that with the progress of technical science we are able, to-day, to treat ores more successfully than ten or twenty years ago? That we now can make mines pay, which could not be put on a paying basis years ago, on account of the lack of knowledge of proper methods of treatment?

Gentlemen, it would appear from these questions that I find fault with the craving of the general public for something new, before they have taken advantage, fully, of these dormant things

lying at our threshold waiting utilization! No; far from it. New mineral discoveries are needed to draw the attention of foreigners, and of foreign capital to this country—Canada in the first place needs a denser population, and, so far as I can judge, we need more foreign capital with which to develop our resources. But it often happens, that just such capital, originally intended for investment in new discoveries, has, for some reason or another, been applied to the development of mineral resources of this country, known for some time, but which on account of expensive methods of separation could not in the past be made to pay.

Here then, logically, another question arises: What constitutes the success of a mine? What are the essential factors which make up the successful mining venture? Gentlemen, to answer this question would require a long dissertation on a subject which lies beyond the scope of this paper. First and foremost, there is required a study of the geology of the ore deposits—a branch of science which has been greatly developed during recent years. To cite only one example of how this enters into practice; it may be remarked that thousands of dollars expended in the fruitless prospecting of twenty years ago, would have been saved, if there had then been the knowledge of secondary enrichment that there is to-day. Next comes the matter of the tonnage, and in the case of metalliferous ores, the assay of the ore developed. Of great importance are the conditions governing the extraction of the ore, and the cost of mining. And last, but not least, the question of the treatment of the ore—its economic separation from the accompanying gangue material. It is upon this latter subject that I should like to say a few words to you, gentlemen, especially to the younger members of my audience, and I feel confident that you, after careful consideration, will find my remarks, based as they are on personal observation in the field, to be not far from the mark.

The mining engineer of to-day requires not only a broad knowledge of the geological conditions which govern the mineral deposits, not only a knowledge of the ways and means of getting out the ore, but he requires also a deep knowledge of the problems of separation. How many mines have been doomed to failure through the absence of just such knowledge? The profession of mining engineering presupposes, nowadays, a very broad knowledge of the principles which govern modern ore separation. Twenty years ago we may say that ore separation was simply in its infancy; a time when it was believed that simply cobbing the ore, or putting it through a crusher and treating it by the wet process, was perhaps enough for so-called rough treatment, and when no further utilization of the residue was deemed necessary. But, to-day, with the great advance in technical science, with progress in all branches of industry, these old processes are found insufficient, and to our great

* Address delivered before the Mining Society of McGill University by Mr. Fritz Cirkel, M.E., Montreal.

satisfaction we find that mining engineers have not been idle in extending and improving the processes in vogue, in fact, old-fashioned separation methods have been succeeded by others that make it possible for a mine to pay dividends which could not have been worked at a profit by old methods.

But, gentlemen, we must not stop here. We must not think there has been such progress that we may now treat all kinds of ore with success. On the contrary, new ores of complex composition, are found each day, and which require special treatment, though the principles involved may be in all cases identical.

Take gold, for instance, We all know that some twenty years ago the only way of extracting gold from its matrix was by the well known amalgamation process, which was, with here and there slight variations, applied to all free milling gold ores. We remember, also, that twenty years ago great excitement was caused by the invention of the cyanide process. Now, from the success this process has attained treating Transvaal ores, as well as those of California, it would seem that nearly all gold ores could be amenable to this process with slight variations. But this we know is not the case. A further development was registered by the application of the Pellatin-Clerici process, an electric process, for which it was claimed, that all gold occurring even in a very fine state of division could be extracted. Yet, although this process was successfully applied to a number of ores, still there are gold ores which do not seem to be attacked successfully by any process in vogue. I have a case in mind, where ores which contain the gold in a very fine state of division, were treated with this process, and the result was that fully 45 per cent. of all the gold was lost. Another case, which will illustrate the necessity of continuous experimentation with one's ore, is one which came under my attention some eight years ago, in the State of Washington. This mine when I made the examination, had, approximately, 100,000 tons of gold ore in sight, averaging eleven dollars in gold to the ton. A mill was built for the treatment of the ore at an expense of \$60,000, but, although great efforts were made to bring the enterprise to a successful issue, it was doomed to failure, owing to the impossibility of getting a satisfactory extraction of the values. This mine, although having a very large tonnage of ore in sight, has been lying idle ever since. Here, gentlemen, is an example of a case where ingenuity can make its mark; here is a case which demonstrates that we have not yet solved the problem of gold extraction in all cases, and it is for the engineer, and for the chemist to work hand in hand for the discovery of such treatment as may deal with ores in which the gold is in an extremely fine state of division. Here, is a case where a fortune awaits the engineer or chemist, who will solve an intricate problem of gold extraction.

I will deal, now, with another ore, which is the mainstay, the backbone and foundation of the wealth of a nation; iron. You know that we find iron deposits through the Laurentian formation. A number of deposits were worked some thirty or forty years ago, and although the mines offered great inducements as regards tonnage in sight, the operations were not successful. What was the cause? Was it the composition of the ore, which prevented it from being used successfully in the furnace? No, it was, simply, the lack of proper separation of the ore from the gangue. But it is with satisfaction we find that since that time processes have been invented which facilitate the concentration and handling of such ores. Magnetic ores, in nearly all cases, are more or less mixed with the rock of the containing formation, and it would be an immense task to separate the ore from the gangue by hand. However, magnetic concentration comes to our aid, and ores which have only a percentage of 23 per cent. can be made use of by concentration. I may add that in the great concentration plants in the Adirondacks, magnetic concentration is in vogue, and the mines, through this process alone, have been made an unqualified success, and put on a paying basis.

From an examination of the iron ore deposits in Ottawa County, I am convinced that our magnetic mines can be put on a paying basis, by just such a system of magnetic concentration, and it is not unlikely that an American firm, which has been conducting diamond drill operations in some of the mines, will put up a large concentration plant, and work the mines to their full capacity.

From what I have said, gentlemen, you may easily infer that here is another case, where there is sufficient ore in sight, but where there has been no mechanical means whereby the ore might be treated, so that it was acceptable to the market. John Stuart Mill says: "To draw inferences is the great business of life."

I may quote another example of my meaning— asbestos. You know that Canada supplies the whole world with asbestos, but this would not be so were it not for the processes of separation which have been invented to extract the fibre from the gangue. The history of this mineral makes interesting reading. Mining operations in the Eastern Townships of Quebec commenced on a small scale in 1878, and in that year 50 tons were taken out for which, however, it was difficult to find a market. The quality of the fibre was excellent, and the width of the veins was everything that could be desired, from 1 inch up to 2, 3 and sometimes 4 inches. This justified the expectation that large deposits of the mineral might exist in that locality, though their true importance and value were not ascertained until several years later. Shipments of the better grades made to London created quite a sensation in the market; extensive tests and investigations were



DR. ROBERT BELL, F.R.S.,
Chief Geologist.

made, and the result was that the high value of this mineral on account of its exceptional qualities for spinning purposes was soon established, and the race for the acquisition of additional areas likely to contain the valuable mineral began. The land was considered practically of very little value for agricultural or any other purpose, and mining operations were rapidly extended.

For the next ten years we witness a rapid development of the industry. The mines are worked on a large scale, while the prospector is still busy exploring for the mineral in the surrounding mountains. Villages spring up like mushrooms, in a country which is physically speaking, one of the roughest. The population, comprising before the beginning of mining operations, only a few scattered families, increases to several thousands, and the whole country shows all the evidences of industrial activity and prosperity.

But it was soon discovered that the primitive methods of hand extraction were faulty, inadequate and expensive, especially as far as the lower grades were concerned. As a matter of fact, under prevailing price conditions, only those mines which were working on richer ground, and had a large percentage of crude asbestos, had a chance to live and carry on operations with a profit. The natural outcome of this condition was obvious; many mines producing only a very small percentage of the higher grades were forced to shut down, and this, together with serious difficulties accentuated by overproduction and a consequent fall in prices, caused the industry to receive a severe set back in the middle of the nineties. For some years the industry languished, all retiring save those who would not be discouraged, no matter what should happen.

However, the mechanical ingenuity of those engaged in the mines, and of those having the development of the industry at heart, came to the rescue; handcobbing of the lower classes of asbestos gave way gradually to mechanical treatment, and this method, in the course of years, was so successfully and effectively worked out that, to-day, we find every mine in the district with a complete milling and fiberizing plant. By this process, all the smaller fibre, which in the earlier years was left in the rock, and thrown on the dump, is saved, and as new uses for this short material sprang up, the life of a mine was prolonged and its management attended with less difficulty.

As a result of these innovations, 16 mills with a capacity of 3,500 tons of asbestos rock per day, are operating in the district, and if reports prove true, the capacity of the mines and mills will be largely increased during the present year.

The asbestos industry is a striking example of what human ingenuity, if applied in the right direction, may accomplish. It demonstrates that, in order to attain success, it is necessary "To strive, to seek, to find and not to yield."

The asbestos mines of the Eastern Townships constitute one of the most prosperous industries of the Dominion of Canada, and they are of special interest to the mining and industrial world, from the fact that, in so far as now known, they represent practically the only deposits where this mineral of a quality adapted for spinning and for the finer purposes of manufacture can be mined with a profit. So great are the advantages which these mines possess, particularly as regards accessibility and the ease with which the extraction of the fibre is now accomplished in the mills that, unless fields as yet unknown and as easy of access can be discovered, the Province of Quebec will long enjoy the privilege of being the principal source of supply of asbestos, not only of the North American continent, but of the world.

I have another case in mind; graphite. Canada has been known for over 50 years to possess rich deposits of this mineral in the Laurentian formation. But what have we to show in the way of a graphite industry, in the way of development of our mines, or of concentration plants? Surely, not much up to this time. The statistics tell us the yearly production amounts to only a few thousand dollars. But there seems to be to-day a better appreciation of our graphite resources, especially by foreigners, and this, going hand in hand with great improvements in concentration will, undoubtedly, result in the establishment of a solid graphite industry.

The general public nowadays is apt too much to live under illusions of prospects of great wealth; they invest blindly in mining ventures where according to their opinion great wealth awaits them, or is, at least, bound to come by persistently putting holes in the ground. As a rule, they consider mining as a gamble, and not as a legitimate business as in any other walks of life. They flee the practical miner who offers a mine abounding in low priced ores; but they listen attentively to the promoter with his fairy tales of fabulous silver finds in the Cobalt district, who will eventually do "mining" himself—not in Cobalt but in the pockets of the public. What is the result? The resources of the lesser minerals lie dormant and are not developed. I have a case in mind where large tracts of graphite lands, with numerous outcrops of fine flake graphite could not find a buyer for years, until American capitalists took hold of them recently. They, by further exploration work, found that the ore bodies were of such large extent that now two graphite separation plants are in course of construction, and over one million dollars has thus been invested in the last two years.

It is gratifying to know that American capitalists are now taking a hand in the development of these resources. They have not been slow in recognizing the great value of these deposits; and that is not all—they have also realized the great value of concentration in making the mineral marketable,

and here—I venture to say—lies the secret of success in the case of graphite mining.

I trust I may be permitted here to discuss some of the principal causes which retarded measurably the healthy progress of this industry. The graphite ores of even the same composition cannot always be treated by similar methods, on account of the different physical characteristics of the mineral occurrences. This difficulty is apparent in the case of ores containing flake graphite, as well as in those containing only dense or amorphous graphite. Both of these ores occur in some localities in gneiss, but it would be futile to attempt to apply a process, which gives perhaps good results in the separation of these ores occur in some localities in gneiss, but is even more complicated, when ores containing both varieties are to be treated.

Another difficulty arises from the fact, that in some localities the gangue, accompanying the mineral, is found to change as development proceeds, and it must be said, that this is one of the principal sources of difficulties in the construction, operation and adjustment of graphite mills. The selection of one or the other method is very often based on guess work, and with very little regard to what the general "run of mine" is likely to be. When a deposit of graphite is discovered, a number of test holes are sunk, as a rule, to determine the character of the ore, or to trace the ore lode on the surface; where the ore appears to be of satisfactory quality and quantity, larger excavations are made, or a shaft is sunk, or a tunnel is run, following the trend of the ore body, and in the majority of cases, where quick returns are essential for the continuation of the enterprise, the construction of a mill for the treatment of the ore is proceeded with, based on preliminary tests with ore generally taken from chutes, which promise to deliver the bulk of the material to be treated. Very often, however, it is found in the further development of the mine, especially in the crystalline formations that the ore changes in character, both physically and mineralogically. That, for instance, an ore originally flaky turns into one that is both flaky and amorphous; that, further, the gangue with the accessory minerals change, and so on, and the result is that the mill which was originally laid out and constructed to suit a specific class of ore has now to treat an entirely different one. A series of experiments then demonstrate, that the arrangement of the apparatus and perhaps these themselves have also, to be changed, in order to meet these new conditions; sometimes an entirely new system has to be adopted, which in the majority of cases can only be done by spending a large amount of money.

The author has a case in mind, where a property was superficially tested and found to contain flake graphite in quartz. Before proceeding with the development of the mine, to determine the extent of the ore body and its character, a mill for the treat-

ment of the ore was erected. In developing this mine, however, it was discovered, that the contents of flake diminished, and that, instead, amorphous graphite appeared. That, further, the gangue changed from quartz into pure calcite. The consequences were obvious. Change after change had to be made in the mill in order to meet new conditions arising solely out of the development of the mine, but with little success, until it seemed inadvisable to alter the existing milling process. The construction of an entirely new mill was the only remedy, but the financial resources being exhausted mill and mine were shut down.

We learn from this example, that the construction of a mill to treat the ores of a mine should only be proceeded with, when all the conditions, the character of the ore, as well as the extent of the ore body, are fully known, and this can only be attained, if the mine is developed properly, the stopes laid open, and the different ore shutes thoroughly tested as to their contents in useful and waste material. Until such is the case experiments on a large scale with the ore should be deferred, the preliminary outlay for opening up the mine is insignificant compared with the large expenditure, to say nothing of the trouble and annoyance, resulting from the premature erection of a milling plant, with a system based upon guesswork, hasty judgment, and insufficient knowledge of the conditions really existing in the mine.

Mechanical ore separation is an ancient art, but during the last ten years it has experienced some remarkable improvements. These have revolutionized the practice of ore dressing in general; it appears, probable, that there will be still further innovations, of a character not yet clearly foreseen, except by some inventors who are working on special lines. Even as recently as five years ago there were practically no methods of mechanical separation, except hand sorting, jigging and washing on tables, and magnetic separation, the last method having only a very limited application. Since then radically new processes, such as electrostatic separation, oil concentration and the flotation of minerals in certain baths have been discovered. In these ways it has become possible to separate a wide range of minerals of close specific gravity, that cannot be separated by jigging or slime washing. Similarly, it has been demonstrated, that phosphate can be separated from hornblende, the difference in specific gravity being only 0.35, further molybdenite, monazite and other rare minerals, can be separated from their gangue, which it is often difficult to do by ordinary gravity concentration. Experiments have shown that graphite may be separated electrostatically from its gangue, and it is not unlikely that such a process will be developed commercially before long. These experiments have been, to a certain degree, successful, and, it may only be a question of time and of some improvements, before a

complete success is attained. It may be of interest to quote the following note from W. R. Ingalls* on general ore separation: "Probably few realize the probable extent of development, which they will experience during the next ten years, or what results may be achieved by them. It is quite certain that no single process is a universal panacea for all the difficult problems of ore treatment. For certain ores one process is best adapted; for other ores another process. For still other ores the best results may be achieved by a combination of two, or three, or even more of the special processes. This is a direction of effort, that has not yet received very much attention. It will be, however, the logical result when the design of such ore dressing plants passes out of the hands of the promoters of special processes into those of the engineer, who is retained by his clients to secure the best results."

Gentlemen, I trust that you have fully understood the purpose of my paper. I have drawn your attention to the fact that good mining engineering besides geology, mechanical engineering and surveying, requires also a thorough knowledge of the principles of ore separation. It is often asserted that in order to make this or that ore marketable, it is only necessary to write to an engineering firm, who will put up the concentration plants at a contract price. This procedure is as stupid as it is unbusiness like. Each firm has certain special machinery to sell, which might work in a satisfactory way, on a specific mineral of a certain chemical composition or physical qualities; but these machines do not give satisfaction on every ore. Generalizations on this subject are entirely impossible, and it is the engineer in charge upon whom falls the task of devising such apparatus, or of making such combinations of known apparatus as will enable him to make the best extraction of his ore. It is when face to face with cases of this kind that the mining engineer can show of what stuff he is made; whether he has fully grasped the value and applicability of general concentration principles.

Many a mining enterprise has been doomed to failure because the party at its head had no knowledge of the theory and practice of the separation and classification of ores. It is not sufficient for an engineer to know whether this rock is a granite, or that one a diorite; it is not sufficient to unearth hidden treasure and bring it to the light of day; no, in ninety out of a hundred cases, the real work and trouble begins with the preparation of the ore for the market. It is all very well to dig out silver by the bushel as they do in some of the Cobalt mines. These mines are exceptions to the rule, and they form only a very minute percentage of the working mines. Gentlemen,—and I mean specially those young fellows who are preparing for the difficult task of the mining engineer,—only a few of

you will have the pleasure of becoming the leading spirit of a mining enterprise, where there is abundance of rich ore, and where there is perhaps no difficulty in marketing whatever you get out of the mine. But, I venture to say, that most of you in the course of your professional career, will have to confront other more serious problems, some of which will tax not only your knowledge of concentration but also your resourcefulness. You may be called upon some day by people who put unlimited confidence in your ability, to take your place at the head of a large mining enterprise, to answer the fundamental questions which determine the value of a property: How much will it pay? How long will it pay? And how much will it cost?

Gentlemen, I think I have already taken up too much of your time, yet in conclusion may I be permitted to say one word more: Do not neglect the study of the fundamental principles of ore separation and classification.

I trust that I have shown you in the examples I have mentioned why you should devote much of your time to these subjects. You enjoy such great facilities here in McGill University, that I should think you would find no trouble, whatsoever, in making yourselves acquainted with the subject under discussion. You have all the important machines that are used in concentration, and on which you can study at your leisure the principles involved, and in this respect, McGill is far ahead of any other institution of a similar nature. I remember that, when I was studying at the Academy at Aachen, Germany, our mining professor explained the working mechanism of various apparatus by small models, which were supposed to be true copies, and that we never had the opportunity—as you gentlemen have here in this institution—to put these to practical tests. I must congratulate you upon the splendid equipment of your mining laboratory and concentration plant; but this is simply due to the untiring efforts of Dr. Bonsall Porter.

CLAY AND THE CLAY INDUSTRY IN ONTARIO.

By W. G. M.

