

MARCH 1, 1916

Single Copies 15 Cents



CANADIAN



MINING JOURNAL

VOL. XXXVII

TORONTO

No. 5

In This Issue:

The proposed tax on Mining Companies.

Mining in Slocan District, British Columbia.

Flotation at Anaconda.

Flotation Methods.

Production of Ontario Mines in 1915.

Estimated Mineral Production of Canada in 1915.

CANADA

DEPARTMENT OF MINES

HON. P. E. BLONDIN, Minister.

R. G. McCONNELL, Deputy Minister.

MINES BRANCH

Recent Publications

The Nickel Industry: with special reference to the Sudbury region, Ont. Report on, by Professor A. P. Coleman, Ph.D.

The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (Quebec). Vol. III. Report on, by W. A. Parks, Ph.D.

The Bituminous Sands of Northern Alberta. Report on, by S. C. Ellis, M.E.

Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.

The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.

The Salt Industry of Canada. Report on, by L. H. Cole, B.Sc.

Electro-plating with Cobalt. Report on, by H. T. Kalmus, Ph.D.

Electro-thermic Smelting of Iron Ores in Sweden. Report on, by A. Stansfield, D.Sc.

Non-metallic Minerals Used in Canadian Manufacturing Industries. Report on, by H. Frechette, M.Sc.

The Mines Branch maintains the following laboratories in which investigations are made with a view to assisting in the development of the general mining industries of Canada:—

Fuel Testing Laboratory.—Testing value of Canadian fuels for steam raising and production of power gas; analyses, and other chemical and physical examinations of solid, liquid and gaseous fuels are also made.

Ore-Dressing Laboratory.—Testing of Canadian ores and minerals, to ascertain most economical methods of treatment.

Chemical Laboratory.—Analysing and assaying of all mineral substances and their manufactured products. Copies of schedules of fees, which are slightly in excess of those charged by private practitioners, may be had on application.

Ceramic Laboratory—Equipment is such that complete physical tests on clays and shale of the Dominion can be made, to determine their value from an economic standpoint.

Structural Materials Laboratory.—Experimental work on sands, cements and limes is also undertaken.

Applications for reports and particulars relative to having investigations made in the several laboratories should be addressed to **The Director, Mines Branch, Department of Mines, Ottawa.**

GEOLOGICAL SURVEY

Recent Publications

Memoir 34. The Devonian of Southwestern Ontario, by Clinton R. Stauffer.

Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

Memoir 56. Geology of Franklin Mining Camp, British Columbia, by C. W. Drysdale.

Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.

Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.

Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.

Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.

Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

Memoir 68. A Geological Reconnaissance Between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.

Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.

Memoir 73. The Pleistocene and Recent Deposits of the Island of Montreal, by J. Stansfield.

Memoir 74. A List of Canadian Mineral Occurrences, by Robert A. A. Johnston.

Memoir 76. Geology of the Cranbrook Map-area, British Columbia, by S. J. Schofield.

Memoir 77. Geology and Ore Deposits of Rossland, British Columbia, by C. W. Drysdale.

Memoir 78. Wabana Iron Ore of Newfoundland, by A. O. Hayes.

Memoir 79. Ore Deposits of the Beavertell Map-area, by L. Reinecke.

Memoir 81. The Oil and Gas Fields of Ontario and Quebec, by W. Malcolm.

Memoir 82. Rainy River District of Ontario. Surficial Geology and Soils, by W. A. Johnston.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

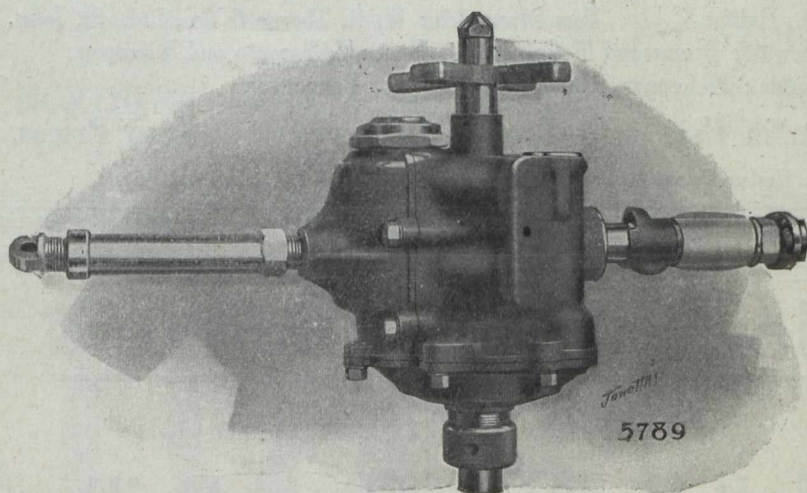
Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to **The Director, Geological Survey, Ottawa.**

A CONVENIENT TOOL FOR A GREAT MANY REPAIR JOBS

A PORTABLE pneumatic Metal Drill will save many times its cost on repair and construction work about the mine.



A "LITTLE DAVID" Drill is a most satisfactory tool for this work because of its simplicity and its great pulling power.

It's an easy tool to keep in good order as it has very few parts and these are well made.

Let us send you a catalog showing "LITTLE DAVID" construction and range of sizes.

CANADIAN INGERSOLL RAND COMPANY, LIMITED

Commercial Union Building, MONTREAL, CAN.

Vancouver, Nelson, Winnipeg, Timmins, Cobalt, Toronto, Sydney. Works: Sherbrooke, Que.

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,
Rutherglen, Glasgow, Scotland

WIRE ROPES

For Mining, Engineering and Shipping: For Hoisting and Haulage in Collieries and Mines: For Cableways and Aerial Ropeways: For Dredgers and Steam Shovels: Specially Flexible Ropes for Winches and Fast Hoists, Coal Towers and Cranes.

OF THE HIGHEST QUALITY

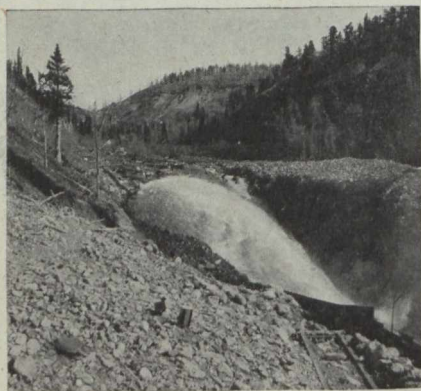
made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognized as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A. 1., Liebers and Private.

Don't Bull-doze Your Boulders



Block-hole them with

Sullivan Hammer Drills

If you have many boulders to break, don't waste time and powder in bull-dozing or "mud-capping" them.

Block-Holed Boulders require one-fifth to one-tenth as much powder, and break up smaller.

On Ruby Creek, British Columbia, a certain placer mine has to break over 20,000 boulders per season in its pit. In 1913 the cost per boulder (bull-dozing) came to 36 cents.

In 1914, the mine installed a *Sullivan Belted Air Compressor* and *40-lb. Sullivan Hammer Drills*, at a total cost of \$1,250. The saving, by block-holing, amounted to \$1,200 for the season.

Hand block-holing is better than bull-dozing. Block-holing with Sullivan Hammer Drills is far faster and cheaper than either.

Ask for Bulletin 666L

SULLIVAN MACHINERY CO.

122 So. Michigan Ave.

Chicago, U.S.A.



“NOTICE TO ALL MINING COMPANIES”

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

“IT WILL PAY YOU TO GET OUR PRICES.”

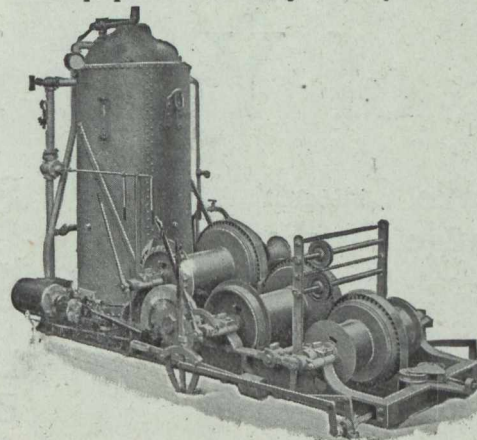
Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO. LIMITED

COBALT PORCUPINE TIMMINS

“BEATTY”

Hoists, Clamshells, Derricks and Material Handling Equipment of every description.



Standard Two-Drum Hoist with Swinger.

Engines for every kind of hoisting duty. “BEATTY PLANT” on your work means uninterrupted service and complete satisfaction.

SEND FOR CATALOGUE TO-DAY

M. BEATTY & SONS, Limited
Welland, Ontario

TORONTO BRANCH, 4th FLOOR, 154 SIMCOE STREET

AGENTS: — H. E. Plant, 1790 St. James St., Montreal, Que.
E. Leonard & Sons, St. John, N.B.
Rob't. Hamilton & Co., Vancouver, B.C.
Kelly-Powell, Ltd., McArthur Bldg., Winnipeg, Man.

1916

We shall appreciate your enquiries and orders for Assay Supplies during the year
1916

LYMANS,
MONTREAL

WE CAN SUPPLY PROMPTLY

your every requirement in the way of bare copper, copper clad, brass and bronze wires.

These products are rolled and drawn in our own mills and are of high quality and accurate guage throughout.

WRITE OUR NEAREST OFFICE FOR PRICES

STANDARD UNDERGROUND CABLE CO. OF CANADA, LIMITED
Hamilton, Ont.

Winnipeg, Man. Montreal, Que. Seattle, Wash.

Manufacturers of Electric Wires, and Cables of all kinds, also Cable Accessories.

UNIVERSITY OF TORONTO FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

- | | |
|--------------------------|------------------------------------|
| 1—CIVIL ENGINEERING | 5—ANALYTICAL and APPLIED CHEMISTRY |
| 2—MINING ENGINEERING | 6—CHEMICAL ENGINEERING |
| 3—MECHANICAL ENGINEERING | 7—ELECTRICAL ENGINEERING |
| 4—ARCHITECTURE | 8—METALLURGICAL ENGINEERING |

Leading to ACADEMIC and PROFESSIONAL Degrees

For Calendar and other information apply to the Secretary,

A. T. LAING

Send Us the Particulars of Your Requirements

Blake Crushers
Dodge Crushers
Gyratory Crushers
Crushing Rolls
Huntington Mills
Chilian Mills
Tube Mills

Shoes and Dies
Stamp Batteries
Compressors
Hoists
Engines
Boilers
Jigs

Trommels
Roasters
Dryers
Smelting Furnaces
Converters
Centrifugal Pumps
Steam Turbines

*Prompt Shipment on standard Machinery. Write for Bulletins
on the Subject which interests you*

FRASER & CHALMERS OF CANADA

LIMITED

59 BEAVER HALL HILL

MONTREAL, P.Q.

Nova Scotia Steel and Coal Co., Limited

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, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3-8" to 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 5-8" to 5" true to 2/1000 part of an 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, NOVA SCOTIA**

The Buffalo Mines, Limited

COBALT :: ONTARIO

Producers of Refined Silver

Cobalt Residues

Mercury for Mining Purposes

HEAD OFFICE :: 14 WALL ST., NEW YORK

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.

Write for Prices.

AGENCY:—

ROSSLAND, B. C.

Imperial Bank of Canada

Established 1875

HEAD OFFICE: TORONTO

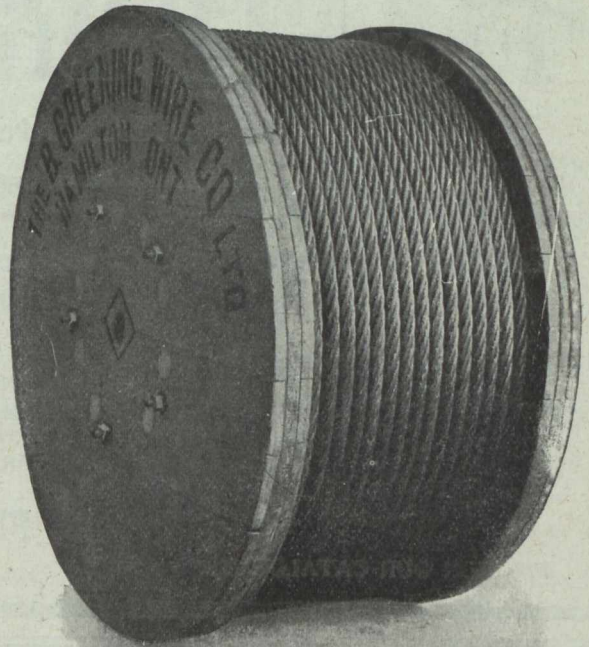
Capital Paid Up \$7,000,000
Reserve Fund 7,000,000

Branches in Northern Ontario at
Cobalt, South Porcupine, Elk Lake,
Cochrane, New Liskeard, North Bay
and Timmins.

Branches in Provinces of
Ontario, Quebec, Manitoba, Saskatch-
ewan, Alberta and British Columbia.

Money Transfers made to all parts of the
World. Travellers' Letters of Credit, Drafts,
Cheques, etc., negotiated.

HAULAGE AND HOISTING ROPES



DERRICK AND DREDGE ROPES SAW CARRIAGE ROPES
ROPES FOR HOUSE MOVING SMOKE STACK STAYS

Standard or Lang's Lay

WIRE ROPE FITTINGS WIRE ROPE GREASE
The B. GREENING WIRE COMPANY, Limited
HAMILTON, ONT. MONTREAL, QUE.

Pig Lead, Ingot Tin, Ingot Copper,
Ingot Aluminum,
Bertha Spelter,
and
Everything in Metals

THE CANADA METAL CO., LIMITED

FRASER AVENUE TORONTO

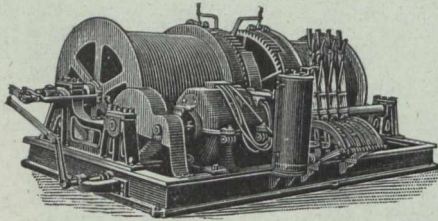
BRANCH FACTORIES MONTREAL, WINNIPEG

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's 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.

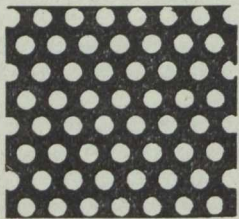
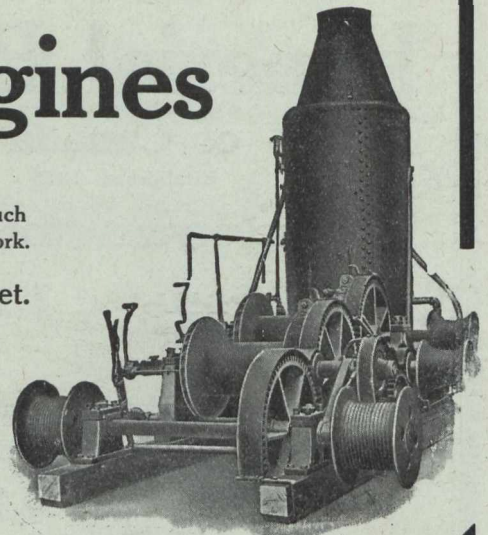
SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.

S. Flory Mfg. Co.

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



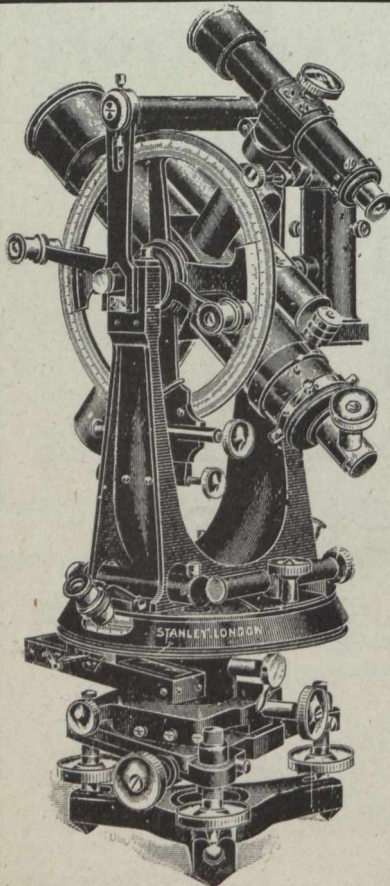
PERFORATED METALS

For Every and All Purposes in all Metals

Elevator Buckets (plain and perforated).
Conveyor Flights and Trough, also
General Sheet Iron Work.

HENDRICK MANUFACTURING CO., Carbondale, Penna., U.S.A.

New York Office: 30 Church St.



Trade
STANLEY
Mark

The largest manufacturers of

SURVEYING and DRAWING INSTRUMENTS in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 65" Catalogue and compare our prices with those of other first-class makers.

W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, High Holborn, W.C.

Head Offices and Showrooms:

286, High Holborn, London, W.C., Eng.

Stanley's Dunbar-Scott Auxiliary Top and Side Telescope. Requires no correction for eccentricity

A New Book By a Mining Engineer

Published April, 1914

Compressed Air

Production—Transmission—Use

By THEODORE SIMONS, E.M., C.E.

Professor of Mining Engineering, Montana State School of Mines
Member American Institute of Mining Engineers.

173 pages, 6x9, fully illustrated. \$1.50 (6/3) net, postpaid.

The author's aim has been to give such insight into the natural laws and physical principles underlying the production, transmission and use of compressed air, as shall enable the reader to comprehend the operation of various appliances and judge of their merit.

He does not attempt to give extensive descriptions of existing types of compressors, but only examples which illustrate the principles, and which enable the student and investigator to solve the theoretical problems arising in the use of compressed air.

— For Sale By —

Canadian Mining Journal, - Toronto, Canada

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, \$73,269,603; Lode Gold, \$81,595,516; Silver \$37,709,282; Lead, \$31,468,462; Copper, \$86,939,370; Other Metals (Zinc, Iron, etc.), \$2,198,949; Coal and Coke, \$149,814,462; Building Stone, Brick, Cement, etc., \$23,827,101; making its Mineral Production to the end of 1914 show an

Aggregate Value of \$486,822,745

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1894, inclusive, \$88,904,199; for five years, 1894-1899, \$46,906,258; for five years, 1899-1904, \$90,391,394; for five years 1904-1909, \$121,618,733; for five years, 1909-1914, \$139,002,161.