The more stable but more prosaic mineral industries of a country are apt to be neglected somewhat for those which appeal more strongly to men's imagination or cupidity. The clay working industry, which next to agriculture, can be called the most ancient of industries, has up to the present been almost neglected by scientific workers, although during late years in Germany, the United States, and in other countries, it has been receiving more attention. Several of the States of the American Union, and other countries, now have departments devoted to the study of clay and its products. In Ontario the clay industry has grown rapidly during

* "Engineering and Mining Journal," 1905, to page 643.

recent years. Brick, being cheaper than stone, is being used in modern cities in place of wood on account of fire protection purposes. As years go on, the clay industry must become proportionately more important. It is well, therefore, at this time, for Ontario to have a systematic report such as that of Mr. M. B. Baker, on "Clay and the Clay Industry." The report is now in press and will be distributed at an early date by the Bureau of Mines, Toronto.

In Part I. of his report Mr. Baker gives, in 41 pages, an account of the character, origin and modes of occurrence of clay, written in such a way as to be understood, it is believed, by persons who have had little technical training. His age classification of clays will doubtless be found very useful by manufacturers as well as having an educational value from the side of culture. Every worker's interests will be widened and his mental attainments broadened by his understanding something of the origin and relationships of the materials with which he is dealing. There is nothing in Mr. Baker's report treating of the relationships of the various shales and clays—Erie, Red Top, Leda and Saugeen—with which every clay worker in the Province has something to do, that cannot be understood by almost any one who can read English. Manufacturing difficulties will thus be avoided and a scientific knowledge will be gained which cannot be estimated in mere dollars and cents.

The 15 pages of Part II. are devoted to the manufacture of clay products. In these pages the methods of manufacture are described and practical hints are given for overcoming difficulties which are met with almost daily in manufacturing.

In Part III., pages 56-112, typical shale and clay working plants are described under the heading of counties, which follow one another in alphabetical order. This part of the report will be of local interest. The clay worker who desires to gain a knowledge of the modes of occurrence of his material, will have descriptions of similar occurrences in his own county with which to compare it.

Pages 112-120 deal briefly with various industries in which clay is used as part of the raw materials.

The 71 illustrations in the report have been carefully selected to represent typical occurrences of clay and shale, to throw light on the modes of occurrence of these materials and to represent various machines and plants used in the clay industry in the Province.

Mr. Baker's work in connection with the industry has not only been of value in the preparation of this report, but he has done work, which has been highly commended by clay workers in various parts of the Province, in giving practical advice in his visits to many plants.

Three or four years ago the clay workers, first of Ontario, and now of the whole Dominion, organized

a society known as the Canadian Clay Products Manufacturers, which holds an annual meeting—the last three being at Waterloo, Hamilton and Toronto respectively—at which numerous papers are read and discussions are held on various topics connected with the industry. These meetings have proved very valuable and every clay worker of the Province should join the rapidly growing membership of the society.

The statistics of the clay industry show more clearly than can otherwise be done the relative importance of clay among mineral products. In this Province the manufactures from clay have till recently represented nearly 20 per cent. of the output of our total mineral industry. In the United States clay products form nearly 10 per cent. of the very large mineral output. Moreover, it should be remembered that a high percentage of the receipts from the clay industry are expended on labor and supplies. From this point of view no mineral industry can be claimed to benefit a community or a country more than that of clay.

BRITISH COLUMBIA IN 1906.

By Arthur Wheeler, Jr., Vancouver, B.C.

The year just past has been by far the best, from the standpoint both of tonnage and value, that British Columbia has had since her advent into the list of mineral producing countries of the world.

While the figures following are only approximate, full returns not being yet available, they have been compiled by Mr. Wm. Fleet Robertson, Provincial Mineralogist, and may be taken as rather under than over the mark.

Compared with the official figures for 1905, the estimate is:—

	1906.	1905.
Gold	\$6,070,000	\$5,902,402
Silver	2,200,000	1,971,818
Copper	8,690,000	5,876,222
Lead	2,690,000	2,399,022
Coal	4,590,000	4,152,936
Coke	1,050,000	1,358,925
Miscellaneous	1,100,000	800,000
Totals	\$26,390,000	\$22,461,325

Worked out these figures mean that copper has increased in value of production 49 per cent.; lead, 13 per cent.; silver, 11.6 per cent., and gold 3 per cent. Coal production has increased 10 per cent. and miscellaneous products 13½ per cent. Coke has fallen off slightly, owing to the seven weeks' strike in the Fernie coal mines during October and November last.

This strike not only lowered the possible production of coke, and coal, but seriously affected the copper, lead and silver production, as during the strike practically all the up-country smelters either closed entirely or seriously curtailed their output.

Consequently many of the mines ceased mining and undertook repair work, and, this reduced the possible output by perhaps \$5,000,000.

As can be seen from the table above the total estimated value of British Columbia mineral output last year reached the enormous total of \$26,390,000, which one, taking the population of the province as only 200,000, being less than the population of the city of Seattle, the fact of the richness of this province is made more apparent.

Figuring out the per capita production of mineral, mined in British Columbia in 1906, shows that nearly \$132 was produced for every man, woman and child in the province.

Tonnage.

From statistics to hand, the ore tonnage for the past year is as follows:—

	Tons.
Coast (estimated)	90,000
Boundary.. . . .	1,155,138
Rossland	281,711
Slocan-Kootenay.. . . .	133,299
Total	1,660,148

ATLIN.

The gold output for this district for 1906 was approximately \$500,000, with every prospect for a much increased production for the coming season, due to the fact that the advent of the Guggenheim Exploration Syndicate has led to much better processes for saving the gold and on a very much larger scale than heretofore.

Pine Creek.—Work on this creek has been confined almost entirely to two companies, the Pine Creek Power Company and the Atlin Consolidated Mining Company. Both of these companies have been very successful. The former operated two pits with three giants with 7-in. nozzles in each pit. From 20 to 25 men were employed in each pit and the plan of exploding 2,000 pounds of 75 per cent. powder in one blast was adhered to with the same gratifying results as in 1905.

The Atlin Consolidated Mining Company is operating above the Pine Creek Power Co. The company did not get properly started until August, when a 70-ton Bucyrus shovel was installed. After work started in earnest \$1,000 was taken out every 24 hours.

On Boulder Creek, a tributary of Pine Creek, La Societe Miniere de la Colombie Britannique realized \$40,000 for the season's work.

Spruce Creek.—It is this creek that the Guggenheims intend operating. They have secured practically everything excepting the property of the Spruce Creek Power Company. They will, in all probability secure enough stock in this company to gain control and will then, according to Mrs. Rosa-

lind Watson Young, A.M., I.M.E., to whom I am indebted for the information concerning Atlin, which appears in the current number of the B. C. Mining Exchange, put in a bedrock flume and mine the gravel by steam shovel.

A company operating on Spruce Creek called the Northern Mines, Limited, has come to grief through having two managers. Another, the Columbia Hydraulic Company, has sold out because it installed a plant without having first prospected the ground, and still another, the British Columbia Dredging Company only operated for one month and, as returns were unsatisfactory, then ceased operations.

So far dredges have proved a total failure in Atlin and only steam shovels have paid the big operators.

McKee Creek.—Work is now confined to the McKee Amalgamated and the McKee Consolidated Companies, who have control of the creek. These two companies are under one management. H. Plumbe, who has been in charge for two years, in the absence of the Hamshaw Brothers, has secured for his company about \$50,000 each year. In the coming season a steam shovel and tram system are to be introduced. McKee has been a dividend producer.

Speaking of this company, Mr. Fletcher T. Hamshaw, the manager, said recently: — "The steam shovel will be operated in conjunction with the hydraulics already in operation. I will hydraulic off the top material down to within 12 feet of bedrock, and pick up the gold-bearing gravel together with four feet of soft bed rock with the steam shovel.

"The plant will consist of a Bucyrus 110-ton steam shovel, one mile of railroad and switches, 30 six-cubic yard cars, two 20-ton electric locomotives and 1½ mile of flume. A permanent washing station will be built on the hogback near the canon, giving 160 feet of a dump, and the dump is at a point where the creek has a 12 per cent. grade. Ten cars will be dumped at one time, and all boulders will be hydrauliced on the grizzly under 150-foot head. There is a 120-foot dump for the grizzly. The system is gravity throughout. Owing to the heavy grade on this creek, the haul will be less than one-half mile on a down grade of one foot per 1,000 feet. The physical conditions are very favorable to economic working. A small sawmill will be taken in this winter on the ice, and the lumber sawed on the ground.

"The Guggenheims have made a success of their steam shovel on Tar Flats this summer, and I understand have bonded one-third of the district, so that I expect next year will see a great deal of development work, and the installation of new plants will greatly add to Atlin's output, and make it one of the heaviest gold-producing sections of the North."

WINDY ARM AND WHITE HORSE.

In both these districts extensive work has been going on all last season. A large number of properties are being opened up in and around Conrad City and Wynton, a town on the British Columbia side of the boundary line, built at the foot of Windy Arm.

Near Tutshi Lake some rich strikes have been made, copper, gold and silver values being very high in many of the ores found.

In all probability a smelter will be built at White Horse this summer.

The ores there are rich in copper, some shipments having realized 30 per cent. net at Tacoma, Wash., U.S.A., smelter. This long haul militates against the successful development of the camp and it is reported on excellent authority that Capt. John Irving of Victoria, B.C., the pioneer in copper mining, has succeeded in raising the necessary capital for the erection and working of a smelter in the White Horse district.

It is also reported that a large concentrating works will be erected at Conrad City to reduce the ores of the Windy Arm camp.

COAST DISTRICT.

The writer has just returned from an extended trip up the British Columbia coast and found throughout the entire coast line the signs of the most encouraging activity. The weather at present and for some time past has been too severe to permit of much work being done, but just as soon as the spring opens there will be one of the most startling mining booms that the coast has ever seen. During the trip I interviewed several miners returning from Portland Canal and the interior and all had the same story to tell of splendid mineral found and lots of it. Coast mining will be the subject of a future article and anticipating that I will briefly review the actual mining done on Portland Canal, Texada and Vancouver Islands.

Portland Canal. — The progress of this camp during the past season has justified all expectations. The many properties on which development work has been done has proved the fact that the ore bodies are of great extent and permanency.

Several new strikes were made, and of the many prospectors who visited the district, and prospected for the season, not one failed to locate property of value. Many of these also took up pre-emptions and purchased lots in the townsite, and erected houses on their holdings.

A considerable number of mining claims changed hands, and many more deals would have been made, but the prospectors for the most part refused to consider any proposition other than a part cash payment down, which in most cases led to the deal falling through. This policy is bad for the camp and also for the prospector.

The delay in commencing the construction of the bridge across the Bear River, which is confidently expected will be built this fall, retarded progress greatly; the heavy snowfall of last winter caused an unprecedented high water in June and July, which rendered the cable by which the river is at present crossed unavailable for days at a time.

In attempting to ford the swollen stream a party of prospectors were swept off their feet and only succeeded in reaching the shore by a miracle.

On Glacier Creek the greatest activity was manifested. McGrath and Griffin have exposed their lead on the Little Joe and Lucky Seven for the entire distance of the two claims, and have crosscut it in several places, exposing ore in every cut. They have also run 30 feet on the vein, and will continue work all winter. The Stewart Trading Company have an option on this property, which is one of the best located in the district, being only five miles from tide water and at an elevation of 2,000 feet. The average width of the vein is six feet, which is galena and iron pyrites with considerable lead carbonates, and the values run from \$30 to \$400 per ton in silver, lead and some gold. The vein lies in the contact between slate and porphyry, and the strike is N.W. and S.E., being the same as practically all the ledges in this district.

Adjoining McGrath and Griffin's property the Portland Development Company have a force of men at work sinking a shaft on their main lead, the ore of which is similar to other veins in the vicinity, the iron pyrites carrying gold to the amount of \$60 per ton.

On the Olga, purchased a year ago, for a few hundred dollars, D'Arcy McDonald has a good showing, an average assay of the dump giving \$51 in silver and lead.

A half interest in the Jumbo group was sold to S. Silverman, of Seattle. S. Gourley, who still retains the other half, has refused many offers for his interest. No work was done on this property other than the usual assessment work, which was also the case on the adjoining claims, the Halla and June. An offer to bond these claims for \$30,000 was refused a year ago, but a deal is now pending at an increased figure.

Some new locations were made adjoining these claims by J. Welch, P. Boyle, Hucker and Strickland, of Ketchikan. This ore is arsenical iron pyrites, and carries values gold, \$37; silver, 6 oz.; copper, 2 per cent. A group of claims was also located by J. Perault, for Ketchikan people on similar ore, three miles further south, the average from which was \$10 in gold.

Rush and Bagg have been working on their lead all summer, and have proved the property to their satisfaction. Some of the ore from this claim runs 2,000 ozs. in silver.

On claims owned by M. K. Rogers the usual assessment work was done. The Copper King was

bonded by G. M. Brown, of Seattle, the first payment has been made, and Mr. Brown, who is now in Seattle, is expected back shortly, with material to work the property all winter. This ledge is 39 feet in width, and carries values from 8 to 12 per cent. copper with a little gold.

McKay and Bibeau will ship some ore this fall from their claim, which is proving, on development, to be one of the best in the district.

Bert Ranche will make a ten-ton trial shipment from his claim, the Main Reef, as soon as the Stewart Land Company have finished their floating wharf. The ore averages \$90 in silver and lead, and the property is favorably situated, being only six miles from tide water.

On the Sunbeam the ledge has been traced throughout the entire claim, and open cuts run, showing up a large body of ore, with a well defined pay streak.

Several new locations were made on Bitter Creek, of which the Copper Canyon group seems the most promising. The main ledge on this property is three feet in width, lying in slate and porphyry, and contains values of \$41 in copper and gold.

On the Roosevelt, a copper-gold property on which development work has been carried on for some years, a four-foot vein of galena was located, which promises to rival the original location both in extent and value.

While doing assessment work on the Rainier, Fred Rainey discovered a three-foot vein of galena and quartz with about eight inches of lead carbonates, an assay from which gave \$174 in silver and 60 per cent. lead.

Among new locations made was the Greenhorn group, a three-foot ledge of quartz carrying copper 12 to 20 per cent., silver 6 oz. Also a group of claims 22 miles from Stewart on an iron cropping carrying values in gold and copper.

On American Creek, the American Girl group maintains its pre-eminence. Only assessment work was done on the claims this season by the owners, who, owing to the San Francisco disaster, were involved in a delay in regard to the taking over of the property. A new lead was discovered on the ground carrying high values in silver.

On the May Bee and Louise a tunnel was run on the ledge which is 17 feet in width; the pay streak is 2½ feet, and averages \$35 in silver. This ledge is crosscut by a canyon, and a vertical depth of over 100 feet of the vein is exposed.

Assessment work was also done on the Rangoon and Bandolier, and some good ore discovered, assays giving silver, \$341; copper, 27½ per cent.

Work was carried on all winter on the Kansas group, and 70 feet of tunnel run. Some new locations have also been made on this creek which promise well. The season is now practically over, and many of the prospectors are leaving. Many have

gone to Maple Bay Mines, where 150 men are now at work. It is expected that about 50 men will winter here, and should the erection of the bridge be commenced immediately probably many more will remain.

Texada Island.—On Texada the Marble Bay Mine has been steadily shipping high grade bornite ore all the year at the rate of 1,000 tons per month, netting the operating company about \$25,000. This mine is perhaps the most profitable in British Columbia and has the best showing of copper ore in the province. The ore at present being mined is obtained at the 800-foot level which is 950 feet below sea level. The writer visited the mine last April and thanks to the courtesy of the manager, Mr. Alexander Grant, had the privilege of examining the mine in company with Mr. Charles Sangster, the coast representative of the Rand Drill Company, and several well-known mining men from Vancouver, including Mr. W. Thos. Newman, M.C., M.I., and the foregoing facts were ascertained then and have since been corroborated by many.

Further north, on Texada Island, the Loyal group owned and operated by Mr. Jacobs, of Seattle, is showing up well as are also the Copper Queen and the Cornell adjoining the Marble Bay. The two are operated by Seattle capital and are both paying good dividends.

Half way across the Island and five miles from the Marble Bay, W. Thos. Newman is opening up the Commodore Mine with considerable success. The showings on this property are remarkable and the geological conditions offered a field for the most thoughtful consideration and were most carefully investigated before any work was undertaken.

The work on the Commodore is now in an advanced stage and Mr Newman reports that next summer will see the Commodore a big producer.

Vancouver Island.—The Tye Mine, on Mount Sicke, has continued to ship ore all year and, in addition, has been steadily sinking, prospecting for the ore body at depth. In this mine the main ore body extends through Mount Sicke in the form of a huge shoot at about the 300-foot level. This shoot is about exhausted but the management has succeeded in locating similar ore but of much lower grade at the 1,000-foot level, and is now cross-cutting this body at the 1,250-foot level. Whether this cross-cut has cut pay ore or not is not yet known. The Tye Company, however, is in splendid shape, and after paying dividends for years, building a smelter and operating the mine, has the original capital intact in the books in London, Eng., and can by securing new ground still continue business. Mr. Clermont Livingstone, the resident managing director, reports that work on an adjoining property, the X. L., is showing up some good ground.

Adjoining the Tye is the Richard III, in which, recently, an important strike of high-grade copper ore was made. This property will be one of the



Canadian Government Mineral Exhibit, Christchurch, New Zealand.

most important shippers in Vancouver Island this coming year.

On the west coast of Vancouver Island, there is every prospect of renewed life in a mining sense this year. Very little work of any description was done last year.

THE INTERIOR.

While on the coast there has been, and is, a very healthy movement in mining, the interior mines have been the mainstay of the industry during the past year. The great bulk of the tonnage has, as can be seen from the table of shipments given at the beginning of this article, come from the Boundary country, assisted materially by Rossland and Slovan-Kootenay.

The greatest producer has been, and is, the Granby Company, operating at Phoenix. Out of a total ore tonnage from the Boundary country of 1,155,138 tons, this company shipped to their smelter at Grand Forks, 804,598 tons or 69 per cent. The Dominion Copper Company ranks next with 216,788 tons and the British Columbia Copper Company third, with 121,241 tons.

The output of the latter company was curtailed very considerably owing to the fact that the plant at Greenwood was closed down for several months while the smelter capacity was being doubled. The smelting capacity of this plant is now 1,500 tons per day and a very large increase may be looked for from the British Columbia Copper Company's mines this year.

According to Mr. W. B. Wilcox, the editor of the Phoenix Pioneer, to whose excellent special number, just published, I am indebted for the information on the Boundary, in six years and a half the mines of the Boundary have sent out to the district smelters approximately 4,644,000 tons of ore. This is from 1900, in the middle of which year ore shipments were commenced, to the end of 1906. It will thus be noted that the progress has been little short of marvellous. In 1900 but 97,000 tons were shipped, while in 1906 a total of about 1,191,000 tons of Boundary ore were dug out of our mines and sent down the hills in different directions to the three district reduction works—eleven times as much in 1906 as in the year 1900. To show the yearly progress and increase of output the following table is given:—

1900..	97,000 tons.
1901..	390,000 "
1902..	509,000 "
1903..	690,000 "
1904..	830,000 "
1905..	953,000 "
1906 (Dec. estimated)	1,191,000 "
Grand total	4,660,000 "

Not only has the British Columbia Copper Company increased the capacity of their smelting plant but the Granby Company has also considerably enlarged some of their furnaces, and at present the Dominion Company are spreading out and are at least doubting their smelter capacity at Boundary Falls.

The recovery of copper per ton from the ore of the mines of the Boundary is known to be low, comparatively speaking, and an average rate of 25 to 30 pounds per ton is considered conservative. On this basis, the copper fine production of the Boundary mines for the first year of ore shipping, 1900, was but 3,000,000 pounds. On the same basis, the recovery for 1906 will amount to about 35,000,000 lbs.—an amount sufficient to make it worth while in the world's grand total. Altogether the mines of the Boundary in these seven short years, have contributed approximately 140,000,000 pounds of copper. In addition to this there are the gold and silver values to be considered. The values of the ores thus treated would amount to more than \$25,000,000, not taking into consideration the high prices prevailing for the brown metal for the last year or more.

The Granby Company is spending about \$100,000 at present on the Victoria property shaft and headworks. This shaft, when completed, will be the permanent working outlet for the whole of the company's mines in Phoenix. They are now down 400 feet, the shaft has been timbered and will be ready for use in the early spring. The hoisting engine will be driven by electricity and is 250 h.p. There are at present two crushers of 150 tons per hour, minimum, capacity and another is being installed at the headworks of a like size, giving the company the necessary machinery to crush 450 tons per hour, minimum.

Ore bins are being erected at the shaft and both the Canadian Pacific and the Great Northern Railway companies are making arrangements for connections.

Development work has been steadily pushed and is now years ahead of needs. More properties have been secured. The Gold Drop group has been extensively exploited and has proved the property has immense tonnage. On the Curlew a large tonnage has also been opened up. This claim being below the Gold Drop may eventually be used to tap the ore reserves of the latter by means of tunnelling.

On the Dominion Copper Company's property new machinery is being installed with a view to in-

creasing the shipments to meet the requirements of the new enlarged smelter.

The B.C. Copper Company has been working towards a much larger output from their Mother Lode mine. The output from this mine will be trebled and will, it is confidently expected, ship 1,500 tons per day this year. The Emma, in Summit Camp, on the C. P. R. branch, from Eholt to Phoenix, has also been extensively developed. The company, last year, purchased outright the Oro Denoro, adjoining the Emma of the B.C. mine in the same camp. The B.C. mine, in the past, has shipped 100,000 tons of ore while the Oro Denoro is known to have large reserves of ore which can be cheaply mined, and being situated right on the railway very cheaply shipped.

A most important feature in connection with the huge operations in the Boundary country, is the fact that the Granby Company has paid dividends during the past year at the rate of 12 per cent. on a capitalization of \$15,000,000 on 1.1 per cent. copper ore. Considering that the original price of the stock was 25 cents on the dollar this means that original holders received, last year, about half their original investment back in the shape of dividends and hold their stock now at 33 per cent. above par.

One important feature of the year's development in the mines of the Boundary was the advent of the Consolidated Mining & Smelting Company of Canada to Phoenix, when that company took a lease on the well known Snowshoe mine here. That this company, which is operating so successfully at Rosslund, should reach out into the Boundary and take up one of the large properties, is another evidence that the Boundary is attracting the attention of more and more mining men of note. The Snowshoe is now shipping ore daily.

While Boundary's copper mines have been shattering all previous records for output, etc., the high grade silver and gold mines of this section have not been forgotten. Chief among these is the Providence, near Greenwood, which is to-day a better mine than ever before. A dividend of some \$16,000 was paid in September, and development with some 35 men has been steady all this year. The company will doubtless make an even better record during the year to come.

The Skylark is another silver mine that has done well, having paid for development and the bond also from the proceeds of the ore shipments in the last two years. Its Phoenix owners should begin to receive some profits this coming year.

Among the large number of mines in the high-grade belt that are looking well and doing satisfactorily may be mentioned the Elkhorn, Prince Henry, Strathmore, Bay, Mavis, Crescent, Don Pedro, E. P. U., Helen, Tip Top, Greyhound, Moreen and a dozen others.

(To be continued.)

THE CANADIAN ROCKIES.*

By Reginald A. Daly.

(Continued.)

It is well known that one of the first designations of the entire mountain group lying between the Pacific and the Great Plains was due to Humboldt. His "Cordilleras of the Andes" extended from Cape Horn to the mouth of the Mackenzie river. Humboldt occasionally used the singular form "Cordillera of the Andes" for the same concept. In view of the general restriction of the term "Andes" to the mountains of South America, Whitney, in 1868, proposed that the name "Cordilleras," with variants, "Cordilleran System" and "Cordilleran Region," be retained to designate the North American equivalent of the Andes. This name was adopted in the United States census reports for 1870 and 1880, and by a great number of expert geologists and geographers since 1868. In process of time, however, the singular form, "Cordillera" and variants, became used in the same sense. In one of these forms the Humboldt root word with Whitney's definition has entered many atlases. It appears on numberless pages of high-class Government reports, geographical, geological, and natural history memoirs, and of such works as Baedeker's "Guide-book to the United States," Stanford's "Compendium of Geography," etc.

The time-honored, erroneous, similarly inclusive name "Rocky Mountains," with variants, "Rocky Mountain System," "Rocky Mountain Belt," etc., has, however, held the dominant place in the popular usage. Its inappropriateness for the heavily wooded Canadian mountains is abundantly evident. For the United States, Clarence King wrote a generation ago—

"The greatest looseness prevails in regard to the nomenclature of all the general divisions of the western mountains. For the very system itself there is as yet only a partial acceptance of that general name Cordilleras, which Humboldt applied to the whole series of chains that border the Pacific front of the two Americas. In current literature, geology being no exception, there is an unfortunate tendency to apply the name Rocky mountains to the system at large. So loose and meaningless a name is bad enough when restricted to its legitimate region, the eastern bordering chain of the system, but when spread westward over the Great Basin and the Sierra Nevada, it is simply abominable."†

The following table summarizes the above-mentioned variants along with others more recently introduced, and still other general names now only of historical interest. The names of prominent authorities and the leading dates when they have published the respective titles are also entered in

the table. The authority for some of the older names is Whitney's work on the United States, published in Boston, 1889.

Mountains of the Bright Stones—

General use, end of eighteenth century.

Shining Mountains—

Morse, "Universal Geography," 1802.

Stoney or Stony Mountains—

Arrowsmith, 1795; President Jefferson.

Columbians (*sic*) Mountains—

Tardieu, 1820.

Chippewayan Mountains—

Hinton, 1834.

The Cordilleras of the Andes (in part)—

Humboldt, 1808, etc.

The Cordillera of the Andes (in part)—

Humboldt, 1808, etc.

The Cordilleras—

Whitney, 1868; many authors since.

The Cordillera—

G. M. Dawson, 1884, etc.; Gannett, 1898; Rand-McNally, 1905.

The Western Cordillera of North America—

J. D. Dana, 1874, 1880.

The Cordilleras of North America—

Hayden, 1883; Leconte, 1892, etc.

The Cordilleran Region—

Whitney, 1868, etc.; Hayden, 1883; Shaler, 1891.

The Cordilleran System—

Whitney, 1868, etc.; King, 1878; Baedeker, 1893.

The Cordilleran System—

Hayden, 1883.

The Cordillera Belt—

G. M. Dawson, 1879; etc.; Rand-McNally, 1902.

The Pacific Cordillera—

Russell, 1899, 1904.

The Cordilleran Plateau—

Hayden, 1883.

The Cordillera of the Rocky Mountains—

J. D. Dana, 1895.

The Rocky Mountain System—

Leconte, 1892, etc.; Heilprin, 1899; many others.

The Rocky Mountain Region—

Powell, 1875, etc.; G. M. Dawson, 1890; Gannett, 1899.

The Rocky Mountain Belt—

Rand-McNally, 1902.

The Rocky Mountains—

Lewis and Clarke; popular.

The Pacific Mountains—

Russell, 1899, 1904; Powell, 1899.

The Western Highland.

Baedeker, 1893; Keith Johnston Atlas, 1896; Davis, 1899.

The Rocky Mountain Highland—

Frye, 1895, 1904.

The Western Plateau—

English Imperial Atlas, 1892.

(To be continued.)

* Published by permission of the Canadian Commissioner, International Boundary Surveys.

† "U. S. Geological Exploration, 40th Parallel, Systematic Geology, 1878," p. 5.

THE TREATMENT OF ARSENICAL ORES.

By Chester F. Lee, Mining Engineer.

The Cascade range is noted for the arsenical character of many of its ores. At Monte Cristo, Goat Lake, Silverton, Silver Creek, Elba and many other places a considerable arsenic content is a characteristic. Not all the ores of this range are arsenical by any means, but those in which this constituent is prominent are so widely spread and so considerable in amount that the handling of them and the getting of some return for the arsenic contained is a vital matter. The only plant in the state that can make marketable arsenic (the white arsenic of commerce, As_2O_3) is at Everett, and indeed, until 1904, when the Anaconda works in Montana were supplied with a plant for extracting arsenic from flue dust, this was the only place in the United States where it was made.

At the present time, what ores of this class are treated at all are shipped to smelters and treated as gold or silver ores pure and simple, and a penalty of about 50c is exacted for each per cent. of arsenic over a certain amount and the smelters refuse to take on any terms ores high in this metal; as they claim that the volatilization of arsenic in the roasting furnaces and the smelter stacks causes undue losses of the precious metal. Producers of ore have long contended that not only should they not be penalized for their arsenic, but they should be paid for it. They point out that the Anaconda works has produced, in the three years ending July 1st, 1906, 1,107,176 pounds of white arsenic, all of which was sold at a good price and all of which came from a by-product, flue dust.

If this is the case, how much more ought their ores, rich in arsenic and of fair gold and silver values, to have the treatment suited to them the pecuniary benefit of which would be felt in every mining district of the state.

The quantity of these ores and the development work done on the properties that can produce them is sufficient to warrant a constant and increasing supply; why, then, cannot this metal receive the same sort of attention accorded to copper, lead, zinc, etc.? The reason probably is that the metallurgy of arsenic has had no attention in this country, as heretofore there has been no visible supply of the raw material. The beginning of better things seems to be now at hand, and the American Smelting & Refining Co., to whose tender mercies we seem to be irrevocably committed as far as reduction works are concerned, are said to have promised some return for arsenic in a certain district, provided a sufficient tonnage to be regularly shipped was guaranteed them.

White arsenic is worth on the average from 3 to $3\frac{1}{2}$ cents per pound. This is the grade known as "commercial."

You will see quoted in the lists of chemicals "refined" and "C.P." (chemically pure) at rates

several times this and at the present time, in sympathy with other metals, the price is considerably above this, but an average of $3\frac{1}{2}$ is all that it is safe to count on year in and year out, for the unrefined product.

The general run of the Cascade ores of this class contain from 3 to 10 per cent. of metallic arsenic (As.). About 6 per cent. may be taken as a fair average, as that is what a careful sampling of two of the best known mines gives. Six per cent. metallic arsenic will produce 160 pounds of commercial white arsenic theoretically (6 per cent. is 120 pounds per ton; allow one-third more for the oxygen absorbed from the air, as the atomic weight of As_2 is 150, and of O_3 is 48.), and we have 160 pounds white arsenic, allow 5 per cent. loss on this in the process of obtaining it, and we have 150 pounds net; now deduct for the cost of reduction, packing in barrels, freight, etc., $1\frac{1}{2}$ c per lb., and we have 150 pounds at 2c., or \$3.04 as a fair return on a 6 per cent. ore. Many of our Cascade ores carry from \$6 to \$10 in gold and silver, and this extra \$3 would make all the difference with them between success and failure, between profit and loss in the mining operations. It costs not a cent more to get this ore out than formerly, and if \$3.00 even can be added to the returns, it is an addition to the net.

Aside from the possibilities of shipping and smelting the ore raw there are at least three other courses open: 1. Water concentration with subsequent smelting of concentrates. 2. Cyanidation of the raw ore for gold and silver, and subsequent roasting for arsenic. 3. Roasting for arsenic with subsequent smelting of the roasted residue.

To take them up in order: Water concentration has been tried at Monte Cristo with only partial success. The sulphides and arsenides which carry the values are softer and more brittle than the quartz in which they occur and excessive fines and slimes result from grinding, the losses in this particular case are said to have run from 30 to 40 per cent. This mill has been lately repaired and will begin a new campaign in the spring under new management and the results will be looked for with interest. There are arsenical ores in other places in the Cascades better adapted to concentration than those of Monte Cristo, ores that are less massive and more granular as to the sulphides and in which the quartz and other gangue matter is not so tough and hard.

Raw cyaniding of sulphide ores has made a good deal of progress in the last few years and has been very successful in a number of cases. Cascade arsenical ores have been the subject of experiment here in Seattle in the laboratory and on a small practical scale and enough has been done to show that the thing is feasible in this case. An extraction of gold of 80 to 90 per cent. has been obtained and the estimated cost in a 100-ton plant is \$1.50 a ton for operation. After cyaniding and washing

the ores can be roasted for arsenic. This roasting should not cost more than 50 cents per ton.

The third possibility is to roast the ore first for arsenic in a comparatively inexpensive plant at the mine and ship the roasted ores to the smelters for the extraction of the precious metals. This would obviate many difficulties at present encountered. The ore would be freed from nearly all the sulphur as well as their arsenic, which would result in a slight enrichment of the product, the arsenic could be marketed by the producer and the smelters would be eager to get the desulphurized and dearsenuretted product and would be willing to pay good rates for it.

Good returns await the company that has ore reserves large enough and the courage great enough to be the pioneer along these lines. Either of the two latter methods should be the subject of careful experiment on a small working scale before works of any size are built. Under competent direction tests can be made at a reasonable cost with results that will be reliable and of great benefit to the mine owner and the mining industry of this section.

CORRESPONDENCE.

FROM THE ANTIPODES.

Dear Sir,—

I have sent you, under separate cover, photos of the mineral section of the Canadian Exhibit. It is by far the largest and most complete collection of economic minerals here, and our installation is quite different from any of the other exhibits.

The exhibition was opened on the 1st of November by the Premier, Sir Joseph Ward, and his first official visit was to the Canadian Court. He was very much impressed with the extent of our mineral resources.

The general public are more interested in our exhibit of asbestos, mica, nickel and cobalt, these minerals being new to New Zealand.

I have not had time to visit the mining districts, but will do so later on, the Minister of Railways having given me every facility for doing so.

The attendance, so far, has been very good and there is every prospect of the exhibition being a great success. Up to date the number of admissions is over 517,000.

New Zealand is a delightful country and the people the most hospitable I have ever met. There is no doubt whatever but that the trade relations between Canada and New Zealand will be materially increased as a result of the exhibition.

I shall be pleased to send you my impressions of the different mineral exhibits here, also anything I may come across during my trip through the colony.

With best wishes for the New Year.

Yours very sincerely,

R. L. BROADBENT,

The Editor, Canadian Mining Review,

Montreal.

[We reproduce in this issue two interesting photographs that accompanied Mr. Broadbent's letter.—Editor.]

We are requested to state that all communications, mail and express matter to the American Institute of Mining Engineers, or the United Engineering Society Building, should be addressed to 29, West 39th Street, New York City.

EXPERIMENTS WITH COBALT ORES.*

By Henry M. Howe, LL.D., William Campbell, Ph.D., and Cyril W. Knight, B.Sc.†

(New York Meeting, April, 1907.)

This paper gives the results of an investigation of the behavior of the argentiferous cobalt-nickel arsenides of Temiskaming, Ontario, in roasting, made in the metallurgical laboratories of the School of Mines of Columbia University in the City of New York. The ore was kindly given by the owners of the La Rose and Tretthewey properties at Cobalt, Ontario, and Mr. E. J. Hall, Tutor in Assaying in Columbia University, has helped us much.

I. Object of the Investigation.

The object of the investigation was to learn:—

1. The temperature at which the arsenic is most rapidly expelled;
2. The thoroughness with which it is expelled by prolonged roasting at this temperature;
3. The effect of adding charcoal (a) near the end of the roast and (b) at the beginning of the roast.

II. Nature of the Ore.

The important ores mined in the Temiskaming deposits are: native silver—with small amounts of dyscrasite (Ag_7Sb), argentite (Ag_2S), pyrargyrite (Ag_3SbS_3)—smaltite ($CoAs_2$), chloanthite ($NiAs_2$) and niccolite ($NiAs$). Misspickel ($FeAsS$) and cobaltite ($CoAsS$) also occur in smaller quantities. The average composition of the ore shipped from this district for the first six months of 1905 was: silver, from 4.1 to 4.8 per cent.; cobalt, from 6.9 to 8.2 per cent.; nickel, from 3 to 4.7 per cent.; and arsenic, from 30.9 to 34.6 per cent. The ore which we treated consists chiefly of smaltite. In our laboratory-work the temperature was kept below the melting-point of silver ($960^\circ C.$) in order to prevent loss of that metal, though our preliminary experiments showed that these ores do not frit or clog at this or even at a somewhat higher temperature.

The Temiskaming ores contain little gold, only \$0.40 per ton in case of the ores which we treated.

III. Sampling and Assaying.

About 43 lb. of the ore, in lumps about 3-in. cubes, were crushed so as to pass through a sieve of 20 meshes to the linear inch. In this crushing we caught and separated particles of metallic silver which represented about 75 oz. of silver to the ton of ore, or about 11 per cent. of its total value. Some of these particles were about 0.25 in. in diameter.

For assaying, a lot of 37 assay-tons was next separated from this crushed product by means of a "split" sampler, and then ground so as to pass a sieve of 100 meshes to the linear inch. In doing this a second lot of metallic silver particles, representing 117 oz. per ton of ore, was separated.

The results of 12 crucible-assays and 9 scorification assays were:—

	oz. per ton of ore
Metallic silver by the crucible process.....	477
Metallic silver by the scorification process. . .	497
Add metallic silver separated in crushing. . .	75
Add metallic silver separated in grinding. . .	117
Total silver-content	689

The ore contains 56 per cent. of arsenic.

For the silver-assay the following quantities were used: For scorification, 0.2 A.T. of ore was roughly divided into halves, each of which was scorified with 60 g. of lead and 1 g. of borax-glass. The resulting two beads were weighed together. For the crucible process, 0.5 A.T. of ore, 2.5

* A paper to be read before the American Institute of Mining Engineers, April meeting.

† Respectively Professor, Instructor and Student of Metallurgy in the School of Mines of Columbia University in the City of New York.

A.T. of lead oxide, 2-3 A.T. of soda, 1-3 A.T. of borax-glass, and 4.5 g. of argol were used.