Production During last ten years, \$260,620,894

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those of any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, British Columbia

YOUR Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully
Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.

(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

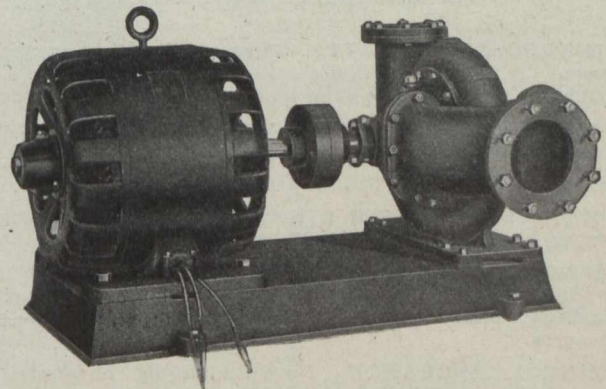
"For information regarding sintering of iron ores and iron flue dust, consult special licenses."

American Ore Reclamation Co.

71 BROADWAY, N.Y.

Pumps For Every Service

Let us know your particular requirements,—We have the right pump for you.



Perfect Workmanship
Right Prices.

The Smart-Turner Machine Co., Limited
Hamilton, Canada

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H.P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

**HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.**



PROVINCE OF QUEBEC

Department of Colonization, Mines and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is \$10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of \$10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of \$5 an acre for SUPERIOR METALS, and \$3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONOURABLE THE MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC

When Answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Dominion Coal Company

Limited

Glace Bay

Nova Scotia

19 Collieries

Output—5,000,000 tons annually

"Dominion" Coal

Screened, run of mine and slack

"Springhill" Coal

Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,

112 St. James Street, Montreal

or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.

and to the following Agents

R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

School of Mining

AND

COLLEGE OF APPLIED SCIENCE

QUEEN'S UNIVERSITY

KINGSTON - - - ONTARIO

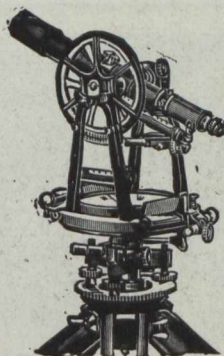
1. Four Year's Course for a Degree (B.Sc.) in
 - (a) Mining Engineering.
 - (b) Analytical and Applied Chemistry.
 - (c) Mineralogy and Geology.
 - (d) Chemical and Metallurgical Engineering.
 - (e) Civil Engineering.
 - (f) Mechanical Engineering.
 - (g) Electrical Engineering.

For Calendar of the School and further information apply to The Secretary, School of Mining, Kingston, Ontario.

Milling and Mining Machinery

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

Alex. Fleck, Ltd. - Ottawa



Berger

TRANSITS AND LEVELS

Let us send complete information on these instruments, and then have us quote on your requirements. We can furnish with these instruments any attachment you may desire.

The BERGER Standard Transits and Levels are the "Inimitable Instruments"

C. L. Berger & Sons

25 Williams Street Boston, Mass., U.S.A.

NICKEL

Shot - High and low carbon.

Ingots -

Two sizes:

25#, 50#.

ELECTROLYTIC NICKEL 99.80%

Our metal is prime for the manufacture of Nickel Steel, German Silver, Anodes and for all remelting purposes, and is produced as rods, sheets, strip stock, wire and tubes.

Send inquiries direct to us



The International Nickel Co.

48 Exchange Place

New York

MONEL METAL

WE ARE SOLE PRODUCERS of this natural, stronger than steel, non-corrodible alloy. Manufactured forms are rods, flats, castings, tubes, sheets, strip stock and wire. Ask for descriptive booklet.

AMERICAN ZINC LEAD & SMELTING CO.

PURCHASERS OF

ZINC ORE

PRODUCERS OF

HIGH GRADE SPELTER

Including "MASCOT" and "CANEY" Brands

SULPHURIC ACID

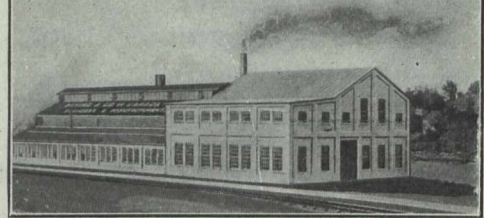
Send Ore Inquiries to
1012 PIERCE BUILDING
ST. LOUIS, MO.

Send Spelter and Acid Inquiries to
2646 EQUITABLE BLDG.
NEW YORK, N.Y.

Boving Hydraulic & Engineering Company, Limited

LINDSAY, ONTARIO

OUR LINDSAY WORKS

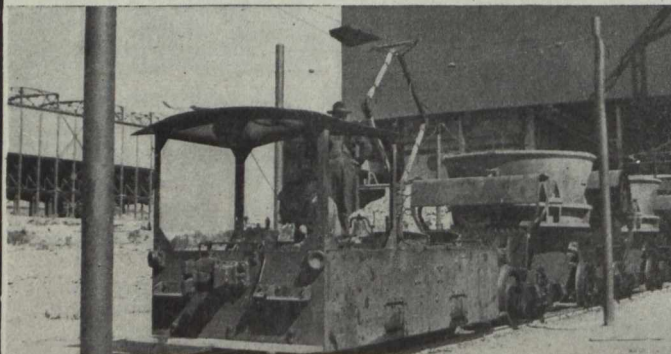


We Manufacture

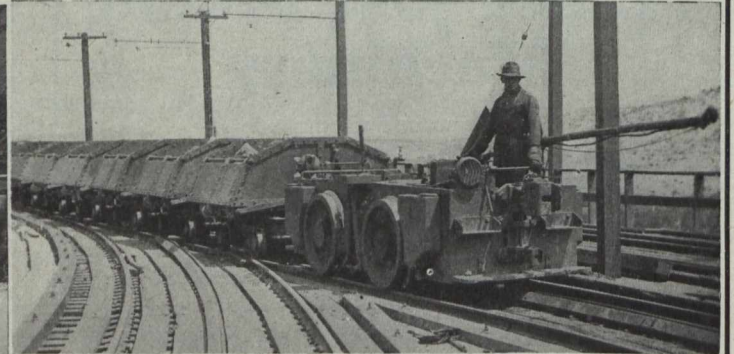
Water Wheels, Hydraulic Governors
Centrifugal Pumps, Mill Machinery
Fly-Wheels [up to 28 feet dia.]

Prompt Shipment

Prices, etc., on request



An 18-Ton Locomotive Hauling Slag Pots from the Furnaces to the Slag Dump.



A 10-Ton Locomotive equipped with special third Rail Shoe. Used for Handling Charge Cars.

Jeffrey Locomotives Show Great Endurance in Smelter Service at the United Verde Copper Co.

The Locomotives for Slag Haulage are provided with special controllers for operating motors on the slag pots, which are thus controlled and dumped by the motorman. All the locomotives are provided with straight air-brake systems.

The Anaconda Copper Co., The Butte and Superior Copper Co., and the Bunker Hill & Sullivan Mining Co. are some of the other prominent metal mining companies who are extensive users of Jeffrey Locomotives.

Write for Catalogs and further information about Jeffrey Locomotives, Elevating, Conveying, Screening, Crushing, Power Transmission and Tipple Machinery, Coal Cutters, Drills, etc.

Three 18-ton, Eight 10-ton, Nine 4-ton, Four 6-ton and three 7-ton JEFFREY LOCOMOTIVES are used around the smelter and mines of this company.

JEFFERY MANUFACTURING CO., Canadian Branch and Warerooms, **Montreal**

THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, March 1, 1916.

No. 5

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office 263-5 Adelaide Street, West, Toronto

Branch Office 600 Read Bldg., Montreal

Editor

REGINALD E. HORE

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

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

CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS

Editorials—

The Proposed Tax on Mining Profits	107
Mineral Production of Canada in 1915. By J. McLeish..	109
Mineral Production of Ontario in 1915. By Thomas W. Gibson	110
Important Factors in the Operation of the Cyanide Process. By G. H. Clevenger	111
Flotation at Anaconda. By F. Laist and A. E. Wiggin..	113
A Sudbury Ore Chute. By Albert E. Hall	117
Mining in the Slocan District, B.C., in 1915. By E. Jacobs	119
Flotation Methods. By C. Terry Durell	121
Ontario Nickel Mines. By Thos. W. Gibson	124
The Proposed Tax on Profits. By Sir Wm. Thos. White	125
Personal and General	127
Special Correspondence	128
Markets	130

THE PROPOSED TAX ON MINING PROFITS

One of the most dangerous proposals with which the mining industry of Canada has yet had to contend has been made by the Hon. Sir Wm. Thomas White, Minister of Finance. It is seldom that a Minister is called upon to meet so many difficulties in a few years as has Sir Thomas, and it is fortunate for Canada that such an able man fills the important office of Minister of Finance at this time. All admire the skill and courage with which he has met new conditions as they have arisen. His proposal to single out one of Canada's chief basic industries for especially heavy taxation was therefore unexpected. The Minister having well earned the confidence of the people, mining men on reading newspaper accounts of the proposed tax on profits assumed that special provision had been made to provide for fair treatment of mining companies. If such is the case, and we still trust that it is, no announcement has been made.