IV. The Roasting.

The roasting was done in an American Gas Furnace Company's oven, 27 in. long and 20 in. wide inside.

The ore was held in shallow iron pans resting on the hearth of this furnace, and lined with 0.5 in. of fire-brick.

The temperature was measured by means of a Le Chatelier pyrometer. The thermo-couple was protected from arsenic and other fumes by a porcelain tube, and was placed immediately above the ore. It entered through a circular hole in the back of the furnace and was connected with a Keiser and Schmidt galvanometer, standardized by means of the melting-points of zinc, aluminum and copper. The temperature was recorded and the ore rabbled every 10 min. In none of the roasts was any fritting or clogging of the ore noticed.

V. At What Temperature is the Arsenic Expelled Most Rapidly?

Roast No. 1.—In this test, 3.5 lb. of the ore, crushed to pass a 20-mesh sieve, were placed in the furnace, the temperature of which had previously been raised to 490° C. The temperature was then gradually raised at the rate of about 120° C. per hour, until it finally reached its highest point, 870° C. Samples were taken with the usual precautions, and their arsenic was determined by fusion with sodium peroxide, neutralizing with acetic and sodium hydroxide (using phenolphthalin as an indicator), precipitation as silver arsenate with silver nitrate, and titrating with ammonium thiocyanate.*

The results of the roast are given in Table I.

Though the arsenic escaped pretty rapidly at first, yet towards the end of the second hour its escape was almost completely arrested, in spite of the continued regular rise in temperature. But when the temperature reached 840°, the expulsion of arsenic again became rapid. These results tend to prove that the behavior of smaltite resembles that of pyrite, of which the first atom of sulphur is removed at a much lower temperature than the second.

Table I.—Record of Roast No. 1. Gradually Rising Temperature.

Temperature of Roast. Deg. Centigrade.	Time from the Beginning. Hr. Min.	Quantity of Arsenic in Ore at Different Stages of the Roast. Per Cent.
490	0 : 00	55.9
559	0 : 25	
547	0 : 35	
577	0 : 45	
591	0 : 55	
596	1 : 00	46.6
601	1 : 05	
611	1 : 15	
624	1 : 25	
641	1 : 35	
666	1 : 45	
691	1 : 55	
706	2 : 00	40.7
721	2 : 05	
735	2 : 15	
763	2 : 25	
788	2 : 35	
814	2 : 45	
828	2 : 55	
838	3 : 00	40.3
848	3 : 05	
844	3 : 15	
864	3 : 25	
858	3 : 30	35.4
872	3 : 35	
863	3 : 45	31.0

*Miller's Quantitative Analysis for Mining Engineers, p. 114.

Conclusions.—1. That 15 per cent. of arsenic (per 100 of ore), i.e. 27 per cent. of the total arsenic, is expelled below 700° C.

2. That the rest of the arsenic is not expelled until the temperature reaches about 840°, when rapid expulsion again sets in.

VI. How Thoroughly Can Arsenic be Expelled at 890° C?

Roast No. 2.—In this roast about 3 lb. of ore, ground to pass a sieve of 20 meshes to the linear inch, were raised quickly to about 890° C. (a temperature a little above that which Roast No. 1 had shown that arsenic is rapidly expelled), and held near that temperature for about four hours, with frequent rabbling.

As shown in Table II, the arsenic was expelled fairly rapidly until it had fallen to about 20 per cent., but thereafter very slowly.

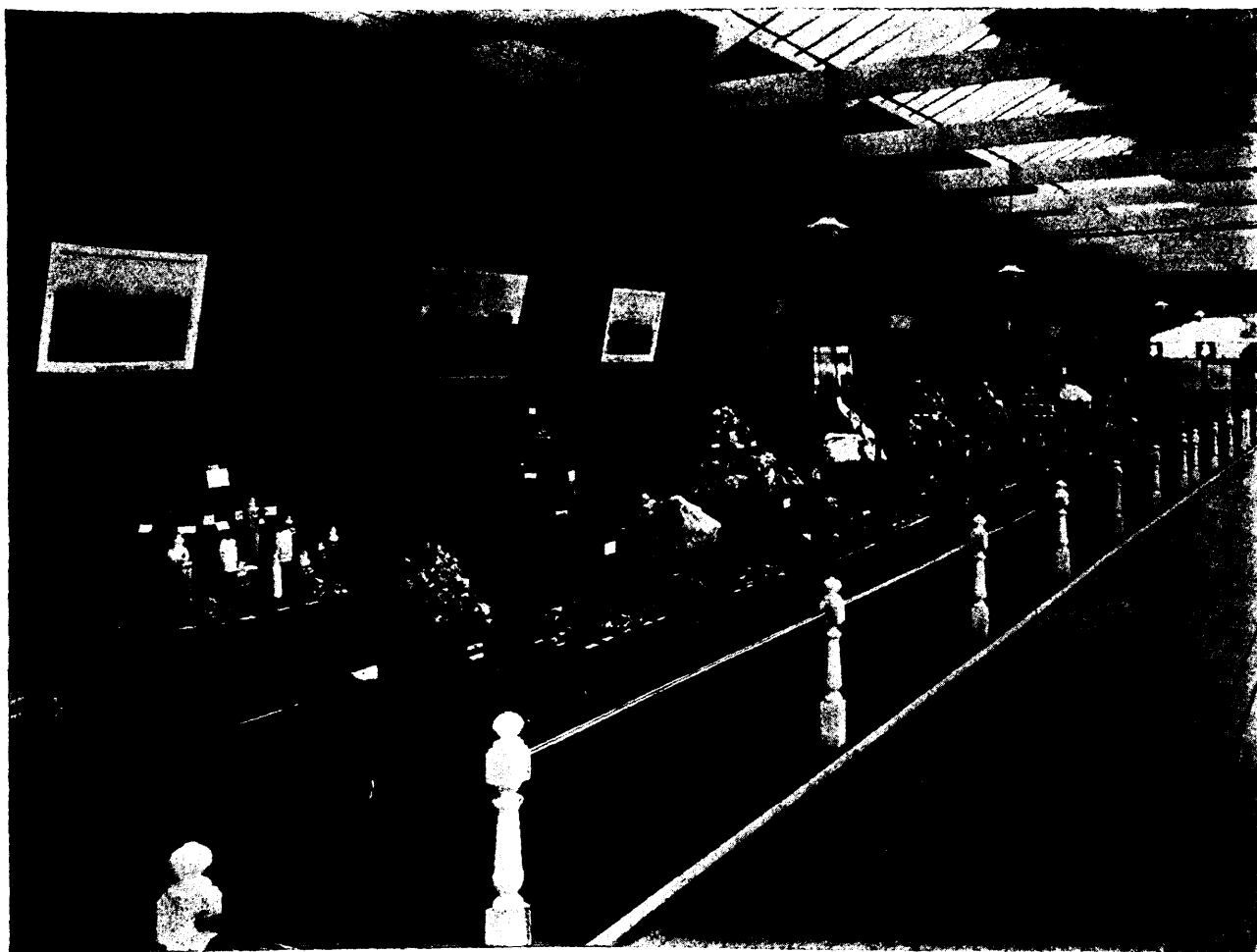
Table II.—Record of Roast No. 2. Temperature Held Near 890° C.

Temperature of Roast. Room Temperature. Deg. Centigrade.	Time. Hr. Min.	Quantity of Arsenic in Ore at Different Stages of the Roast. Per Cent.
463	0 : 35	55.9
533	0 : 45	
622	0 : 55	
693	1 : 05	
738	1 : 15	
795	1 : 25	
846	1 : 35	44.6
895	1 : 45	
895	1 : 55	38.0
909	2 : 05	
897	2 : 15	26.3
901	2 : 25	
886	2 : 35	21.7
883	2 : 45	
883	2 : 55	19.3
883	3 : 05	
885	3 : 15	
889	3 : 25	
883	3 : 35	18.3
891	3 : 45	
894	3 : 55	
899	4 : 05	
897	4 : 15	
902	4 : 25	
900	4 : 35	17.5
900	4 : 45	
898	4 : 55	
887	5 : 05	
883	5 : 15	
878	5 : 35	17.3

VII.—Does Charcoal Added after Roasting at 890° Cause Further Expulsion of Arsenic?

Table III.—Record of Roast No. 3. Charcoal Added After Roasting Near 890° C.

Temp. of Roast. Room Temperature. Degrees Centigrade.	Time from the Beginning. Hr. Min.	Quantity of Arsenic in Ore at Different Stages of the Roast. Per Cent.
470	0 : 35	55.9
606	0 : 45	
660	0 : 55	
723	1 : 05	
815	1 : 15	
856	1 : 25	
873	1 : 35	
886	1 : 45	
872	1 : 55	
864	2 : 05	
870	2 : 15	
874	2 : 25	
888	2 : 35	
875	2 : 45	
897	2 : 55	
890	3 : 05	15.8



Canadian Government Mineral Exhibit, Christchurch, New Zealand.

Charcoal added here.

882	3 : 20	
882	3 : 35	
894	3 : 50	
884	4 : 05	15.0

Roast No. 3.—In order to learn whether an addition of charcoal after long roasting between 840° and 890° C. (temperatures between which we had found that arsenic is expelled rapidly) causes further expulsion of arsenic by reducing the fixed arsenates to the volatile forms of arsenious acid and metallic arsenic, one of us roasted a third lot of ore at temperatures between 870° and 890° for 1.5 hr., and, without removing it from the furnace, he then stirred in 10 per cent. by weight of charcoal, ground so as to pass a sieve of 10 meshes to the linear inch, but not one of 20 meshes. The results are shown in Table III. If too coarse, charcoal disintegrates and scatters the ore, and if too fine it burns away too fast.

At the time of adding the charcoal, fumes of arsenic had ceased to be visible, but this addition caused a sudden evolution of dense fumes, which lasted for only a few minutes.

The charcoal had little effect on the arsenic. Before its addition the ore contained 15.8 per cent. of arsenic, and 1 hr. later this had fallen only to 15 per cent.

In this roast, after the ore had been exposed to a temperature above 856° for 1 hr. 40 min., its arsenic-content had fallen to 15.8 per cent., whereas in Roast No. 2, after it had been exposed 2 hr. to temperatures above 846° , it still contained 18.3 per cent. of arsenic. This difference tends to show that unnoticed variations in conditions may materially influence the rate of expulsion, as is the case in many roasting-operations.

The fact that the arsenic was expelled in this roast, before the addition of the charcoal, more thoroughly than

in any of the others, in spite of the very rapid raising of the temperature at the beginning, goes to show that the behavior of smaltite differs in an important way from that of pyrite, the temperature of which must be raised very carefully and slowly, lest the fritting or enamelling of the outer surface of the individual particles prevent the free access of the air to their interior, and thus arrest the roast.

VIII.—Does Charcoal Added at the Beginning of the Roast Increase the Expulsion of Arsenic?

Roast No. 4.—About 2 lb. of ore were mixed with 10 per cent. by weight of charcoal, raised to 880° in 2 hr., and held near that temperature for 1.75 hr. more, or a total of 3 hr. 45 min. The charcoal seems to have had little effect, because at the end of this time the ore still contained 17.5 per cent. of arsenic, or more than in Roast No. 3 after it had been above 856° for 1 hr. 40 min., and but little less than in Roast No. 2 after it had been above 795° for 2 hr. 10 min.; and in each of these latter cases the expulsion of arsenic was brought about without the use of charcoal.

These cases are here recapitulated:—

Roast.	After Remaining Above	For	The Ore Still Contained
No 2	846° without charcoal.	2 hr.	18.3 per cent. of arsenic
No. 3	856° without charcoal.	1 hr. 40 min.	15.8 per cent. of arsenic
No 4	880° with charcoal.	1 hr. 45 min.	17.5 per cent. of arsenic

IX.—Does Finer Grinding Increase the Expulsion of Arsenic?

Roast No. 5.—In order to learn whether finer grinding would lead to further expulsion of arsenic by exposing the ore more fully to the air, the ore which had already undergone Roast No. 3 was re-ground so as to pass a sieve of 100 meshes to the linear inch, and re-roasted for 2 hr. 30 min. at about 880° C.; but this re-roasting caused no further expulsion of arsenic.

X.—Summary of Results.

The following conclusions apply only to the particular ore here treated:—

1. The percentage of silver as determined by the scorification-method is about 4 per cent. higher than as determined by the crucible-method.

2. The ore neither clogs nor frits at or even somewhat above 960°, the melting-point of silver.

3. The arsenic can be reduced from about 56 to 41 per cent., or by 15 per cent., by roasting below 700° C. (Roast No. 1, Table I.).

4. It can be further reduced by about 24 per cent., viz.:—to 17 per cent., by roasting at temperatures above 840°, and in this higher range the arsenic is removed much faster than at lower temperatures. (Roast No. 2, Table II.).

5. Hence our inference that the behavior of smaltite in roasting is probably analogous to that of pyrite, which loses its first atom of sulphur much more readily than its second; yet, unlike pyrite, this ore may be raised suddenly to 800° without harm, because, unlike pyrite, it does not frit or enamel when thus suddenly heated, but remains open and porous, so that the air may penetrate it. (Roast No. 3.)

6. Charcoal, whether added at the beginning or towards the end of the roast, fails to increase the expulsion of arsenic. (Roasts 3 and 4.)

7. We doubt whether it will pay to reduce the arsenic-content below 20 per cent.; even by roasting at temperatures above 890° C., because its further reduction is very slow.

A NEW MINING ASSOCIATION.

The Hastings (Ont.) Mining Association has been incorporated with the following members:

Mr. W. A. Hungerford, Vice-President of the Atlas Arsenic Co., was unanimously elected President.

Mr. Arthur Coe—1st Vice-President.

Mr. E. B. Davies—2nd Vice-President.

Mr. S. Wellington—3rd Vice-President.

Mr. D. Gillen—Secretary.

Mr. R. T. Gray—Treasurer.

The Vice-President, in his address at the organization meeting held in Madoc, spoke as follows:

I can assure you I consider it a very great privilege to have this opportunity to speak to you this evening on a question that is of the deepest importance to this section of Ontario and this county in particular. We have met here to-night for the purpose of organizing two associations, both with the same object in view, the welfare of the community. And I do not think there is a gentleman here to-night, but is heartily in accord with the object of this meeting. I am not intending to speak altogether in the interest of the Board of Trade, only that I sincerely hope you will be successful in forming such an organization as at this time, more than at any other time in the history of Madoc, such an organization should be formed. But I would like to say a few words in behalf of the mining interest of Eastern Ontario. As we, the miners of this section, feel that the present mining laws and regulations are not adapted for this section, and that the legislation that has taken place is all based in the interest of the Cobalt section, and not for the older portion of the province. And we feel separate legislation should be made, so as to meet the wants of the eastern district. The conditions existing in this section, and the Cobalt section, are so far apart that the same laws and regulations cannot govern both districts satisfactorily. We also feel that nothing has yet been done by the present Government that has benefited in any way this portion of Ontario, not that they wish to discriminate against this section, but from their want of reliable information regarding our wants. And we feel that representation should be made to the Government, so that we may have our rights. This county is the premier mining county in Ontario, in fact, I might say in Canada. And although Cobalt is immensely rich in silver and we hope also in

gold, yet as a matter of fact, there is as much or more wealth in sight at the present time in Eastern Ontario and in this county, than Cobalt will ever produce, and when Cobalt has gone the way of all such mining camps, Hastings district cannot fail to be a flourishing mining centre. I do not make this statement out of any doubt about the richness of that section, but I make it from the facts connected with our county. In the first place Cobalt, we know, has some enormously rich silver mines, but in that alone consists her wealth. When they are worked out nothing will be left. Now, what has this district got. In the first place, we have more arsenical ores in the County of Hastings and Addington, than can be found in any other country in the world, and with capital to develop their deposits, we could produce enough arsenic in this district alone to supply the world's demand. And I make this statement knowing what I say to be the fact, that in no part of the Dominion of Canada can such views of auriferous free milling quartz be found as in this county. In the northern part of these townships you can see veins from fifty to two hundred feet wide. At the Craig mine in Tudor there is a vein over three hundred feet carrying free gold. True, the ores are low grade, but all high enough to pay if worked on a large scale. Then there are iron deposits in every township in North Hastings, and no finer iron can be found in the Dominion than in some of the best iron deposits. Look at the mines at L'Amable, owned by Mr. Farham, for which he refused \$2,000,000 within the last month. And what about our pyrites? In what part of this continent can they be found in such abundance as in this district. See what the Nickle's Co., of New York, are doing in the township of Hungerford—erecting a plant at a cost of over one million dollars, to treat the products of their own mines. Then we have copper. See what Col. Saunders has been doing with his copper smelter at Eldorado, and Mr. Cushman at Bannockburn, with his lead smelter. And besides these ores we have talc, soap-stone and marbles of every shade and color, sandstones, feldspar, mica, asbestos, actinolite, corundum, cobalt, plumbago, flourspar, lithographic stone, molybdenite zinc, sodalites, celestite, marbells, antimony, barite, apatite, fowlerite, and pyrrhotites, besides quarries of granites, gneiss, slate and lime stones. And it is because we have these minerals that we feel some sort of assistance should be given, and we hope that this association will be the means to bring this district more prominently before the public. The question has been often asked why our gold mines have not paid. The question is easily answered. In almost every case it has been the want of money, the want of experience, the want of development, and the cost of power. This is not a poor man's country, it requires capital to develop our mines, and the ores must be treated in large quantities, with two exceptions the largest mills in this district are ten stamp mills. As a rule our ores will not go over \$4.50 to \$5.50 per ton, although these exceptions in gold, which even with ten stamp mills would pay well, provided we had cheap power. When I tell you that it cost the Gold Fields Co. in the neighborhood of \$35,000 to \$38,000 per year for fuel, over \$80 per horse-power per annum, and the Atlas Arsenic Co., when working the Gawley shaft over \$20,000 per year with only a ten-stamp mill, you can have some idea of where the profits go, but now that the Government has taken up the power question, there is no reason if we can get the power at a reasonable cost, but that any one of our gold mines will pay. Of course, we who are in the arsenical district are not depending on the gold product alone, as we have the arsenic as a paying product, and there is every reason to believe that the arsenic mine will be in full blast next summer, provided arsenic holds its present price. Two years ago arsenic was sold in New York at \$60 per ton. Now it is worth from \$140 to \$160 per ton. With our supply of arsenical ores, and the fact that in England where the main supply came from, manufacturing arsenic is a thing of the past, on that account there is good reason to believe that the eyes of capitalists will be directed to this district. In fact, they have got to, as with our gold product which our mispuckle ores contain, we can manufacture arsenic

at a cost of \$40 less per ton than they could do in any other country. It has also been said by skeptics who know nothing about the conditions of this section, that our pay ores do not continue with depth. I defy any one to show any truth in this statement. The fact is, that in every instance better values are found in the lower workings than on top. It is quite true we have no deep mines. The deepest shaft is on the Gold Fields' property at Deloro, which is in the neighborhood of 500 feet. The ore at this level is richer in arsenic and in gold, than was ever found on top. The same applies to the Cordova at its 400 feet levels, and also at the Gawley and Atlas arsenic mines, as well as at the copper mines at Eldorado, and lead mines at Bannockburn; also the Craig Co. mines in Tuar, and the richest and largest bodies of ore at the Nickle's property in Hungerford township, were found at these present workings between three and four hundred feet, and there has never been an instance on record where a true vein has pinched out in this section; so I may say that any statement of that sort is utterly misleading and untrue. Now, gentlemen, what do we want from the Government? We ask from the Dominion Government that no bounty be paid on pig iron which is smelted in part or in whole from American ores, but that a bounty be paid on iron manufactured from Canadian ores. That there shall be no duty on coal when used for smelting purposes. From the Ontario Government we ask that there shall be no licenses required for prospecting either on Government or private lands in this district; that the mining license system be done away with; that there shall be no bounties on gold ores that do not pay over \$20 per ton. We also want that a full list of all the Government lands be placed in hands of the clerks of each township in this district where mine lands exist, so that those wishing to prospect Government lands may know the lots owned by the Government, and we ask that a tax of not less than 20c per acre shall be paid by owners on the mineral rights of properties who do not own the surface rights, and who are not working the properties. As you are aware, in this section thousands of acres are held by speculators who buy up these lands at tax sales. Selling the surface rights and holding the mineral rights for speculative purposes. By doing this the municipalities will get the benefit of this revenue, and they will either have to sell their properties at reasonable figures, or contribute to the revenue of the country. We would also ask the Government that an appropriation be made each year for assisting to build roads to mines that are situated in the unsettled parts of the county. We would also ask that assistance be given or a bounty paid for establishing reduction work for the treatment of pyrite ores, so as to encourage this industry in this section, where there are so many undeveloped pyrite properties. These questions with others on the same lines I hope will be brought up at our future meetings, and I am confident with our united efforts, we can show investors that there is no better field for investment than in this section.

QUEBEC'S MINING AREA.

The following communication has been received:

"While the Province of Ontario is selling the beds of Cobalt lakes for millions in cash, and so forth, the Province of Quebec is permitting speculators to take up vast blocks of the public domain, under "mining license," at five dollars a square mile. Recent discoveries in the Lake Chibougamau district have made it about as certain as anything in regard to mining can be, that this country is going to be a rich mining one, although the public has hardly realize that this is the case, and that we have in our own province a mineralized area, which, if it were served by a railway, would make Cobalt look like a pawnbroker's shop after a pledge sale. Already there is not an acre of rock or swamp in that district that a free prospector can go in on, for ten miles, at least, around Paint Mountain. When the railway is built, as built it must be in the near future, the prospectors must buy the rights to prospect from the gentlemen who hold the mining licenses, not from the province, and the minerals, when

found, must be bought, not from the province, but from the same fortune miners, who mine by taking up blocks of, say, ten square miles by getting four lines drawn on an imaginary map, and paying fifty dollars. All this is to be the more regretted because the discoveries in the Chibogamoo district seem to be of such a nature as to lead to the belief that a very profitable, and what is better, a permanent mining industry will in time be established there. Free prospecting cannot now take place, and the indispensable railway cannot now be built with any hope that the mineral discoveries will recoup the expenditure, as must have been the case already in Ontario; for the returns from Cobalt (including the fees on company flotations), must have gone a long way towards paying for the Temiscaming Railway. One thing is certain, the mineral areas in the northern part of this province must be opened up by a railway, and that immediately. How it is to be done is a matter for the Government to decide. It has granted the licenses; it must face the music and the organ men it has fed so splendidly.

"QUEBECKER."

THE COBALT CAMP OUTPUT.

Cobalt ore shipments during the month of January, 1907. Period January 1st to January 12th, 1907:—

Jan. 3, G.T., 21,631, Buffalo Mine to Chas. L. Dennison, Perth Amboy, N.J., 59,000 lbs.

Jan. 4, G.T., 4,673, McKinley, Darragh, & Savage Mining Co. to Balback Smelting & Refining Co., Newark, N.J., 60,000 lbs.

Jan. 7, G.T., 7,802, Coniagas Mine to American Smelting & Refining Co., Perth Amboy, N.J., 62,700 lbs.

Jan. 7, G.T., 9,037, Coniagas Mine to American Smelting & Refining Co., Perth Amboy, N.J., 54,800 lbs.

Jan. 9, C.P., 44,838, Green Meehan to Canada Copper Cliffe, Ont., 61,210 lbs.

Jan. 10, P.R.R., 14,681, O'Brian Mine to American Smelting & Refining Co., Perth Amboy, N.J., 103,000 lbs.

Jan. 10, G.T., 29,806, Nipissing Mining Co., Nipissing Mining Co., New York, N.Y., 40,100 lbs.

Jan. 11, Soo, 25,386, O'Brian Mine to Canada Copper Co., Copper Cliffe, Ont., 64,866 lbs.

Jan. 12, Soo, 18,498, O'Brian Mine to Canada Copper Co., Copper Cliffe, Ont., 64,795 lbs.

Period January 20th to January 26th, 1907.

Jan. 21, N.D., 20,596, O'Brian Mine, Canada Copper Co., Copper Cliffe, Ont., 60,570 lbs.

Jan. 21, G.T., 6,142, Coniagas Mine to American Smelting & Refining Co., Perth Amboy, N.J., 56,720 lbs.

Jan. 21, C.P., 40,870, Cobalt Townsite Mining Co. to Orford Copper Co., Copper Cliffe, Ont., 47,160.

Jan. 22, G.T., 27,309, Buffalo Mine to Chas. L. Dennison, Perth Amboy, N.J., 40,000 lbs.

Jan. 23, G.T., 2,311, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 41,730 lbs.

Jan. 23, L.V., 8,953, University Mine to University Mine, c/o Leecox Co., New York, N.Y., 61,385 lbs.

Jan. 23, C.P., 24,558, Cobalt Silver Queen Mining Co. to Canada Copper Co., Copper Cliffe, Ont., 38,860 lbs.

Jan. 23, C.P., 147,942, Cobalt Silver Queen Mining Co. to Canada Copper Co., Copper Cliffe, Ont., 86,823 lbs.

Jan. 24, G.T., 25,479, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 40,400 lbs.

Jan. 24, G.T., 24,135, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 42,047 lbs.

Period January 28th to February 2nd, 1907.

Jan. 29, G.T., 3,413, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 60,460 lbs.

Jan. 29, G.T., 13,453, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 60,394 lbs.

Jan. 30, G.T., 14,413, Nipissing Mining Co. to Nipissing Mining Co., New York, N.Y., 61,450 lbs.

Jan. 30, G.T., 28,886, Buffalo Mine, American Smelting & Refining Co., Perth Amboy, N.J., 40,000 lbs.

Feb. 1, G.T., 25,365, Nipissing Mining Co., Nipissing Mining Co., New York, N.Y., 40,180 lbs.

Making a total for this period of 262,484 lbs.

CANADIAN MINING INSTITUTE, ANNUAL MEETING.

The Ninth Annual Meeting of the Canadian Mining Institute, will be held at the King Edward Hotel, Toronto, on March 6th, 7th and 8th, 1907.

The usual single fare rate will obtain over all Canadian transportation lines.

The King Edward Hotel also offer a special reduced rate for members and others attending the meeting.

An interesting programme of papers has been arranged.

Members will be good enough to notify the Secretary as early as possible of their intention to attend.

The Nominating Committee submit, (in accordance with Par. XXVII., Sec. V. of the By-Laws), the following list of nominations to offices falling vacant at the end of the next Annual Meeting.

President—Mr. Frederic Keffer, M.E., Greenwood, B.C.
Vice-Presidents—Dr. J. Bonsall Porter, Montreal, Que.; Mr. W. G. Miller, Toronto, Ont.; Mr. W. Fleet Robertson, Victoria, B.C.

Secretary—Mr. H. Mortimer-Lamb, Montreal, Que.

Treasurer—Mr. J. Stevenson Brown, Montreal, Que.

Council—Mr. E. W. Gilman, Montreal, Que.; Mr. Jas. McEvoy, Fernie, B.C.; Mr. Frank B. Smith, Edmonton, Alta.; Mr. R. W. Brock, Ottawa, Ont.; Mr. J. C. Gwillim, Kingston, Ont.; Dr. F. D. Adams, Montreal, Que.; Mr. H. E. T. Haultain, Craigmont, Ont.; Mr. David H. Browne, Copper Cliff, Ont.

BOOK REVIEWS.

Bulletin No. 28 of the Institution of Mining and Metallurgy, London, E.C., England, has been received. It is replete with papers of interest to mining engineers and metallurgists.

The production of gas, coke, tar and ammonia during 1905 in the United States is given in a pamphlet just issued by the United States Geological Survey. The author is Edward W. Park.

"Land Smelting and Refining, with Some Notes on Lead Mining," is the title of a work that has been issued from the press of the Engineering and Mining Journal, New York. It is a reprint of various articles pertaining, especially, to the smelting and refining of lead together with a few papers bearing on mining of lead ore, taken from the pages of the Engineering and Mining Journal, together with others that have appeared in the Transactions of the American Institute of Mining Engineers. The editing has been done by Dr. W. R. Ingalls, whose intimate acquaintance with this branch of metallurgy, is, of course, well known. The book will be found a most useful work of reference by those having to do with either the smelting, refining or mining of lead ore. The price is \$3.00.

The following reports and catalogues have been published by the Geological Survey since January 1, 1906:—

No. 913. The Mineral Pigments of Canada. By C. W. Willmott (pp. 39). Published February 18, 1906.

No. 914. Supplementary List of Publications during 1904 and 1905 (pp. 11). Published February 20, 1906.

Mineral Production of Canada for 1905 (pp. 16). Published March 15, 1906.

No. 939. Preliminary Report on the Rossland, B.C. mining district. By R. W. Brock (pp. 40). Published June 2, 1906.

No. 923. Report on Chibougamau mining region. By A. P. Low, (pp. 61).

No. 940. Report on Graham Island, B.C. By Dr. R. W. Ellis (pp. 46). Published July 20.

No. 888. The Geology and Petrography of Mount Yamaska. By G. A. Young, forming Pt. H. Annual Report. Vol. XVI (pp. 43).

No. 955. French edition of 923 (pp. 57). Published August 2.

No. 947. Summary Report of the Acting Director, for 1905 (pp. 144). Published August 31.

No. 950. Palaeozoic Fossils, Vol. III., Part IV. (and last). By J. F. Whiteaves (pp. 208). Published October 10.

No. 956. Catalogue of Publications (pp. 129). Sent to printer June 11. Signed for printing September 21. Published October 12.

No. 907. Annual Report (New Series), Vol. XIV. (pp. 1193).

No. 911. Annual Report (New Series), Vol. XV., (pp. 1025).

No. 905. "Cruise of the Neptune." By A. P. Low (pp. 355). Published November 19, 1906.

No. 928. Section of Mines, Annual Report, 1904.

The following reports are going through the press:—
No. 902. Report of Brome Mountain, Que. By J. A. Dresser.

No. 942. Report on the Upper Stewart River, Yukon. By J. Keele, and

No. 943. On the Peel and Wind Rivers, Yukon. By C. Camsell.

No. 952. Annual Report (New Series), Vol. XVI., (pp. 733).

No. 958. Annual Report on Chemistry and Mineralogy. By G. C. Hoffmann.

No. 949. Cascade Coal-field. By D. B. Dowling.

No. 961. Reprint of Report on Nickel and Copper Deposits of Sudbury district, Ont. By Dr. A. E. Barlow.

No. 962. Reprint of Report on the Nipissing and Timiskaming region, Ont. By Dr. A. E. Barlow.

The British Columbia Bureau of Mines has issued Bulletin No. 1, 1906, describing the mineral claims on the West Coast, and in the vicinity of Great Central Lake, Vancouver Island. It was written by the Provincial Assayer, Mr. Herbert Carmichael. The groups described are those of the June, and Yreka, and the hematite ore deposits of Quatsino Sound; the Marble Quarry, Storkiat Harbour, Indian Chief, and Nootka Sound; Hesquiat Inlet; Ormond, near Matilda Creek, Pete and Iron King, Copper King, Nos. 1, 2, and 3 and Ormond No. 2, near Ahousat; Good Hope, Killapa, American Wonder, and Hetty Green, of Clayoquot Sound; Red Rover, Enterprise, Sarita Group; Cascade Southern Group; Happy John Group; Monitor, The Nahmint, Gladys and Edith Group; on Barkley Sound. In addition, the Great Central Lake district is described. It is reached from the town of Alberni by waggon road, 12 miles long; the lake being 200 feet above the sea.

The general trend of the lake is east and west, and it is about twenty-five miles long by a mile or so wide. At its western end two creeks flow in, heading from mountains still farther west. A trail from the lake follows the most northerly of these creeks on a gradual ascent for a distance of ten miles, until it ends in a basin, shut in by high mountains, the basin having here an elevation 1,500 feet above the Great Central Lake, or 1,700 feet above the sea. To the south a precipitous bluff rises 2,075 feet high, from which pours a considerable stream of water that barely touches the rocks until it reaches the bottom, breaking into a mass of spray in its descent. The ascent of the bluff requires stout muscles, and the aid of the small bushes which cling so tenaciously to the clefts in the rock. On the top there is a small rocky plateau, or basin, enclosing a lake about half a mile long by a quarter wide, the elevation of the lake being 3,350 feet above the sea. The mountain lake, situated in the heart of Vancouver Island, with snow-clad mountains rising 2,000 feet above it, and the blue crevassed glacier of the "Nine Peaks" showing up to the south in the morning sun, forms a beautiful scene.

Big Interior Group: This group consists of seven claims, viz.: Big Interior, Nos. 1 to 7, and was located by Drinkwater and Nicholls, of Alberni. The claims are reached from the head of the small lake referred to, by

following up a small second basin, about a quarter of a mile. The head of this second basin is hemmed in on three sides by precipitous cliffs a thousand feet high, on which rests a snow cap, terminating in peaks which are 2,000 feet above the lake below. Practically, this entire face, some 4,000 feet wide by 1,000 feet high, shows the strong red color due to iron stain, while at the base there are thousands of tons of the same rock which have been mined by the action of elements. A closer examination shows this cliff to be a granitoid rock, mineralized with copper pyrites, pyrrhotite, and pyrite in varying proportions, some zones showing strong mineralization, while in others it is more sparse. To the west the rock assumes a brecciated structure and has been cemented together by a filling of calcite, with a considerable impregnation of copper carbonates, and into this zone a tunnel has been driven a distance of 31 feet. The ascent of the bluff is somewhat dangerous, owing to the rather precarious foothold, and the absence of vegetation, the top being reached at an elevation of 1,375 feet above the small lake. From the top of the bluff a snowslide was followed until a further elevation of 500 feet was reached, at which point the ore is uncovered, and shows the strongly mineralized granitic mass which is seen to penetrate a nearly horizontal strata of limestone, alternate bands of which continue to the top of the mountain 500 feet still higher. This sharp ridge, with its altitude of 5,700 feet, may be considered as the backbone of Vancouver Island, shedding the water to the south down the Alberni canal, to the northeast down Buttle Lake and the Campbell River, and to the west of Bear River into Clayoquot Sound.

The mineralized zone, showing in the face of the cliff to the north of the basin, and forming the great mass of low grade mineral on the property, is so large, so inaccessible, and the mineralization so scattered, that it would be impossible to obtain anything approximating an average general sample of the exposure without the expenditure of an amount of time and money not justifiable under the circumstances. However, at the foot of the cliff, there is a talus extending the whole length or width of the mineralized zone, made up of material broken away from the whole face of the zone in question. While this talus may to a certain extent have been affected by weathering, it still may be considered a very approximate sample of the inaccessible cliff. Samples were taken from this talus, from which it is judged that approximately the central portion of the mineralized zone will assay from $\frac{1}{2}$ to 1 per cent. copper, with $1\frac{1}{2}$ to 2 oz. silver per ton, and a trace of gold. These values extend over a width of about 1,500 feet, while to the right of the mineralization gradually fades off into the country rock.

To the left of the mineralized zone is what has been called, for purposes of designation, the "brecciated zone," and which is merely a continuation, to the left, of the mineralized zone which has been subjected to a crushing due to movement and in which the interstices between the fragments of the rock have been filled with secondary minerals, chiefly calcite, with some carbonate of copper, forming a secondary enrichment. This secondary enrichment has taken place, as would be expected, along defined channels, producing streaks of higher grade mineralization often forming commercial ore. Here, again, no general sampling was possible; although a tunnel has been driven for some 31 feet into the bluff, it was found impossible to examine the face of the cliff for 10 feet on either side of the tunnel mouth.

The mineralization just described, and which forms the great bulk of visible mineralization on the property is admittedly very much diffused through the rock, and is consequently so low grade as to be of value only if found to be amenable to some form of concentration, and of which there seems to be a fair probability.

On the top of the mountain, is an area in which the mineralization seems to be more concentrated, producing, in places, ore of a grade to stand transportation and treatment charges. This higher grade ore appears to occur along the lines of contact of alternating bands of granitic rock and limestone. The extent of the latter

deposit it was found impossible to determine, as the ore was found to be covered in most places by a heavy capping of gossan, and in many places seemingly permanent snow and ice covered up the formation. While the future of the property is far from being proven, the very great extent of the mineralization, with occasional concentrations, certainly renders the proposition worthy of most careful investigation and prospecting.

Della and Glacier: These claims are situated on the small lake in the Big Interior Basin, and are owned by Drinkwater and Engvik. On the claims is a small quartz vein from 2 to 3 feet wide, mineralized chiefly with arsenical iron. Assays of the straight ore gave the following result:—Gold, 5.12 oz. per ton; silver, 5.2 oz. per ton; copper, 1.0 per cent. The vein has not yet been worked to any extent, but an attempt has been made to extract the values by roasting the ore and grinding in an arastra, which has been erected and is being run by a small water-wheel constructed on the ground.

An examination of the different properties on the west coast of Vancouver Island, especially those on which extensive development work has been done, would point to the following theory as to the mode of ore deposition.

The properties, with the exception of those in Quatsino and Great Central Lake, present nearly identical conditions. The mineralization occurs in or close to diabase dykes. Sometimes there is sufficient quartz in the fissure to make a quartz vein, but more often there is an entire absence of quartz, the vein-matter being the crushed material of the dyke. There appears to have been two periods of movement, the first in which the dykes have formed, when no mineralization took place; the second period in which these dykes were scattered and twisted, when probably secondary dykes of a similar composition to the first series were injected into the fissures found by the movement.