It is an axiom of good government that basic industries should be encouraged. Sir Thomas seems to recognize this when he singles out agriculture for favorable treatment. Agriculture is Canada's greatest basic industry and well merits the fostering care of our government. Mining is, next to agriculture, our greatest basic industry. It might have been expected that Sir Thomas would therefore show some concern for the future of the mining industry. What he proposes, however, is quite the contrary. He would tax the mining industry more severely than any other industry in the country.

The grossly unfair treatment of successful mining companies has not been pointed out by the Minister in the House. He has so worded his proposal that discrimination against mining companies is not apparent to those who are unfamiliar with the mining industry. By putting companies of so many kinds in one class he strikes a blow at mining in an effective manner without the average citizen realizing the injustice and shortsightedness of it. A producing mine is a wasting asset. Sir Thomas knows it. Why does he ignore the fact?

Development of our resources and increase in production should be the aim of our government at all times and particularly now. Why does Sir Thomas propose to discourage mining companies from increasing production? Why does he discourage the investment of foreign capital?

It must, of course, be admitted that a Minister of Finance in these days has an extremely difficult task. It is easy to criticize his proposals, for new methods of taxation must be devised to meet the war expendi-

tures, and new methods are almost sure to result in distributing the burden unevenly. Sir Thomas undoubtedly wants to place it on those most able to bear it. Many have made fortunes out of Canada's mines, and the Minister naturally considers that such persons should contribute freely. A reasonable tax on the profits of successful mining companies, in spite of the fact that mining, like agriculture, is a basic industry and deserving of the fostering care of Government, might, under the circumstances, have been accepted by mining men without protest. An unfair tax such as Sir Thomas proposes is, however, beyond all reason.

Sir Thomas said in his budget speech that seven per cent. per annum is, in normal years, a reasonable profit on the paid up capital of a mining company. Think of it, and imagine if you saw that a Minister of Finance in a country like Canada, in which mining is one of the chief basic industries and which has enormous undeveloped mineral resources, stating on the floor of the House that seven per cent. per annum is, in normal years, a reasonable profit on the paid up capital of a mining company. The statement is absurd, and yet, so far as we have been informed, it was scarcely commented on in the House, but swallowed whole by our representatives.

The life of a mine is short. The profitable life is shorter. In Ontario the profitable life of most mines is less than ten years. How would you like to invest your money in a mine that would yield you seven per cent. for ten years and eat up your invested capital in that time? What would the people think if our Minister of Finance should propose to invest Government funds in such an enterprise? Can you imagine Sir Thomas making such a proposal?

Mining is attractive because it frequently yields large profits. Mining men take risks because the prizes are big. Undeveloped ore is of doubtful value. It takes money and labor to develop ore and determine whether it can be mined profitably or not. Money spent in exploration and development is often a total loss. If there were no rich prizes there would be little development of our mineral resources. If such a tax as Sir Thomas proposes were enacted, development of Canada's mineral resources would undoubtedly be checked.

In accepting the challenge of Germany to fight for our possessions Canada has accepted a financial burden which makes the development of our resources more necessary than ever. We should and could greatly increase production. During 1916, if Sir Thomas modifies his proposal, there will be a great increase in mining activity in Canada. It is to be hoped that further consideration of possible results of the proposed legislation will result in more favorable treatment of mining companies.

We believe that Canada's mineral resources are great and that with due care on the part of the Government the production in 1916 will be much larger than ever, and that future years will see great increases in output. Ore undiscovered is, however, of

no present value, and ore undeveloped is of doubtful value. To make our mineral resources a source of revenue there must be an expenditure of capital and labor. These are the main sources of profit in mining. Both must be treated with consideration.

Increased production from the mines will help us to pay the cost of the war. Severe taxation of mining companies will not do it. Does Sir Thomas want to kill the goose?

Since the above was written we have been advised that Sir Thomas' proposals will be modified and that when the bill is introduced it will be found to contain provisions which the Finance Minister thinks will meet the criticisms which have been offered.

On Thursday, Feb. 23, in reply to questions in the House, Sir Thomas intimated that in the case of mining companies provision would be made for a partial return of capital investment.

It appears that either the Minister has been, by criticism, convinced that the original proposal is dangerous or that his original proposal has been misinterpreted. In one of his statements on Thursday, Feb. 23, he said that "the profits to be taken will be net profits." This might be interpreted to mean profits after return of capital has been provided for. These intimations make us wonder whether Sir Thomas has not been misunderstood.

Perhaps, instead of criticizing Sir Thomas we should blame the system of bookkeeping adopted by Canadian and American mining companies. Few companies operating in Canada make provision in their financial statements for return of capital. The International Nickel Company is one of the few concerns which shows on its annual balance sheets a large charge against "mineral exhaustion." Most mining company books show no such item, and none of our Canadian companies show provision for return of capital expended on the properties. Hence most mining men think of profits as inclusive of a partial return of capital. Sir Thomas, having another idea of what is meant by the term "net profits," may not have had any intention of taxing mining companies so severely as we imagined. Possibly that is why the confidently expected announcement of special treatment for mining companies has not been made.

Deloro Township is to be the scene of considerable activity this year. The announcement that the Armstrong-McGibbon and the Maidens-McDonald claims are to be worked under options held by Mr. Clifford E. Smith and Mr. G. C. Bateman will arouse new interest in this township.

An interesting feature of the proposed tax is the liability of the International Nickel Company. This company's chief assets are the mines and smelter in the Sudbury district, operated by the Canadian Copper Company. The Nickel Company's profit is not all made in Canada, however, for the refinery and sales departments make their share in the United States and are not liable for the Canadian tax.

MINERAL PRODUCTION OF CANADA IN 1915

(Subject to Revision.)

As estimated by John McLeish, Department of Mines.

Metallic.		
Product.	Quantity.	Value.
Antimony, lb.	961,040	\$192,208
Cobalt, metallic, lb.	211,610	
Cobalt, oxide, lb.	379,219	502,388
Nickel, metallic, lb.	55,325	
Nickel, oxide, lb.	200,032	42,193
Copper, valued at 17.275c. per pound, lb.	102,612,486	17,726,307
Gold, oz.	916,076	18,936,971
Iron pig from Canadian ore, tons	158,598	1,740,808
Iron ore sold for export, tons	93,444	187,682
Lead, valued at 5.60c. per pound, lb.	45,377,065	2,541,116
Molybdenite, lb.	28,600	28,460
Nickel, valued at 30c. per pound, lb.	68,077,828	20,423,348
Silver, valued at 49.604c. per pound, oz.	28,401,735	14,088,397
Zinc ore, tons	15,553	636,204
Total		\$77,046,082

Non-Metallic.		
Product.	Quantity.	Value.
Actinolite, tons	220	\$2,420
Arsenic, white, tons	2,291	141,830
Asbestos, tons	113,115	3,491,450
Asbestic, tons	25,700	21,819
Chromite (a), tons	11,486	162,618
Coal, tons	13,209,371	31,957,757
Corundum, tons	262	33,138
Feldspar, tons	15,455	59,124
Graphite, tons	2,610	121,023
Grindstones, tons	2,580	35,768
Gypsum, tons	470,335	849,928
Magnesite, tons	14,779	126,535
Manganese (b), tons	47	5,460
Mica		81,021
Mineral Pigments—		
Barytes, tons	550	6,875
Ochres, tons	6,248	48,353
Mineral water		118,796
Natural gas, M. cu. ft.	18,319,710	3,300,825
Product.	Quantity.	Value.
Petroleum, value at \$1.395 per barrel, bbls	215,464	300,572
Phosphate, tons	217	2,502
Pyrites, tons	296,910	1,028,678
Quartz, tons	127,108	205,153
Salt, tons	119,900	600,226
Talc, tons	11,885	40,554
Tripolite, tons	317	12,119
Total		\$42,755,594

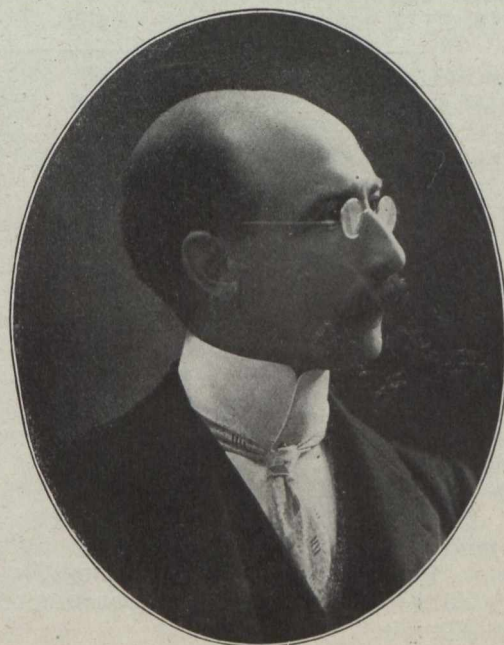
Structural Materials and Clay Products—		
Cement, Portland, bbls.	5,681,032	\$6,977,024
Clay products—		
Brick, common, pressed, paving		2,341,483
Sewer pipe		795,646

Fireclay, drain tile, pottery, etc.		781,071
Kaolin, tons	1,300	13,000
Lime, bushels	4,932,767	1,015,878
Sand and gravel		2,098,683
Sand-lime brick, No.	23,211,802	182,651
Slate, sq.	397	2,039
Stone—		
Granite		1,634,084
Limestone		2,504,731
Marble and Sandstone		365,784
Total structural materials and clay products		
		\$18,712,074
All other non-metallic		42,755,594
Total value, metallic		77,046,082
Grand total, 1915		\$138,513,750

(a) Additional returns make the Chromite production 14,291 tons, value \$208,718; (b) Exports are reported as 255 tons, valued at \$6,855.