A careful examination of these deposits would lead one to the conclusion that mineralization took place at this time, not as a secondary enrichment, but as a direct deposit by ore-bearing solutions from below. The solid mineral is seen to penetrate what were originally cavities, and to follow along old slip-walls, inside of which, as a rule, no mineral whatever is seen, as would be the case if segregation had occurred. The deposits are often brecciated structure, the ore enclosing fragments of the original dyke-rock, and only occasionally is it seen forming a part of the dyke, and then it would be accounted for as forming part of the second upheaval when the later dykes were formed. Mineralization is found along fractured zones in these diabase dykes, and where these fractures contained cavities for the entrance of mineral-bearing solutions we now have ore-bodies, but where the ground is tight or shows only slight movement little or no ore is found.

Chalcopyrite forms the principal mineral of value, while pyrrhotite is a common mineral, occurring both massive and mixed with pyrite and chalcopyrite, but carrying little or no value in itself. Arsenopyrite occurs in any of the properties, and, as a rule, carries gold values.

While no geological map or extensive examination of this region has been made, the general country rock outside of the mineralized zones appears to be syenite, occurring often as mountains of great size and connected with a series of fesspathic dykes which penetrate the older rocks.

PERSONALS.

Mr. A. A. Talmage has become associated with the Pittsburg-Salt Lake Oil Company, his headquarters being in the Chamber of Commerce Building, Los Angeles, California.

On the evening of January 30, a supper was given to Mr. W. A. Duff, assistant manager of the Canadian Westinghouse Company, Limited, on account of his leaving Montreal to take the position of manager of the Canadian Westinghouse Company's office in Winnipeg.

On Feb. 6, about 60 or 70 members of the Ontario Legislature visited the School of Mines at Kingston, going by special train from Toronto. The School of Mines has asked for an increased grant, and the management were desirous that the members should see the work being done.

Mr. Robert R. Hedley, M.E., has resigned his position of manager of the smelter of the Hall Mining and Smelting Company, Ltd., Nelson, B.C.

Thomas A. Nevins, head of the banking firm of Thomas Nevins & Son, and a party of New York, Philadelphia and Pittsburg capitalists, have been in Cobalt inspecting properties.

Samuel Newhouse, E. P. Earl, W. B. Thompson, and Eugene Meyer, who have been inspecting the Nipissing properties, returned to New York at the beginning of the month.

Col. J. H. Robeson, a mining man of Denver has been secured by President Newhouse as manager of the Nipissing property.

Dr. J. J. Deadman, manager, and Fred. R. Price, secretary of the Abitibi Mining Company, have been in Toronto.

Mr. Geo. S. Wynne has been appointed acting general manager of the Lake Superior Corporation in place of Mr. Sawyer, who has returned to Pittsburg.

MINING NOTES.

A French writer says:—All the known deposits of platinum are becoming exhausted, and the price is going up to a prohibitive extent. In 1876 the metal could be bought for \$100 the kilogramme. Four years later it had doubled; in 1901 it had quadrupled, and to-day the price is \$1,200 per kilogramme, or twice the price of gold. Even that is for crude platinum. The worked metal is twice as dear again. Considering how many industries are now absolutely dependent upon platinum, the question of replacing it by some really efficient alloy or combination is acquiring vital importance.

NEWFOUNDLAND.

Valuable copper mines, covering an area of nearly a square mile, and situated at St. John's, Nfld., were a few days ago purchased from Messrs. Kawaja Bros., and the other two shareholders, by Mr. T. H. Ryan, representing a number of New York capitalists. The purchase price was \$75,000. Sir E. P. Morris, of St. John's, who represented the North Sydney shareholders, transacted the deal. The property is said to be the most valuable of all the many copper areas in the Ancient Colony.

NOVA SCOTIA.

The development work which has been going on at Barrachois for the past few months has resulted in the exposure of an eighteen foot seam of iron ore. The operations have been carried on under the direction of W. F. Jennison, C.E., who leased the areas some months ago.

Samples of the ore were sent to Sydney Mines for analysis. The report from there was that the ore was of an A1 quality, and suited for the purpose of mixing with the Wabana ore in the manufacture of Bessemer pig.

QUEBEC.

Our esteemed contemporary, the Gazette of Montreal, had an editorial on Superintendent Obalski's report for 1905, in its issue of January 31. Better late than never. Yet the readers of the Mining Review read a resume of it in our July issue. The Gazette was more belated than the report.

ONTARIO.

Mr. E. J. Donn has been around Larder Lake for years. Mr. Donn states that about 1,500 persons are now living around the lake, and that about 2,000 claims have been staked.

Native silver is said to have been found forty miles up the Montreal River, in a location about twenty miles distant from Cobalt. It is stated that, in view of this find, the possible silver-bearing lands will be included in a block about twenty miles square.

Mr. Aubin, M.P.P. for West Nipissing, is authority for the statement that there is considerable activity in copper mining around Sturgeon Falls. Prospectors are going in by the dozen and rich veins are being discovered. A short time ago an area of some 480 acres was sold for \$300,000.

This week we are able to announce the formation of the "Hugo Von Hagen Exploration Company," with an authorized capital of fifteen million dollars, being divided into three million shares of five dollars each, three-fifths of which are treasury stock, says the Wabigoon Star. This company has secured 51 per cent. of the stock of the Laurentian Gold Mines, Ltd., besides controlling interests in various other incorporations.

Mining Recorder Smith at Haileybury says remarkably rich specimens have been shown him as coming from Larder Lake.

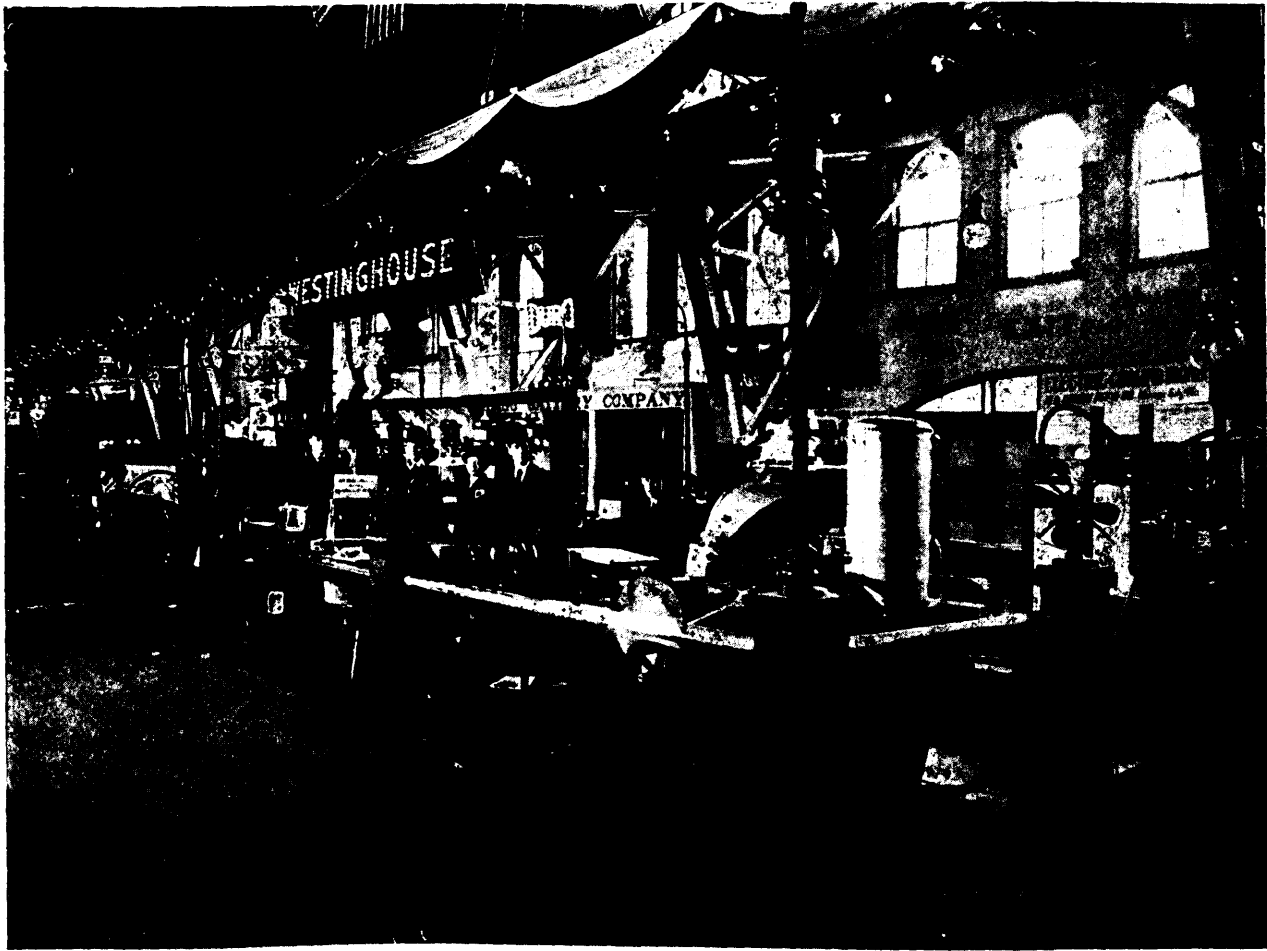
From what can be gathered of the district generally, it would appear that it holds possibilities of becoming an important mining camp. Whether its future is good or bad, there is no doubt but that the district will be invaded this coming summer by a large number of prospectors.

A company has been organized to operate a mine discovered some time ago along Sturgeon Lake, in the Sturgeon Lake gold field district. The mine is reached from St. Ignace, and is 150 miles west of Port Arthur. The company will be known as the Douglas Mining Company, and will have a capital of \$500,000. The directors will be Messrs. G. S. Gzowski, John Douglas, J. A. Gaggett, Geo. Laird, Toronto, and James Atwood, of British Columbia.

For the year 1906 the revenue of the Ontario Bureau of Mines reached a total of \$250,090. This sum included the first royalty ever collected by the province from those engaged in the development of mineral deposits. This payment, amounting to \$15,000, was made by the holders of the O'Brien mine, on a carload of ore shipped in 1905, subject to the outcome of a lawsuit then pending. Later the action was abandoned, and the O'Briens agreed to pay a royalty of 25 per cent. of the value of the ores mined. The aggregate also includes the sum of \$108,500, the 10 per cent. payment made on the acceptance of the tender for the purchase of Cobalt Lake. Miners' license fees netted the province \$70,000.

In 1905, the receipts reached a total of \$61,560, while the appropriation made by the Legislative Assembly for the Bureau of Mines, including salaries for the staff in the office and in the field, and a vote of \$25,000 for work in the Gillies limit, was \$86,950. The revenue thus exceeds the year's expenditure by \$163,140.

At the annual meeting of the Nancy Helen Mines Company, Messrs. W. R. Smyth, M.P.P., Wm. Black, and J. F. Black were respectively re-elected president, vice-president and secretary-treasurer. The reports presented were of a most satisfactory nature. Some work has been done on the 40-acre claim in Bucke township, owned by the company, and it gives promise of being a fine mining property. On the company's mine in the town site of Cobalt work has been and is being steadily continued. This property is numbered among the shipping mines of the district. A shaft has been sunk 82 feet and three carloads of ore are now awaiting shipment. A plant and



Westinghouse Exhibit at St. Louis.

equipment costing \$20,000 is being installed, in fact, some of it is already in place. Several new and most promising veins have been discovered on this property quite recently, besides those now being worked. Among mining men in the Cobalt district the company's properties stand high and there has been considerable inquiry of late as to whether the company will make a public issue of stock. The company, it is said, intends to adopt this course some time in February.

A new mining district in Northern Ontario, which threatens to rival the far-famed Cobalt camp, is opening up in the Sutton Bay country, situated in Harris Township, lying eight miles east and one mile north of the town of New Liskeard. The new camp is commonly called the Casey mountain range, and at the present time of writing the showing prognosticates wonderful things for the future of the Casey mines.

The Casey mountain region is identical with Cobalt in formation. The same lower Huronian conglomerate with diabase contact is found to permeate the district, which lies on the edge of a swamp or the former level of Lake Temiskaming in pre-historic times.

The mountain range rises to a considerable altitude and runs east one and one-half miles, and has all been claimed. Native leaf silver in fairly large quantities has been found, and the two mining companies already operating are very much encouraged and expect to run into pay ore within a short time.

The companies operating are the Cobalt Silver Crescent Mining Company and the Bucknell Mining Company. The Silver Crescent Company is in charge of Herbert Murray, a mining engineer of large and varied experience, which has been gathered in California and at Nome, Alaska. Mr. Murray is of a conservative temperament, but even this trait does not prohibit him talking enthu-

siastically regarding the future of the Casey mountain range. At present the Silver Crescent Company has fifteen men working on the claim, busily engaged in cross-cutting and sinking a shaft to catch several veins of great promise. The several fissures are 4 or 5 inches wide, and carry cobalt ore and native silver. The decomposed cobalt bloom on one of these veins is as fine, if not better, than any in the Cobalt district farther south. The Silver Crescent Company has a nicely equipped camp, and in the early weeks of spring, machinery will be established for working the mine. The Cobalt Silver Crescent Company has a capital of \$500,000, divided into dollar shares, and Pittsburg magnates are largely interested in the proposition.

The Bucknell Mining Company, next to the above claim, is working twenty-five men. They are just now erecting an engine and boiler-house, preparatory to establishing an up-to-date plant. A shaft has been sunk 40 feet on the property, and drifting from this centre 60 feet has transpired. The vein followed has a good showing of smaltite, or cobalt, ore and native silver, and recent assays promote confidence for the future in a large measure.

The Casey mountain range is two and one half miles from White River, a waggon road making transportation easy and quantities of wood and water abound for mining purposes.

COBALT.

The last car shipped from the Foster mine will, it is said, run over \$58,000. "This is the richest yet shipped," says General Manager Adler.

It is rumored on the street that the negotiations in connection with the amalgamation of the Peterson Lake Company and the Nova Scotia are about completed.

The Nancy Helen Mines Company, which owns forty acres in Bucke Township, reports that a shaft has been sunk 82 feet, and that three car loads of ore are ready for shipment. A plant costing \$20,000 is being installed.

The Coniagas people have commenced work on a 5x7 shaft in the Imperial Bank lot opposite the Prospect Hotel. There is known to be under the butcher shop to the north an important vein of ore, and it is the intention of the Coniagas to crosscut to this.

It is reported that McKinley-Darragh-Savage has declared a dividend of 2c monthly, equivalent to 24 per cent. per annum, on its 2,500,000 shares of \$1 par value. No official announcement of a dividend has, however, yet been made, and local interests say they have not heard of it yet, though the mine has made some exceedingly rich shipments lately.

A report to Green-Meehan directors has just been received from Mr. C. A. O'Connell, manager, in which he gives the following figures: Number of days worked 53; average number of men employed, 35; number of tons of ore extracted, 47; actual cost of producing ore, \$4,349.62; actual cost of production, per ton, \$92.55; estimated value of ore shipped, \$87,340.

Word has been received from Cobalt that an effort is being made to induce the settlers there to remove to Upper Cobalt, on Lake Temiscaming, a distance of about one and a half miles from the present site. The advantages of the new situation are that the site is much better, being on a gentle declivity, which slopes down to the lake. More sanitary conditions obtain, and good water can be secured. Upper Cobalt, it is also claimed, can be converted into a good summer resort.

Two shafts have been sunk on the eastern shore of Cobalt Lake by the Cobalt Lake Mining Company and calcite bloom has been discovered and some free silver obtained.

The draining of the lake will not be proceeded with for some time. The town of Cobalt, it is thought, might protest against the cutting off of the supply of water for fire protection purposes.

The proposition is to empty the lake by means of syphons and pumping plants.

At the second annual meeting of the Silver Leaf Mining Company, held January 30, in Toronto, the following were elected officers and directors for the ensuing year: President, Mr. A. G. Browning, North Bay; treasurer, Mr. A. E. Osler, Toronto; managing directors, Messrs F. B. Chapin and Frank Culver; directors, Messrs. S. C. Smoke, Toronto; Geo. L. Walker, Boston; John R. Stanton, New York; J. H. Rice, Houghton, Mich.; W. S. Pickett, Michigan, and Mr. Wm. D. Elwell, Boston.

Mr. E. T. Corkhill, provincial inspector of mines, Toronto, has returned to Toronto from the Gillies limit, where he has had charge of the operations of the government mining party.

He reports that work on the discovery reported some time ago is progressing steadily at the seventy-foot level, and that the ore body is showing up splendidly. In reply to a question as to whether they were shipping yet, he said that it had not been decided to do so yet, although they had lots of rich ore on the dump ready to do so. He states that all indications point to a great rush of prospectors into the Larder Lake district, when the spring opens.

A contract was signed recently between the financial agents of the Central Mines Company, Messrs. Thomas Nevins & Sons, and the Traylor Engineering Company,

under which the latter is to supply the complete equipment for a 100-ton concentrator for the Cobalt-Central properties. This will be the first concentrator to be built in the Cobalt region. The crushers, rolls, rigs, concentrating tables, power house and elevators will be shipped as speedily as possible. The plant will enable the company to ship concentrates that will run high in silver. The company will also be able by this means to get full value for its shipments, as it will be able to carefully sample the same and know the average value before they are shipped, which is not possible to do on any shipments made from Cobalt as matters stand to-day.

R. Meeks, in The Engineer and Mining Journal, makes the following statements in a write-up of Cobalt:

It may be of interest to mention the final disposal of the ore from this district. While there are rumors of a smelter being built near the mines for the treatment of their ores, still, so far as can be ascertained, they are only rumors. Experiments are being conducted at Hamilton, Ont., which are said to be successful, and, moreover, it is claimed that mine-owners of Cobalt are financially interested in the venture. But at present all the ore is treated in three smelters, and must be hauled a long distance, and at considerable cost.

From the correspondence which I saw at Cobalt, the following smelter charges were derived: The American Smelting & Refining Company agrees to pay for 94 per cent. of the silver contents, and charges a flat rate of \$10 per ton. The terms are cash immediately after the agreement of assays, and no payment is made for nickel, cobalt, or arsenic values. The matte containing the nickel and cobalt becomes the property of the smelters, and it is claimed that this is shipped to Saxony, Germany, for treatment. The shipper must also pay a sampling charge of from \$5 to \$6 per ton, and the freight charge, which amounts to \$10.20 per ton. This charge is divided as follows: From Cobalt to North Bay, \$3.20; from North Bay to New Jersey points, \$7.

The Balbach Smelting & Refining Company of Newark, N.J., has a sliding scale, as follows:

Ore containing 400 oz. silver, \$6; 400-500 oz., \$5; 500-600 oz., \$4; 600-700 oz., \$3; 700-800 oz., \$2; 800 oz., or more, no charge.

They agree to pay for 93 per cent. of the silver contents at New York market prices on the day of contract, settlement to be made 14 days after agreement of assays, or 1 per cent. less for cash. In this case, also, the shipper pays for sampling and freight charges as before.