TOUGH-OAKES.

Haileybury, Feb. 26.—On behalf of the Tough-Oakes Mine, as plaintiff, a writ has been issued against the present Board of Directors, consisting of Messrs. Harry Oakes, R. J. Robins, P. W. Morrison, W. H. Wright, J. B. Holden, Albert Burt and J. Y. Murdock, for fifty thousand dollars damages, which the plaintiff claims for "tort and illegal and wrongful interference by the defendants with the working of the plaintiff's company." The case is expected to be one of the biggest actions ever heard in the North Country.



MR. A. A. COLE
President-Elect, Canadian Mining Institute

MINERAL PRODUCTION OF ONTARIO IN 1915

A Preliminary Report by T. W. Gibson, Deputy Minister of Mines.

The rapid growth which marked the mineral production of Ontario for a decade prior to 1914 received a severe check in 1914, owing in part to business depression, but chiefly to the outbreak of war and the consequent disturbances in industrial and financial conditions. In 1915 there was a turn in the tide with an increase in production over 1914. Gold exhibits a large advance, offset to some extent by decrease in silver production. Nickel and copper show what would be in times of peace considered abnormal increases. The demand for these metals for munition purposes has been great, and increased prices have stimulated production to the maximum capacity of the mines.

The following table, subject to revision, summarizes the mineral output of Ontario for 1915, with comparative values of different items for 1914:

	Quantity.	Value 1915.	Value 1914.
Gold, oz.	411,588	\$8,501,391	\$5,529,767
Silver, oz.	23,730,839	11,742,463	12,795,214
Copper ore, tons...	271	4,418	.....
Copper in matte, tons.....	19,608	3,921,600	2,081,332
Nickel in matte, tons	34,039	17,019,500	5,109,088
Iron ore, tons	394,054	764,515	531,379
Pig iron, tons	493,400	5,910,625	7,041,079
Cobalt ore, tons...	177	21,464	27,743
Cobalt (metallie.), lb.....	111,588	103,746	.....
Cobalt oxide, lb. . .	314,906	254,447	518,736
Nickel (metallie) lb	11,905	4,762	.....
Nickel oxide, lb....	145,323	17,968	27,716
Other cobalt and nickel products, lb.	75,447	9,227	45,189
Molybdenite ore, tons.....	192	12,859	.....
Molybdenite concentrate, lb.	1,068	1,240	.....
Net value metallic production		\$47,721,180	\$33,345,291
Non metallic products		9,811,664	12,950,668

Total value mineral production \$57,532,844 \$46,295,959

Gold.—The producing gold mines in Ontario in 1915 were seventeen in number, twelve being in Porcupine. Some of the large producers were:

	Tons Milled.	Ounces Recovered.	Value per ton.
Hollinger	334,750	156,575	9.67
Dome.	317,740	73,726	4.79
Aeme.	106,486	49,933	9.69
McIntyre.	101,955	36,094	7.31
Porcupine Crown	46,419	29,032	12.92
Tough-Oakes	26,196	26,658	21.04
Vipond.	35,899	11,871	6.83

Other gold producers were: Dome Lake, Gold Reef, Schumacher, Porcupine Pet, Mines Leasing Co. (Rea), Porphyry Hill, Croesus, Canadian Exploration Co., Cordova and Olympic.

Silver.—The production of silver by camps was:

	Oz.	Value.
Cobalt proper	23,187,545	\$11,481,265

Casey township	223,939	105,846
Gowganda.	242,229	116,856
Silver from gold ores	77,126	38,496
	<u>\$23,730,839</u>	<u>\$11,742,463</u>

Nine companies each produced over 1,000,000 oz. in 1915:

	Oz.
Nipissing.	4,610,051
Mining Corporation (Townsite)...	2,776,589
Kerr Lake	2,109,355
Seneca Superior	2,109,355
Coniagas.	1,996,257
Mining Corporation (Cobalt Lake)	1,566,206
Temiskaming.	1,486,400
La Rose	1,071,694
McKinley - Darragh - Savage.....	1,061,827

As to the future of the Cobalt camp, there is little doubt that the decline in output which began in 1912 will continue. Several of the companies are developing old prospects which have not received attention since the first years of the camp's life.

Nickel and Copper.—Heretofore the low valuation placed on the nickel-copper matte by the producing companies has been accepted for statistical purposes. In 1914 these figures were 11.2 cents per lb. for nickel and 7.2 cents for copper. Exact values cannot be obtained, for the reason that nickel-copper matte is not a commodity bought and sold in the open market. The basis of valuation for 1915 has been fixed by the Bureau of Mines at 25 cents per pound for nickel and 10 cents for copper. These figures are conservative, in view of the fact that the average price of refined copper in 1915 was about 17 cents, and that the nickel refined in Ontario in 1915 was sold at 40 cents per lb.

The quantity of nickel-copper ore raised in 1915 was 1,325,973 tons, of which 11,923 tons came from the Alexo mine in Dundonald township, as against 7,982 tons in 1914. Ore smelted by the Canadian Copper Co. and Mond Nickel Co. was 865,169 and 407,144 tons respectively.

Legislation.—The Canadian Minister of Finance announced Feb. 15, 1916, that a special business tax for war expenses would be levied on companies, including mining companies, with a capital of over 50,000, to the extent of one-quarter of all profits in excess of seven per cent. The measure is to be retroactive and to cover the three year period from Aug. 4, 1914, to Aug. 4, 1917. In most commercial enterprises large annual returns mean the building up of the business or property, while mining profits are taken from real capital and mean an exhaustion of ore reserves. The War Revenue Bill promises to be most important in its relation to the mining industry.

Dividends.—During the year dividends paid by silver mines operating in the Cobalt are amounted to \$4,441,948. The total return to shareholders up to the end of 1915 reached \$59,660,912.

Up to the end of 1914 two Porcupine gold mines, Hollinger and Porcupine Crown, had paid dividends amounting to \$2,850,000. During 1915 the Dome and Tough-Oakes have been added to the list. The total paid by gold mining companies to Dec. 31, 1915, amount to over \$5,000,000.

IMPORTANT FACTORS IN THE OPERATION OF THE CYANIDE PROCESS*

By G. H. Clevenger.

Inasmuch as the cyanide process is of vital importance in the present-day hydrometallurgy of gold and silver, a discussion of the more important controlling factors of the process is in order.

The degree of comminution of the ore is one of the most important factors, particularly in the treatment of silver ores. The purpose of grinding is to free the gold and silver minerals from the enclosing gangue and to reduce the mineral particles to such a size that they are readily dissolved. Grinding should be carried on in such a manner as to waste as little power as possible in grinding the worthless gangue and still fulfil the above named conditions to the fullest extent possible, since the less the mineral is protected by the gangue and the greater the surface of the mineral exposed to the solution, the more rapid the rate of dissolution.

It then follows, for example, in the case of certain silver ores, that while fine grinding may not produce any greater ultimate extraction, yet in general it will materially reduce the time of treatment necessary. But this advantage is not always realized without the disadvantage of greater consumption of cyanide arising, since finer grinding not only causes a greater surface of the minerals containing the precious metals to be exposed to the solution, but also a greater surface of those minerals, if present, which may act as cyanicides. Careful correlation of the time of treatment with degree of comminution may serve to minimize this difficulty.

Selective grinding whereby the heavy mineral particles are ground finer than the lighter particles of gangue takes place automatically to a greater or less degree in closed circuits where hydraulic or mechanical classifiers are employed so that actually in the majority of plants the heavy mineral particles are ground finer than the gangue. The additional cost of finer grinding, together with the attendant disadvantages which may arise, must in each case be carefully weighed against the additional extraction possible, or the decreased time of treatment necessary to obtain a given extraction.

The concentration of the solution of cyanide is a vital point. In general, the stronger the solution, within certain fairly well defined limits, the more rapid the dissolution, and, furthermore, the less the interference of a given percentage of impurity which might be present in solution. On the other hand, a greater proportion of impurity may be dissolved by the stronger solution. In the case of a plant which is operating at forced capacity a stronger solution may be used to advantage in order that the maximum extraction may be attained under this condition of operation. Stronger solutions may result in increased cyanide consumption, although the magnitude of this loss in a properly operated plant is not so great as has been supposed.