Corroborated particulars relative to the charges made by the Canadian Copper Company, at Copper Cliff, were not available, but they are said to be as follows: The smelter makes no charge for smelting or sampling, and agrees to pay for 93 per cent. of the silver contents at market rates, and also agrees to pay for cobalt, providing it is in excess of 15 per cent., and that the nickel values are low. The freight charge to this smelter from Cobalt is \$5.20, or practically one-half that charged to New Jersey. There is, besides, a direct saving of \$5 to \$6 for sampling, depending upon the value of the ore. In some districts a freight and treatment charge of possibly \$25 per ton would be the determining factor between profit and loss.

BRITISH COLUMBIA.

The management of the Jumbo mine have decided to expend \$75,000 in working this property, and the mine will be opened by a shaft of several hundred feet depth.

The total shipments of Rossland ore for 1906 were 277,361 tons, which is less than in 1905. The falling-off is due to a strike of the employees of the Crow's Nest Coal Company. At an estimated value of \$12 a ton, the total output is worth \$3,338,332. Since 1894 the total output has been 2,592,254 tons, valued at \$36,728,480. The best shippers last year were the Le Roi and Centre Star which produced 126,396 and 114,500 tons of ore respectively.

On the White Bear mine drifting and diamond drilling has been done on the 800-foot level, and drifting and cross-cutting has been kept up on the 700-foot level. There has also been drifting on the 1,000-foot level. The most important find was made on the 700-foot level, when a shoot of ore 20 feet wide, and of good grade, was uncovered. About 1,350 tons of second-class ore has been run through, the plant producing 1,350 tons of concentrates. During the year 570 tons of raw ore were shipped.

The reports for the year show that the Central Star and its allied mines have much improved. The holdings of this company were increased by the purchase of the Idaho and the Iron Mask properties. The workings of the Iron Mask have been connected with those of the War Eagle and Centre Star by drifts and cross-cuts, which makes it possible to bring its ore out above its 450-foot level through the connections made between the 400-foot level of the War Eagle and the 350-foot level of the Centre Star. Considerable surface work has been done on the Centre Star, and its related properties and a large crusher having a capacity of 1,000 tons a day, and a 700-horse power motor have been installed. About 350 men are employed.

On the Le Roi mine is a staff of 325 men. A cross-cut has been driven through the dike, which runs across the western end of this mine, and ore bodies of good grade have been discovered on the west side of the dike. The western section has been opened on 800, 900 and 1,000 feet levels, and the workings have been extended 250 feet west of the dike. About half the tonnage which is now being shipped is from this portion of the mine. The explorations at the 1,200-foot level have resulted in the finding of a good shoot of ore, and by extending a winze from the 1,350-foot to 1,750-foot level, large ore bodies have been revealed. A contract has been let to sink the main shaft down below the 1,350-foot level.

The gross shipments of ore from the Le Roi-Tevo mine were 21,000 tons; of a gross value of \$24 per ton, and the concentration milled 10,500 tons of second-class ore at a value of \$3.50 per ton. The concentrates were worth from \$25 to \$30 per ton.

COAL NOTES.

The approximate output and shipments for the month of January of the Dominion Coal Company were as follows: Output, 252,108; shipments, 165,215.

One thousand union men went out on strike on February 4, at No. 3 colliery of the Nova Scotia Steel Company at Sydney Mines. The men refuse to work with non-union men, of whom there are about one hundred employed at the mines. The trouble, which has been brewing for some time, is purely between the men themselves, the company having absolutely nothing to do in the matter. For some time the union men have been trying to induce their non-union friends to join the association, but without success. At a meeting of the Pretoria Lodge, held on Saturday night, it was decided to quit work on February 4, in the event of their demands not being acceded to. All the prominent P.W.A. officials are now on the spot. The mine has been closed down.

General Manager Brown, in an interview stated that, for his own part, he did not think the company would interfere in the matter. The company cannot compel any man to join the union. They must treat all employees alike. On the other hand, the miners claim the company must discharge the non-union men or close down the mine.

The P.W.A. held a session of their lodge from 1.30 this afternoon until 10 o'clock to-night, when the entire situation was considered.

Nothing could be learned as to the conclusion reached, as it was decided not to divulge anything until to-morrow.

The Nova Scotia Steel Company has a large quantity of coal banked.

THE MINING AND INDUSTRIAL SHARE MARKET.

(Specially reported for the CANADIAN MINING REVIEW by ROBERT MERRIDITH & Co., Mining Brokers, 57 St. François Xavier St., Montreal.)

Active interest in mining shares has not yet become evident, the market has been dull all the month for mines as well as other securities. The monetary situation and great congestion of general trade, is no doubt to a considerable extent responsible for the condition, but there is evidence that with the advent of spring active operations will be commenced in many camps, and it is probable that the production of precious metals this year will far exceed any previous one in the history of the Dominion.

In industrial shares the same condition prevails, and while most of the companies are showing good returns and doing a profitable business, the demand for the stocks is limited, and in consequence prices are irregular.

The latest quotations are as follows:—

	Bid.	Asked.
Consolidated Mines	135	140
Can. Gold Fields	6¼	7¼
Granby Consolidated	139	140½
Rambler-Cariboo	25	27½
North Star	10	20
Monte Christo	2	3
White Bear	8½	10
California	4¼	6½
Virginia	6½	8
Deer Trail .....	...	2
International Coal	60	63½
Sullivan	7½	9
Cariboo-McKinney	3½	4½
Denoro	10	15
Diamond Vale Coal	33	35
Alberta Coal and Coke	30	32
Dominion Copper	6¾	7
Novelty	2½	3½
Nipissing	11¾	12
Foster	2¼	2½
Silver Queen	2½	2¾
Trethewey	1¾	1¾
Kerr Lake	4¼	5¼
Silver Leaf	20	20½
Green-Meehan	140	150
Peterson Lake	50	51
Dominion Coal (com.)	6½	63
Dominion Coal (pref.) .....	...	...
Dominion Iron & Steel (com.)	21	21¼
Dominion Iron & Steel (pref.)	56½	59
Intercolonial Coal (com.) .....	...	...
Intercolonial Coal (pref.) .....	...	...
Nova Scotia Steel & Coal (com.)	69	70½
Nova Scotia Steel & Coal (pref.) .....	...	...

INDUSTRIAL NOTES.

Messrs. F. H. Hopkins & Co., are sending out a very artistic postcard, showing the 1907 model Ransome concrete mixer in operation.

The Gutta Percha and Rubber Manufacturing Company, of Toronto, Limited, state that their company is not in any way, shape or manner, a part of, or connected with any rubber merger or trust.

That more gold lies in the bosom of that far-north country than has ever been brought out of it is a fact which the public, in its usual carelessness, seems to have lost sight of completely. It seems to think because there's no more mad rush, there's no more gold.

But there are men here and there who are not content to let the precious metal stay up there any longer than they can help. One of the firms actively interested is The Yukon Consolidated Goldfields Company, Limited. Believing that the best aid they can have up there is electricity, they have purchased a large supply of apparatus from The Canadian Westinghouse Company. They will use this apparatus in dredging.

There is no doubt that electric power will be the most effective and least expensive in the end. And the operations of this company will be watched with interest.

The phenomenal growth of the use of concrete construction during the past two years has carried with it an equally augmented demand for finely crushed stone.

A few years ago the "screenings," a product of a stone crushing plant of a size of $\frac{3}{4}$ in. and less, was considered waste, while in a great many localities there is now the greatest demand for this size of product. Finely crushed stone is required for many purposes for which it was formerly considered unsuited.

In order to meet this new demand for finely crushed stone, the Allis-Chalmers Company, represented in Canada by the Allis-Chalmers-Bullock, of Montreal, has designed for the Gates Rock and Ore Breaker a short type of head and concaves, by the use of which the desired product may be obtained. An illustrated bulletin on this subject is now in preparation in which it is shown that the builders have not departed from the accepted standards of the Gates Breaker, the only changes being a simple substitution of the crushing parts. With the short head and concaves, the head is made shorter and of larger diameter than in the case of the standard length head.

This type of breaker has been used with excellent success when a fine product is desired from the machine, and when the stone fed into the breaker is of a comparatively small size.

It has also been used to equally good advantage as a rejection crusher when a fine product is desired and when the stone fed in is principally slabs and spalls from a larger machine which have been rejected by the screen.

The short head and concaves are fitted to either style D or style K Gates Breakers. The machine may be fitted with either the chilled iron head and chilled iron concaves, or manganese steel "gunlock" mantle and cast iron centre and manganese steel concaves.

A new double drum electrically driven hoisting engine built by the Lidgerwood Mfg. Company for the Inca Mining Company, which was shipped recently, will have to travel over an interesting and complicated route before it reaches its destination beyond the summit of the Andes in Peru and be set up for use.

The Santo Domingo Mines, for which the hoist is destined, lie in the old dominion of the Incas in Peru and behind the Lake Titicaca region where the Spanish conquerors found such stores of precious metals.

The Santo Domingo Mines were discovered about twelve years ago by a couple of Peruvians who had wandered across the summit from Arequipa in search of placer gold. Suddenly they discovered a vein of gold-bearing ore where a landslide had uncovered the native rock. A year later the property was acquired by a party of men of Bradford, Pa., and the Inca Mining Company and the Inca Rubber Company were formed. Besides the mining property the Bradford men have a concession of about one million acres of rubber producing lands which they are developing. Work on the mines was begun about eleven years ago, and more than two and a half million dollars worth of gold has been taken out up to this time. The company has about thirty miles of tunnels, shafts and drifts opened up.

The hoist which is now on its way is to be placed in a tunnel which has been run 1,700 feet into the mountain, cutting the vein 1,500 feet below the outcropping, at the top of the hill. A 500-foot-deep shaft has been sunk from the tunnel, and the new hoist is to bring the ore from the lower workings to the tunnel level. Accompanying the hoist are two 200 kilowatt General Electric generators. These will furnish current generated from a water power to operate the hoist, mill and other machinery of the mine. The mill contains 10 stamps, a concentrating and a cyaniding plant. The hoist will go by steamer to the port of Mollendo. From there a railroad will take it to Tirapata in the Lake Titicaca region. There the Inca Mining Company will receive it and carry it 150 miles over roads of its own building, to the mine.

The first part of the way for 100 miles is over a waggon road. This reaches to the summit of the Andes at Lake Arracoma, 16,000 feet above the sea level. The next 50 miles is only a mule road. To make it possible to transport the big hoist over this part of the route it was built in sections, with no one piece weighing more than 300 pounds. The total weight of the hoist is 13,800 pounds. The drums are each 48 inches in diameter with 40 inch faces. The hoist is designed for a duty of 3,000 pounds, to be lifted at a rate of 400 feet per minute. It is driven by a 37 horse power induction motor of the General Electric Company's make, and operated by a 440 volt alternating current.

The power house is about a mile away from the mill. It is intended to develop about 250 horse power at first, and this can be doubled by adding another standpipe. The mine lies at an elevation of 5,000 feet above the sea. Beyond the mine the company has built a road about 75 miles long to the Tambopata river, where it is now putting together a little steel-hulled steam boat for navigating the Tambopata, Madre de Dias and Beni rivers. At the crossing of the Irambari river the road is carried by a wire rope suspension bridge, 320 feet long. Telephone lines 250 miles long, belonging to the company, connect the mines with the railroad and points where work is being prosecuted.

Safety Blasting Fuse was invented in 1836 by the late Wm. Bickford, of Cornwall, England, and the firm of Bickford, Smith & Co., Ltd., are his successors. White Jacket Fuse is their latest production, and takes the place of Blue Jacket Fuse, which was introduced into South Africa and Australia four years ago, and into Canada quite recently by Mussels Limited. The blasting fuse, which is ordinarily used all through the Dominion of Canada at the present time, is white counteracted gutta percha. One of the properties of gutta percha is that, on keeping for several months, it perishes, and owing to this property, it has always been necessary to be sure that gutta percha fuse was fresh from the factory, or at any rate not more than six months old, in order that it might be perfectly safe in wet ground. If the gutta percha has perished in any way, the fuse is very likely to crack and let damp into the powder, which would prevent the fuse burning through to the end, which would cause one of those misfires, which frequently lead to serious loss of life. In the White Jacket Fuse the water-proofing is put on twice with a special black varnish, the composition of which is the property of Bickford, Smith & Co., and which no one else has yet been able to successfully copy.

White Jacket Fuse will stand twenty-four hours immersion in water, and this is far more than is ever required in practice. Instead of having to be used as soon as possible after leaving the factory, it can be kept for one or two years without in any way deteriorating, and is of great importance in the case of a commodity like fuse, which is held in stock by dealers in different parts of the country, making it almost impossible for the customer to tell how long the stock has been held. Besides these special qualities, the burning speed of the fuse is every regular, and is guaranteed to vary less than ten per cent. on either side of the standard. It also stands rough handling and rapid changes of climate and temperature better than any fuse which has ever been on the market in Canada before.

The Hancock Cons. Copper Co., Mr. John L. Harris, Supt., whose mines are located at Hancock, Mich., has recently ordered from the Sullivan Machinery Co., of Chicago, a hoisting engine to be used for sinking the principal shaft and for permanent service, after the shaft is completed to its final depth of 4,000 feet.

This hoist will be of the first motion, heavy duty, Corliss type, with engines 24 in. diameter by 48 in. stroke, and two loose drums, 8 feet in diameter by 9 feet long, driven by band friction clutches, and designed for hoisting in balance. The drums will be grooved for 1 1/4 in. steel rope, and the maximum hoisting speed under full load will

be 3,500 feet per minute. The clutches and band brakes will be steam operated, with automatic compressed air substitution, in case the steam pressure falls below a given point, owing to accident or for other reasons.

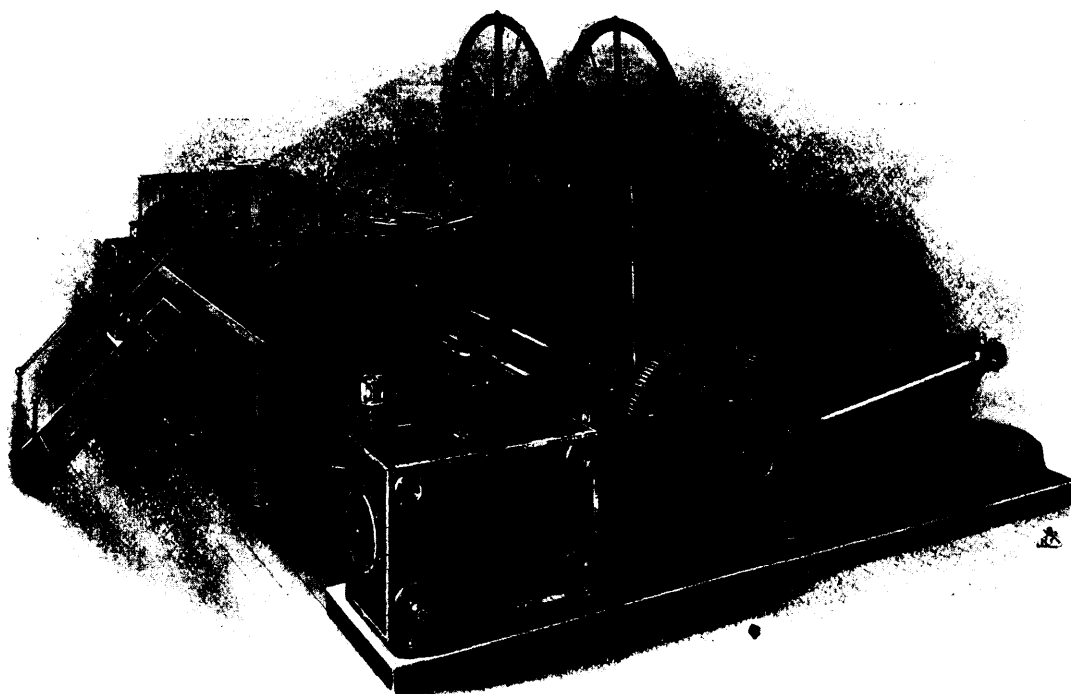
This hoist will be furnished with the Sullivan patented automatic throttle closing device and interlocking automatic stop. By these contrivances, the steam will be automatically shut off at a fixed distance from the top of the shaft, allowing the engineer to bring the cage to a stop at the desired point, by use of the brake. In case the engineer, for any reason, fails to set the brakes, they will be set automatically at the proper point, to prevent an overwind.

Hoists of this same design have recently been furnished to the Republic Iron & Steel Co., Republic, Mich., the Ironton and Colby Mines, Bessemer, and the Dunn Mine, Crystal Falls, Mich.

The Silverford Cobalt Mining Company, Limited. Capital, \$200,000, divided into two hundred thousand shares of one dollar each. Head office: Toronto, Ont. Provisional directors: T. H. Barton, F. D. Byers, and O. F. Taylor, all of Toronto, Ont.

The Jack Pot Cobalt Silver Mining Company, Limited. Capital, \$750,000, divided into seven hundred and fifty thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: R. S. Gilpin, D. A. Rose and F. T. Whittemore, all of Toronto.

Quebec Cobalt Mining Company, Limited. Capital, \$1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: J. E. Day, J. M. Ferguson, E. V. O'Sullivan, J. H. Hallett and Mary Donevan, all of Toronto.



Sullivan Hoisting Engine, Ironton Mine.

MINING INCORPORATIONS.

ONTARIO.

Mines, Limited. Capital, \$40,000, divided into four hundred shares of one hundred dollars each. Head office, Toronto, Ont. Provisional directors: W. H. Moore, Gerard Ruel and Geo. F. MacDonnell, all of Toronto, Ont.

Cobalt Gem Mining Company, Limited. Capital, \$1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: J. E. Day, J. M. Ferguson, E. V. O'Sullivan and Mary Donevan, all of Toronto.

Silver Horse Shoe Cobalt Mining Company, Limited. Capital, \$40,000, divided into forty thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors: Jos. Brown, Neil Sinclair and A. M. Harley, all of Toronto, Ont.

Kennedy Cobalt, Limited. Capital, \$1,000,000, divided into one million shares of one dollar each. Head office: Toronto, Ont. Provisional directors: W. H. Jackson and J. A. Morden, of Toronto, Ont., and David Kennedy, of Toronto Junction, Ont.

Duluth Cobalt Mining Company, Limited. Head office: Haileybury, Ont. Capital, \$500,000, divided into five hundred thousand shares of one dollar each. Provisional directors: J. F. Gillies and J. F. Hope, of Toronto, and John Mackay, of Sault Ste. Marie, Ont.

The Cobalt Mutual Mines Company, Limited. Capital, \$100,000, divided into one hundred thousand shares of one dollar each. Head office, Haileybury, Ont. Provisional directors: Arthur G. Slaght, Hugh LeRoy Slaght and Wm. Henry Phelan, all of Haileybury, Ont.