However, in a plant where there is considerable mechanical loss of solution the additional cyanide loss would prove an important factor. For this reason a strong solution is not generally favored when continuous decantation is used. The tendency in some cyanide plants has been to use a lower concentration in cyanide than that capable of giving the highest economical result. This probably is through the fear of excessive cyanide loss.

The alkalinity both as regards the kind of alkali and its concentration is perhaps only second to the concentration of the solution in cyanide in importance. The effective alkalies are the alkaline hydroxides, the most available being caustic soda and lime. Lime in contact with the solution becomes calcium hydroxide, slightly soluble, but sufficiently soluble to be effective as an alkali in cyanide treatment. Lime in the majority of localities is much cheaper than caustic soda and, fortunately, is in the majority of cases the most satisfactory alkali to use. Many of the impurities which form soluble sodium salts form with calcium insoluble compounds which are eliminated with the tailing, thereby maintaining the solution at a higher degree of efficiency. There is evidence to indicate that when certain antimonial minerals are cyanided caustic soda may prove the more satisfactory alkali; this, however, is not definitely proved, and most certainly is not true in all cases.

The concentration of alkali, or as it is usually termed the protective alkali, may vary from practically 0 to 100 points. At the Homestake a very low alkalinity is conducive to the best extraction, while in treating raw Cripple Creek ores a rather high alkalinity, employing lime, results in the highest extraction and the lowest consumption of cyanide.

Dilution or ratio of solution to dry ore in the pulp undergoing treatment is generally recognized as a factor to which proper attention must be paid if the highest extraction is to result. If a higher dilution is used than is necessary the capacity of the plant is cut down, and, on the other hand, if the dilution be too low the maximum extraction is not attained. It is quite impossible to give general figures for minimum dilution as these figures vary for different ores. In general, lower dilutions can be used with gold ores than with silver ores, probably on account of the greater weight of metal to be dissolved in the latter case. Other conditions being equal, it appears that lower dilutions can be used with the Pachuca agitator than with the mechanical agitator on account of the greater proportion of air brought in intimate contact with the pulp.

The time of treatment depends upon the character of the silver and gold minerals and upon their degree of comminution, and, as previously pointed out, also upon the concentration or strength of the solution in cyanide. It therefore follows that finer grinding, or increase of the cyanide concentration of the solution, or both, will in general result in reducing the time of treatment necessary. In cases where the cost of power is high, and as a consequence the cost of fine grinding would be excessive, the ore may be ground to the point where the minerals are liberated from the gangue and then separated into sand and slime, the slime being treated by agitation followed by either decantation or filtration. The sand containing the coarse mineral particles requiring a long period of contact with the solution for dissolution can be given the long period of contact necessary at a reasonable cost by leaching. Cases of this kind clearly indicate where combined sand and slime treatment can be employed to advantage.

The method of precipitation employed, assuming equal efficiency as regards the precipitation and recovery from solution of the precious metals, may exert an important influence upon extraction, either through introduction of the precipitant used into solution or its failure to precipitate certain interfering elements. For example, zinc in the presence of arsenic may interfere in the treatment of certain ores. If aluminum

*Extract from paper presented at the Second Pan-American Congress, Washington, D.C., January 8, 1916.

precipitation is used the difficulty is overcome through the elimination of zinc. When copper reaches a certain concentration in solution difficulties arise with both extraction and precipitation. Neither zinc nor aluminum precipitate copper to any extent, hence if copper is to be removed from solution electrolytic precipitation must be used.

Carbon, which at times occurs in gold and silver ores, may occasion difficulty in cyanidation. It has been generally assumed that carbon occurs in gold and silver ores in the form of graphite, but the evidence available by no means supports this view in all cases. The two extremes of carbon as regards its behavior in cyanide solutions are graphite and charcoal. Graphite is dense and does not possess pores, therefore cannot occlude gases, while charcoal is porous and has the property of occluding relatively large volumes of gases. Graphite does not precipitate gold and silver from cyanide solutions while charcoal does. Intermediate between these two extremes are various forms of carbon which will precipitate gold and silver to a greater or less extent.

The only gold ore containing carbon which I have had an opportunity of investigating carefully showed but little tendency to cause premature precipitation. This fact, together with its general appearance, led to the conclusion that the carbon in this ore was largely by interfere with cyanidation. Experiments with def-graphite. However, the graphite was found to definite-flocculation of the colloidal portion of the ore including the graphite gave negative results, but it was discovered that if the physical state of the graphite were altered, most conveniently by heating, that the extraction was wonderfully improved.

Practically all gold or silver ores can be treated by the cyanide process or by the cyanide process in combination with some other preliminary or accessory treatment, with the exception perhaps of certain ores containing a considerable amount of copper, lead, etc. In such cases, the desirability of recovering the base metals leads to smelting the ore upon either the lead or copper basis, and the necessity for hydrometallurgical treatment for the recovery of the gold and silver disappears since the precious metals are recovered by the smelting operation in connection with the base metals. Despite the fact that most ores can be successfully treated by the skillful application of the cyanide process, either alone or in combination with other accessory operations, it cannot be said that such treatment is always profitable, so that much remains to be done in the way of simplifying and lowering the operating costs of hydrometallurgical processes for the treatment of gold and silver ores, and in many cases improving the percentage of extraction.

CHAMBERS-FERLAND.

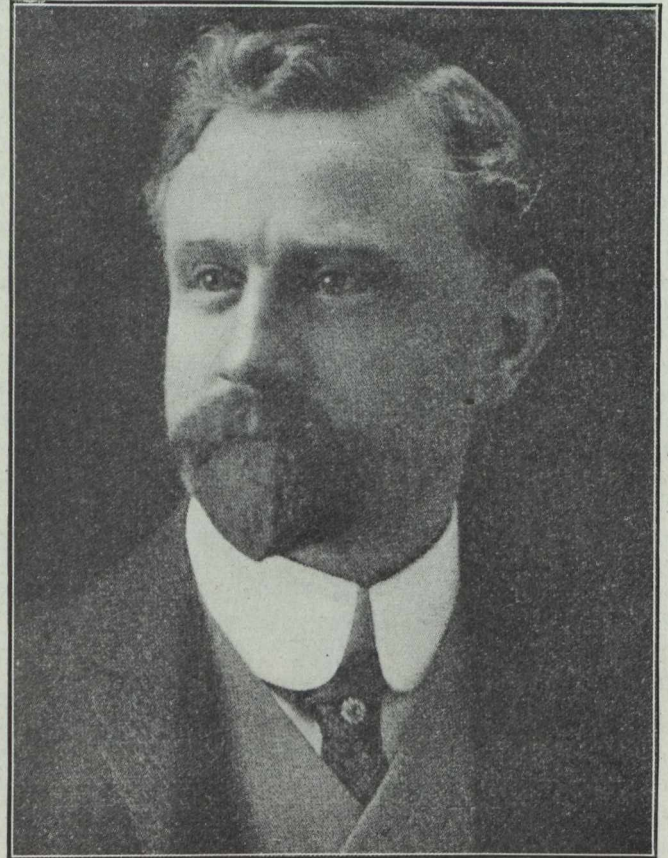
Cobalt, Feb. 26.—Sinking at the Chambers-Ferland has been resumed. Stopping at the 90-ft. drift at the 426-ft. level has been going on for about ten days in order to complete a carload shipment of high-grade. The latter car will be shipped next week.

DOMES MINES.

President J. R. De Lamar of the Dome Mines Co., says regarding the proposed Canadian war tax: "The trivial payment of 35 cents a share which Dome would have to contribute to this war taxation will be paid with the greatest pleasure, notwithstanding that I own over one-quarter of the outstanding stock."

TO DIAMOND DRILL IN THE PAS COUNTRY.

According to stories reaching Cobalt from The Pas, considerable activity in the way of prospecting is likely to occur in the spring. Four diamond drills are said to have been shipped from Sudbury. These should be on the ground very soon. It is understood that Messrs. Smith & Durkee have a 50,000 drilling contract with the Hammell Syndicate, which owns property near Flin Flon Lake.—Cobalt Nugget.



MR. G. G. S. LINDSEY
Retiring President, Canadian Mining Institute

PORCUPINE KEORA MINE.

The Keora property situated north-east of Porcupine Lake, Ont., is now under option to an American company. The Keora was organized in 1911 by Mr. William B. Gunton, of Toronto. Mr. Gunton explored the surface and its vein system very extensively. He is said to have found strong veins with good values, and to have sunk a shaft sixty feet on the widest of the lodes. The financing depended upon sale of stock, and Mr. Gunton, like many other Porcupine promoters, was, after the fire in 1911, unable to interest the public and therefore forced to discontinue the work. From that time until now the mine has been idle. Mr. A. J. Brant, who will be in charge for the holders of the option, states the work will be started at once, and a shaft sunk to 200 ft. This work will probably be let out to contractors.

A despatch to Washington from the United States consul at Johannesburg, South Africa, gives the information that the gold output of the Transvaal for 1915 was 9,093,671 oz., as compared with 8,394,322 oz. for 1914.

FLOTATION CONCENTRATION AT ANACONDA*

By Frederick Laist and Albert E. Wiggin.

Early in 1914 it was decided to test, on a fairly large scale, the treatment by flotation of Anaconda slime and mill tailing. For this purpose a standard-type Minerals Separation machine was installed at the Washoe Reduction Works during May and June, 1914. This was followed by the installation of a full-size Callow pneumatic machine plant. Experiments were also made, on a smaller scale, with the Froment, the Towne, the Fields, and the Anaconda flotation machines. The last-named machine was developed at this plant. In addition to the tests made in the standard-type Minerals Separation machine some tests were made using a Minerals Separation machine of the sub-aeration type.

During the series of experiments a large variety of oils was tested. Experiments were also conducted using both round-table feed and tailing to determine whether it would be better to displace the round tables by flotation for the treatment of the slime, or to supplement the round tables by flotation of the round-table tailing.

A series of tests was also made on the treatment of the mill tailing by grinding followed by flotation to determine the relative merits of flotation and leaching for the treatment of this product. In addition, flotation tests were made on mixtures of mill tailing and slime.

The round-table feed referred to above is the total slime from the mill. It contains about 35 per cent. colloidal solids and approximately 90 to 95 per cent. of the total solids will pass through 200 mesh (0.067 mm.). It assays from 2.3 to 2.6 per cent. Cu.

The mill tailing referred to above is the total discard from the mill, exclusive of the slime. It is all finer than 2 mm. and about 90 to 95 per cent. will remain on 0.25 mm. It assays about 0.60 per cent. Cu.

A brief summary of the experimental flotation results follows:

A series of tests was first carried out to determine roughly the best conditions for flotation, using the standard Minerals Separation machine and treating round-table feed: The following reagents were tested either alone, or in combinations: Turpentine, crude oil, cresylic acid, stove oil, tar oil, Carolina oil of tar, argols, sludge acid, fuel oil, wood creosote, and sulphuric acid. In some of these tests sulphuric acid was used and in others it was omitted. Also, the effect of the temperature of the pulp upon the flotation results was tested by heating to various temperatures.

As these tests were merely preliminary, no record was kept of the amount of reagents used. It was conclusively proved, however, that the best combination of reagents was sludge acid, wood creosote, stove oil and sulphuric acid. Fortunately, of all the reagents tested, these happened to be the cheapest. It was also proved that the addition of sulphuric acid to the pulp was of decided advantage in the treatment of the slime. In two successive tests in which sludge acid, wood creosote, and stove oil were used, the tailing assayed 1.25 per cent. Cu when no acid was used and 0.3 per cent. Cu when acid was used. Since these tests were made we have omitted the use of stove oil.

Tests With Standard Minerals Separation Machine.

This machine, with the accessory apparatus, was installed in a separate building, south of the round-table plant. It had 16 agitator compartments, each 2 feet

square, and 14 spitzkastens, and was of the standard Minerals Separation design. This machine is known by us as M. S. Machine No. 1. The agitators were of the standard Minerals Separation type, the impellers being 18 inches in diameter and the agitators making 265 r.p.m. This gave the impellers a peripheral speed of 1,245 feet per minute. The machine required 45 to 55 h.p., including motor and belt transmission loss, when operating under a full load of slime pulp.

We wish at this point to express our appreciation of the able manner in which the experimental work on the Minerals Separation machine was carried out by George A. Chapman, and staff, of the Minerals Separation Co.

The first products to be tested were the round-table feed and tailing. Conclusions from these tests were:

1. The economic capacity of the M. S. No. 1 machine when treating slime as produced from the mill at present (May 1st, 1915) seems to be from 80 to 90 tons.

2. The best combination of reagents for the treatment of slime seems to be sulphuric acid, kerosene sludge acid, wood creosote and stove oil. There is some question as to the real value of the stove oil. Its principal function seems to be to make a more compact froth.

3. It would not be economical to retain the round tables as the recovery by treating the slime directly by flotation is just as high as by retaining the round tables and treating the round-table tailing by flotation. The grade of concentrate would probably be the same in either case, but any difference would be in favor of treating the round-table feed directly by flotation. The heating of the round-table tailing pulp, on account of its low density, would increase the cost of the flotation.

4. In treating the round-table feed directly by flotation, the resulting tailing should assay 0.30 per cent. Cu, or less, with a concentrate carrying not over 40 per cent. insoluble. Possibly the concentrate can be made much cleaner with no sacrifice in the recovery.

5. It is thought that the best circuit density for the slime pulp for flotation treatment is about 12 per cent. solids.

6. It is thought that about 70 degrees F. will be found to be the most economical temperature at which to keep the pulp.

7. Acid seems to be absolutely essential to the successful treatment by flotation of our slime.

8. The addition of air in the last spitzkasten is of no advantage.

9. Any considerable increase in speed of the agitators above a peripheral speed of about 1,300 feet per minute seems to be disadvantageous.

From the treatment of mill tailing after grinding through 60 mesh, the following conclusions were drawn:

1. Although not definitely demonstrated, it is thought that the economical capacity of the M. S. No. 1 machine when treating sand tailing crushed through 60 mesh is about 175 to 200 tons per 24 hours.

2. The best combination of reagents seems to be sludge acid kerosene and sulphuric acid. However, a mixture of creosote, turpentine, and pine oil, in a non-acid circuit gave good results also. The non-acid circuit, however, seems to require more delicate adjustment and more careful attendance than the acid circuit.

*Extracts from a paper to be presented at the Arizona meeting of the American Institute of Mining Engineers, Sept., 1916.

3. The grinding mill makes an ideal agitator, and it is of decided advantage to add the oil ahead of the grinders.

4. The treatment of the mill sand tailing ground through 60 mesh should result in a tailing assaying not over 0.10 per cent. Cu. and a concentrate carrying not over 30 per cent. insoluble.

5. It is thought that the best density of pulp is from 25 to 30 per cent. solids.

6. Heating of the pulp to about 70 degrees, F. seems to be of advantage, although there is a possibility that this heating may be dispensed with during the summer months without any injurious results.

7. Acid seems to be beneficial but it is not of as much importance as in the treatment of the slime.

Tests With Minerals Separation Machine of Sub-Aeration Type.

This machine was sent here by the Minerals Separation Co., and was set up and tested at its request.

The principal difference between this and the No. 1 machine is that air is introduced at the bottom of the agitator compartment. The agitator was of the Howard type, practically a "balanced" pump impeller run backward, and each shaft had two impellers, one placed above the other and separated by a stationary grid. There was also another grid above the top impeller. There were four agitator compartments and four spitzkasten. The agitators made 185 r.p.m. At first it was planned to suck air from the atmosphere by the action of the impellers. This did not work, however, and it was found necessary to force air into the cells under a few pounds pressure. The feed was introduced through the bottom of the first agitator cell. The laundering was arranged so that as many spitzkasten as desired could be sent to finished concentrate, the remainder going to middling and being returned to the machine. This machine required 47 h.p. under a full load of slime, including motor and belt-transmission loss.

Two tests were made, one treating round-table feed, and one treating round-table tailing. It may be possible to develop an efficient machine of this type, but the particular machine sent here for testing was certainly not satisfactory.

A later test was made in which the spitzkasten were dispensed with and the froth was taken directly off the top of the agitator cells. Under these conditions, the four agitators seemed to create too much disturbance for the proper removal of the froth, and only two agitators; the first and third were operated. These modifications did not improve the work of the machine. This modified machine was called No. 2A.

Tests With Callow Pneumatic Machine.

Tests made by Mr. Callow at his laboratory in Salt Lake on samples of our mill tailing ground through 40, 60 and 80 mesh, and of our slime, had given such promising results that it was decided to try out the Callow machine on a commercial scale. Accordingly, there was shipped here during September, 1914, five standard Callow cells, 2 by 8 feet, a Pachuca agitating tank and accessory apparatus, consisting of blower and sand pumps. This equipment was installed in the old 80-ton experimental leaching plant and was ready for operation the latter part of October.

In addition to the Pachuca agitator recommended by Mr. Callow, we built a set of two mechanical agitators. These agitators consisted of a tank about 10 feet long by 2½ feet wide and 2½ feet deep, in which revolved a horizontal shaft carrying a set of paddles. These agi-

tators were belt driven from one motor and required a total of 25 to 30 h.p., including motor, belt and counter-shaft power loss. The agitators seemed to work well and had a combined capacity of about 60 tons of slime per 24 hours.

From tests on treatment of round-table feed and tailing by these machines, we concluded:

1. On our slime, air agitation is not as satisfactory as mechanical.

2. The capacity of one standard Callow cell is about 15 to 20 tons of slime per day.

3. The Callow machine produces a clean concentrate, but does not give as clean a tailing as the Minerals Separation machine.

4. The Callow machine is more sensitive and requires closer attention than the Minerals Separation machine.

5. The cost of repairs would probably be less on the Callow machine than on the Minerals Separation machine. This cost, however, is comparatively small for either machine.

6. The power required per ton treated in the Callow system is just about the same as that required in the Minerals Separation machine.