Montreal Cobalt Power Company, Limited. Capital, \$1,000,000, divided into ten thousand shares of one hundred dollars each. Head office: Toronto, Ont. Provisional directors: J. W. Bain, G. B. Strathy, R. R. Perry, L. C. Todd, and J. E. Riley, all of Toronto, Ont.

Cobalt Mines Syndicate, Limited. Capital, \$100,000, divided into one hundred thousand shares of one dollar each. Head office, Toronto, Ont. Provisional directors, J. E. Day, John M. Ferguson, E. V. O'Sullivan, James H. Hallett and Mary Donevan, all of Toronto.

London-Cobalt Mining Corporation, Limited. Capital, \$2,000,000, divided into two million shares of one dollar each. Head office: Toronto, Ont. Provisional directors: Geo. Stevenson, F. H. Potts, J. W. McDonald, E. Gillis, and Eva Lena Bradley, all of Toronto.

The Cobalt Ore Sampling Company, Limited. Head office: Cobalt, Ont. Capital, \$100,000, divided into one hundred thousand shares of one dollar each. Provisional directors: W. H. Fletcher, G. W. Parker, C. H. Moore, G. A. Woodward and George Ross, all of Cobalt, Ont.

Independence Cobalt Silver Mines Company, Limited. Capital, \$1,000,000, divided into one million shares of one dollar each. Head office, Toronto, Ont. Provisional directors: W. M. Williams, Joplin, Missouri; C. E. Mabon, of Lewiston, New York, and C. E. Loomis, of Attica, N.Y.

The Sharpe Lake Cobalt Silver Mining Company, Limited. Capital, \$1,000,000, divided into one million shares of one dollar each. Head office, Ottawa, Ont. Provisional directors: J. E. Murphy, W. Abbott, of Cobalt, Ont., and W. R. Bradbury, W. E. Matthews and R. G. Code, of Ottawa, Ont.

The Bucke Silver and Cobalt Mining Company, Limited. Capital, \$300,000, divided into three hundred thousand shares of one dollar each. Head office: Ottawa, Ont. Provisional directors: F. A. Heney, Nepean, Ont.; H. Hopp, E. L. Horwood, T. A. Beament and John L. MacLaren, all of Ottawa, Canada.

The Cobalt and Larder Lake Gold Mining Company, Limited. Capital, \$300,000, divided into three hundred thousand shares of one dollar each. Head office: New Liskeard, Ont. Provisional directors: Geo. C. Legge, Norman Bingham Strong, W. J. Egan, J. J. Kelly, and H. D. Graham, all of Haileybury, Ont.

The Youngstown-Cobalt Silver Mining Company, Limited. Capital \$1,000,000, divided into one million shares of one dollar each. Head office: Cobalt, Ont. Provisional directors: Geo. Albert Baker, Youngstown, Ohio; Walter A. Sadler, and D. H. Granville, of Cobalt, Ont., and G. W. P. Hood, of Toronto Junction, Ont.

The Casey Mountain Cobalt Mining and Development Company, Limited. Capital, \$250,000, divided into two hundred and fifty thousand shares of one dollar each. Head office, Haileybury, Ont. Provisional directors: R. B. Fergusson, R. G. Williamson, Geo. A. Pollard, David A. Reid, all of Regina, Saskatchewan, and David Williamson, of Haileybury, Ont.

BRITISH COLUMBIA.

The Bay Gold Mining Company, Limited. Capital, \$200,000, divided into two hundred thousand shares of one dollar each. Office in Yale District, B.C.

The Old Dominion Copper Development Syndicate, Limited. Capital, \$35,000, divided into thirty-five thousand shares of one dollar each. Office, Kamloops, Yale District, B.C.

CATALOGUES.

The Atlas Engine Works, of Indianapolis, have issued Bulletin No. 134, showing the various engines and boilers manufactured by the Atlas Engine Works. The headquarters of the company are at Indianapolis.

Catalogue A describes the Butters Patent Filter. This will thoroughly filter and wash slime at a minimum cost, and will handle slimes that cannot be treated by any other method. The sales agents are The Blaisdell Company of Los Angeles, Cal.

"Everlasting" is the title of Catalogue No. 16, issued by Wendell & MacDuffie, 26 Cortlandt street, New York. This firm makes asbestos shingles, slates and sheathing, made wholly of mineral fibre, asbestos, and the best Portland cement obtainable.

The Report of the Board of Trustees and of the State Mineralogist, California State Mining Bureau, have been issued to cover the fiscal year ending January 30th, 1906. The total value of the mineral production of California during that period was \$43,069,227.

A useful article in a prospecting outfit is a No. 10 forge; height 31 inches, width, 18 x 18 inches, weight, 125 lbs. They claim that if one of these forges should fall 20 feet its appearance might be spoiled, but it would be ready for business. Mussels Limited keep them in stock.

Mussels Limited send us a pamphlet descriptive of the Reading Multiple Gear Chain Hoist, capable of handling weights of from 1,000 to 40,000 lbs. Also some descriptions of hoisting machines manufactured by Marsh & Henthorn, of Belleville, Ont., for which Mussels Limited are the agents.

The Sullivan Diamond Core Drills are known the world over, though some interesting details may be gained, even by experienced men, from Catalogue No. 5, issued by the Sullivan Machinery Company, Railway Exchange Bldg., Chicago. It leaves very little to be said about the Sullivan Diamond Drill.

The Hathorn Works of the Western Electric Company are adequately described in a well illustrated pamphlet issued by that company. A map showing the positions of the different branches of the Western Electric Company, may be found useful by those wishing to procure electrical apparatus and supplies.

Catalogue No. 1, issued by the C. L. Hathaway Rock Crusher Company, Denver, Col., is descriptive of the Gyratory Rock and Ore Crusher manufactured by that firm. Every part of the crusher is shown, and a very full description of its mechanism, and the mechanical principles involved is included.

"The Diamond Drill and its Work" is the title of Catalogue No. 26, issued by the American Diamond Rock Drill Company, 95 Liberty street, New York City. Anyone having drilling to do would do well to procure a copy of this pamphlet before deciding where to order. Several of these drills are in use in the regions about Cobalt and Sudbury.

"Westinghouse Motor Applications" this month treats of A.B.C. Disk Fans. The introduction to this pamphlet states that ventilation is a subject that can never receive too careful consideration—a statement with which our readers well agree most thoroughly. Westinghouse motors from .25 to 2.85 h.p. are suitable for driving fans 18 inches to 60 inches in diameter. The Canadian Westinghouse Company will be pleased to send this pamphlet to all enquirers.

Westinghouse Motor Applications, is the name of a little booklet issued by the Westinghouse Electric Manufacturing Company of Chicago, represented in Canada by the Canadian Westinghouse Company, Limited, whose general offices and works are at Hamilton, Ont., with branches in Toronto, Vancouver, Winnipeg, Montreal and Halifax. This publication deals with the use of the small power motor for blacksmiths and blowers. Small motor powers are to-day replacing hand drive with even greater success than has been attendant upon the replacement of other forms of power drive by the larger types of motors.

PROVINCE OF QUEBEC

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

GREAT MINERAL TERRITORY

Open for Investment in the Province of Quebec.

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

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

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

All mines belong to the government of the Province on all unsold lands and on all those sold since the 24th of July, 1880, but gold and silver are always reserved, whatever may be the date when the land was sold, unless it be otherwise mentioned in the patent.

The government grants PROSPECTING LICENSES for lands on which the mines belong to it, giving the holders of such licenses the first right to purchase the mines. In the case of lands where the surface alone is sold, the owner of the surface may be expropriated if he refuses an amicable settlement.

The price of prospecting licenses is \$5.00 per 100 acres on surveyed lands and per square mile on unsurveyed lands. If the surface has already been sold, the price is only \$2.00. They are valid for three months and are renewable at the discretion of the Minister.

When mines are discovered, they can be bought or leased from the government. The purchase price is as follows :

Mining for superior metals on lands situate more than 12 miles from a railway in operation, \$5.00 per acre, and on lands situate less than 12 miles from such a railway, \$10.00 per acre ;

Mining for inferior metals—the price and the area of the concessions are fixed by the Lieutenant-Governor in council.

The words "superior metals" include the ores of gold, silver, lead, copper, nickel and also graphite, asbestos and phosphate of lime ; and the words "inferior metals" mean and include all the minerals and ores not included in the foregoing definition and which are of appreciable value.

MINING CONCESSIONS are sold in entire lots in surveyed townships or in blocks of not less than 100 acres in unsurveyed territories.

Patents are obtained subject to the following conditions :
The full price must be paid in cash : specimens must be produced

and accompanied by an affidavit ; a survey at the cost of the applicant must be made on unsurveyed lands ; work must be bona fide begun within the two years.

Mining licenses giving the right to work the mine and dispose of its products, are granted on payment of a fee of \$5.00 and a rent of \$1.00 per acre per annum. Such licenses are valid for one year and are renewable on payment of the fee and of the same rent. They may cover from 1 to 200 acres for one and the same person and must be marked out on the ground by posts. The description or designation must, however, be made to the satisfaction of the Minister.

Persons working mines must send in yearly reports of their operations to the government.

The attention of the public is specially called to the new territory north of the height of land towards James Bay, which comprises an important mineral belt in which remarkable discoveries of minerals have already been made and through which the New Grand Trunk Pacific Railway will run.

The government has made special arrangements with Mr. Milton L. Hersey, 171 St. James Street, Montreal, for the assay and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. Tariffs of assays can be obtained on application to him.

The Bureau of Mines at Quebec, under the direction of the Superintendent of Mines, will give all the information asked for in connection with the mines of the Province of Quebec and will supply maps, pamphlets, copies of the law, tariff of assays, etc., to all who apply for same.

Applications should be addressed to :

THE HON. MINISTER OF COLONIZATION, MINES & FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC

Ontario's

MINING

LANDS

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

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

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

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

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

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

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

The Canadian Pacific Railway runs through the entire mineral belt.

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

HON. FRANK COCHRANE,
Commissioner of Lands and Mines.

or
THOS. W. GIBSON,
Director Bureau of Mines,
Toronto, Ontario.

PROVINCE OF NOVA SCOTIA

**Leases for Mines of Gold, Silver
Coal, Iron, Copper, Lead, Tin**
AND
PRECIOUS STONES

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

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

THE HON. W. T. PIPES

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

W. McNALLY & CO.
MONTREAL

Portland Cements=====
Fire Bricks=====
Contractors', Builders' and Mining Supplies
Fire Clay Goods of all kinds=====

**SUBSCRIBE
NOW!**

THE CANADIAN MINING REVIEW
will be more interesting than
ever this year.

**THOMAS FIRTH & SONS
LIMITED**

"Speedicut" High Speed Steel,
Tool Steel, Axe Steel, Saw Steel, Files, Etc.

A LARGE STOCK CARRIED.

Office 60, Warehouse 51 St. Patrick Street, Montreal.

MONTREAL STEEL WORKS, Ltd.
AGENTS FOR CANADA

T. A. MORRISON & CO.

No. 200 St. James St., Montreal.

Contractors' Plant, New and Second-hand.
Champion Steel Jaw Stone Crushers, all sizes.
Sturtevant Roll Jaw and Rotary Fine Crushers.
Balanced and Centrifugal Rolls, Emery Mills.
Steam Road Rollers, Boilers and Engines.
Rock Drills, Concrete Stone.
Bridge and Building Limestone, Bricks, etc., etc.

COME TO HEADQUARTERS

We carry the fullest line of everything
the Chemist or Assayer requires:—

**CHEMICALS
GLASSWARE
APPARATUS**

Send for Catalogue.

**The Chemists and Surgeons
Supply Co. Ltd.** 32 McGill College Avenue
MONTREAL

CORRUGATED
WRITE FOR PRICES
METALLIC ROOFING CO.
LIMITED.
TORONTO, CANADA.
IRON

HADFIELD'S STEEL FOUNDRY CO. LIMITED SHEFFIELD

Heclon Rock and Ore Breaker

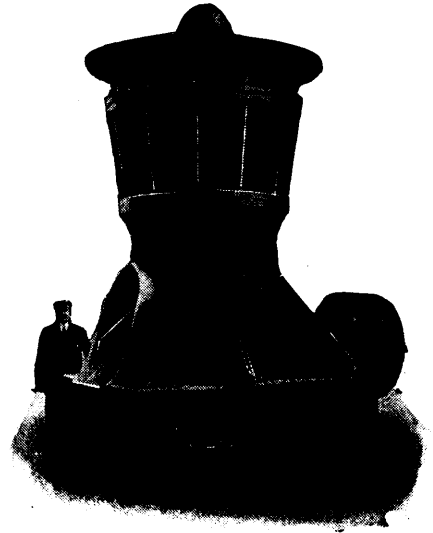
HADFIELD AND JACK'S PATENT

The only Perfect Gyratory Stone-Crusher

THE PARTS THAT ARE SUBJECT TO EXCESSIVE WEAR ARE MADE OF

Hadfield's Patent "Era" Manganese Steel

WE MANUFACTURE JAW BREAKERS, CRUSHING ROLLS, ELEVATORS, BIN GATES, AND GOLD MINING REQUISITES.



Sole Representatives of the Hadfield Steel Foundry Company, Ltd., Sheffield, for Canada.

PEACOCK BROTHERS, Canada Life Building - MONTREAL

M. BEATTY & SONS, LIMITED

WELLAND, ONTARIO

MANUFACTURERS OF

DREDGES
DERRICKS
MINE HOISTS
CENTRIFUGAL PUMPS
for SAND and WATER
STONE DERRICKS
STEEL SKIPS

DITCHERS
STEAM SHOVELS
HOISTING ENGINES
SUBMARINE ROCK
DRILLING MACHINERY
CLAM-SHELL BUCKETS
COAL AND CONCRETE TUBS

AND OTHER CONTRACTORS' MACHINERY

AGENTS:

E. Leonard & Sons, Montreal, Que., and St. John, N.B.

The Stuart Machinery Co., Winnipeg, Man.

The Wm. Hamilton Mfg. Co., Vancouver, B.C.

NICKEL

THE CANADIAN COPPER COMPANY.

NICKEL FOR NICKEL STEEL

THE ORFORD COPPER COMPANY.

WRITE US FOR PARTICULARS AND PRICES

General Offices: 43 Exchange Place, NEW YORK.

CONTRACTORS TO H. M. GOVERNMENT

ALLAN, WHYTE & CO.

CLYDE PATENT WIRE ROPE WORKS
Rutherglen, Glasgow, Scotland

MANUFACTURERS OF

WIRE ROPES For Collieries, Mines, Aerial Tramways

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



Illustration of Winding Rope, 240 fms. long x $3\frac{1}{2}$ circ. Galvanized Special Improved Patent Steel. Compound Make, supplied to Kenneil Collieries, Bo'ness, Scot., which gave a record life of 6 years and 2 months. Showing condition when taken off.

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

AGENTS IN CANADA:

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

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

DRUMMOND, McCALL & CO.

IRON, STEEL AND GENERAL METAL MERCHANTS

General Sales Agents

Algoma Steel Co., Ltd., Sault Ste. Marie,

And Importers of

Beams, Channels, Angles and other Structural Material,
Steel Plates—Tank, Boiler and Firebox Quality.

Cold Rolled Steel Shafting.

Mild Steel Bars—all diameters.

Wire Rope. Snow Steam Pumps. Tool Steel.

COMPLETE STOCK KEPT IN MONTREAL.

General Offices: CANADA LIFE BUILDING, - - Montreal.

MONTREAL PIPE FOUNDRY Co., Limited

MANUFACTURERS OF

CAST IRON **PIPE**
WATER and GAS

and other Water Works Supplies.

"LUDLOW" VALVES AND HYDRANTS.

General Offices: Canada Life Building - - Montreal.

PIG IRON

"C.I.F." Charcoal Pig Iron, also
"Midland" Foundry Coke Pig Iron

MANUFACTURED BY

CANADA IRON FURNACE COMPANY, LIMITED

Plants at RADNOR FORGES, Que., and MIDLAND, Ont.

General Offices: Canada Life Building - - Montreal.
GEO. E. DRUMMOND, Managing Director and Treasurer.

HOISTING ENGINES

ALL SIZES AND CAPACITIES

FOR

MINES, SHIPS, COAL WHARVES, DOCKS

QUARRYMEN, CONTRACTORS, BRIDGE BUILDERS

RAILROAD, DOCK, SUBWAY CONSTRUCTION

DREDGING, LOGGING, HAULING, ERECTING, DRIVING

ELECTRIC HOISTS

BELT HOISTS

PROMPT SHIPMENT

WIRE ROPE

FOR:

COLLIERIES, MINES

GUYS=====

AERIAL TRAMWAYS

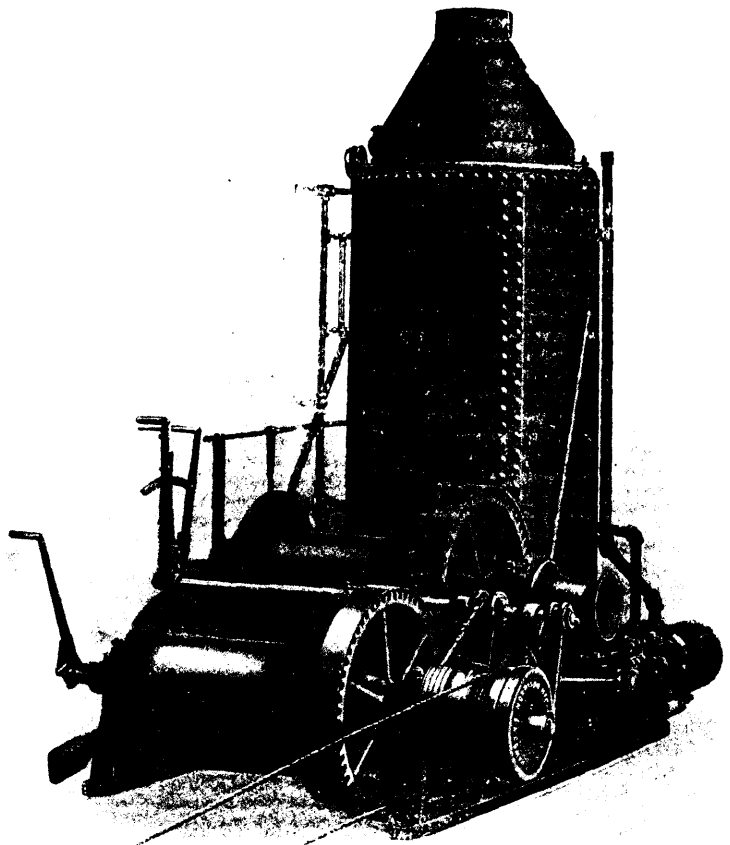
HOISTING, HAULAGE

TRANSMISSION=====

AND FOR ALL=====

CLASSES OF SERVICE

IN STOCK



F. H. Hopkins & Co.

Successors to the late JAMES COOPER

MONTREAL