In all of these tests the original feed was divided among the Callow rougher cells, operating in parallel. As a rule, there was one cleaner cell operating also. When this was operating the concentrate from the rougher cells went to it, the cleaner making a final concentrate and a middling which was returned to the system. The rougher cells made the final tailing.

From tests on treatment of mill tailing after grinding through 60 mesh we concluded:

Conclusion From Tests.

The conclusions drawn from the foregoing tests were that the Minerals Separation machine was best adapted for the flotation work at Anaconda. Furthermore, that the most efficient reagents would be sludge acid kerosene, wood creosote, and sulphuric acid.

Description of Remodeled Concentrator as Adapted to Flotation.

The concentrator at Anaconda, as remodeled for flotation, consists of eight sections, each of 2,000 tons per day capacity, giving a grand total of 15,000 tons per day, allowing for shutdowns, repairs, etc. All sections are alike with the exception of Section 1. In this section Hancock jigs are used in place of Evans jigs and tube-mills are used in place of Hardinge mills.

Milling Division.

The ore is fed from the bins to a 2-inch round-hole shaking screen, the oversize going to a 12 by 24-inch Blake crusher. The product from this crusher is delivered to a 2-inch round-hole trommel, the oversize of which is sent to two 8 by 20-inch Blake crushers. The product from these crushers, together with the undersize from the 2-inch screens, is elevated and passed through 1-inch round-hole trommels. The oversize from this is treated in coarse Harz jigs, making a middling and a concentrate; the undersize is passed through ¾-inch trommels, the oversize being treated in fine Harz jigs making a concentrate and a middling. All sections are alike up to this point. In Section 1, the undersize from the ¾-inch trommel is screened on 1½ by 12-mm. trommels, the undersize going to the Anaconda classifiers and the oversize to the Hancock jigs. The treatment of the products from this point is the same in all sections, except that Section 1 uses tube-mills in place of

Hardinge mills for grinding, as noted previously. The undersize from the $\frac{3}{8}$ -inch trommel is screened through 4-mm. trommels, the oversize from these going to the double compound Evans jigs and the undersize going to $1\frac{1}{2}$ by 12-mm. trommels. The undersize from these trommels goes to the Anaconda classifiers, the oversize to double compound Evans jigs. The two sets of Evans jigs make a concentrate which goes to the dewatering bins and a middling which is ground for further treatment.

The concentrate from the coarse Harz jigs is dewatered and conveyed to bins. The middling is screened on a dewatering screen, the undersize together with the hutch product from the coarse Harz jigs going to the Evans jigs. The oversize is passed through rolls, 54 by 24 inches, and thence back into the system ahead of the 1-inch round-hole trommels. The concentrate from the fine Harz jigs is sent to the bins. The middling is screened through a dewatering screen, the oversize going to 54 by 24-inch rolls and then back into the system ahead of the 1-inch round-hole trommels. The undersize of the dewatering screen together with the hutch discharge of the fine Harz jigs goes to the Evans jigs.

The concentrate from the Evans jigs is dewatered in bins to about 7 per cent. moisture, and sent to the smelter. The jig concentrate assays about 15 per cent. insoluble and 8 per cent. copper. The middling, together with the hutch product is dewatered in tanks and screened through $1\frac{1}{2}$ by 12-mm. trommels, the undersize from which goes to the Anaconda classifiers, the oversize through 54 by 24-inch rolls, and back to the $1\frac{1}{2}$ by 12-mm. trommels.

The spigot from the Anaconda classifier is treated on 18 Wilfley tables, fitted with Butchart riffing, making a concentrate and a middling. These tables make a concentrate assaying 25 per cent. insoluble and a middling assaying 0.9 per cent. Cu. The concentrate is sent to the dewatering bins, together with the fine jig concentrate, and the middling is sent to the 10 by 4-foot Hardinge mills. The overflow from the Anaconda classifiers is sent to the slime thickener division, consisting of 28 by 3-foot Dorr tanks. The spigot product from these tanks is divided; about one-half is returned to the section and the remainder is sent to the slime plant.

The product from the Hardinge mills is treated in six simplex Dorr classifiers—one classifier to each mill—the overflow going to the flotation division and the classifier sand being returned to the mill.

At the time it was first decided to remodel the concentrator, it was not definitely known whether pebbles or steel balls would be used for grinding. To provide for this uncertainty a compromise was effected. The mills were made 10 by 4 feet and built sufficiently strong for steel balls in case balls were used. Each mill was equipped with a 225 h.p. motor directly connected through a flexible coupling. The mill filled with pebbles takes from 95 to 115 h.p. to operate. In case steel balls were used it was planned to put in a false wood lining back of the steel lining in the cylindrical part of the mill to reduce the effective diameter of the mill.

This latter plan was finally adopted, and the Hardinge mills will be equipped with the false wood lining, 15 in. thick, in the cylindrical part of the mill, and a Cascade steel lining. With this form of lining, the mill is virtually 7 1-2 by 6 ft. and requires about 225 h.p. when loaded with steel balls.

The lining was designed by the American Manganese Steel Co. At first the pebbles, and later the balls, were fed to the mills through the feed scoop. This method of introducing the grinding medium into the mill gave considerable trouble, due to the breaking of the feed boxes caused by the jamming of a pebble or ball between the revolving scoop and the feed box. We tried to obviate this difficulty by various changes in the amount of clearance left between the scoop and the box, but without success. In our particular case this trouble was aggravated by the fact that we had to use 7 ft. diameter scoops, in order to lift back into the mill the sand discharged by the Dorr classifier. Finally a method was tried of feeding the pebbles, or balls through a spout passing through the centre of the feed scoop. This device has worked splendidly and all of our mills have since been equipped with it.

Flotation Division.

The flotation division consists of four Minerals Separation machines, each having 15 agitators 3 ft. square, and 14 spitzkasten or floating compartments. The agitators for the Minerals Separation machines are of gun metal and are driven by bevel gears from a line shaft, the direction of rotation of the agitators alternating.

The machines are made of California red wood; the agitator boxes are further lined with hard maple extending about 18 in. from the bottom of the box.

Each machine has an individual drive, power being supplied to the line shaft by a 150-h.p. motor running at 385 r.p.m. The speed of the agitators is 225 r.p.m. and as the impellers are 18 in. in diameter the peripheral speed is about 1,060 ft. per minute.

Each machine makes three products, a concentrate, which goes to the dewatering division, a middling which is returned to the head of the machine, and a tailing which goes to waste. The concentrate is taken from the first three to five spitzkastens and the middling from the last nine to eleven. A portion of the pulp is overflowed from the last three spitzkastens together with the froth. About 6 to 8 lb. of $(50^\circ \text{ Be } \text{H}_2 \text{SO}_4)$ per ton of flotation feed is used together with 2 to 3 lb. of kerosene sludge acid and 1-2 to 1 lb. of crude wood creosote. A portion of the wood creosote is added ahead of the Hardinge mill (about 0.03 to 0.05 lb. per ton of feed) and the remainder is added in the sixth agitating compartment. The sulphuric acid and sludge acid are added at the head of the machine. The pulp is heated to from 60 to 70 degrees F., by passing live steam into it at the head of the machine. Three machines are used for treating sand and the fourth for treating current slime from the upper portion of the mill. Each machine has a capacity of about 400 tons per day on sand and 175 tons on slime.

The method of adding the oil and acid is rather unique. The mechanism consists of a revolving disk to which are attached, around the circumference, a number of cups. This disk is set vertically so that its lower edge dips into a pan of acid or oil. As the cups come around they are filled and later discharge their contents into a suitable launder leading to the flotation machine. The disk is driven by the friction of a wheel against another disk attached to the main drive. The wheel is run at constant speed and by varying the point of contact between wheel and disk any speed desired can be given to the main disk and thus the amount of oil or acid added can be regulated. In addition to the speed regulation, the amount of oil or acid fed may be varied by adding or removing cups or by changing the size of the cups.

At present (December, 1915), seven sections are operating on the new flowsheet, and the whole mill will be remodeled not later than Jan. 15, 1916. The sections are being remodeled one at a time. All the work is being done by the company's engineering force. Things have been so well organized and systematized that it requires less than 30 days to tear out the old section and install the new equipment, ready for operation.

(To be continued.)

YUKON GOLD.

Attached to the Guggenheim Exploration Co. circular is a general statement regarding the position of the Yukon Gold and its outlook, prepared by O. B. Perry, general manager:

"Company now owns dredging and hydraulic mines located near Dawson, Yukon Territory; dredging properties in the Iditarod and Ruby districts in Alaska; and on the Feather River, Butte Creek and American River in California. It has also 11 dredges, with power plants and other equipment required for their operation; a 70-mile ditch system, and complete hydraulic plant.

"The company has for several years past adopted the policy of purchasing new properties to add to its holdings and to take the place of its older mines as they eventually become worked out. * * * Substantial holdings have been added to the properties originally acquired. During the last two years it has acquired gold dredging properties in Alaska and California, which it is estimated will yield over \$3,000,000 of net profits.

"Company is now indebted to the Guggenheim Exploration Co. in the sum of \$1,375,000, for advances made from time to time as funds have been required, for working capital, additional equipment, and other purposes. The Guggenheim Exploration Co. owns * * * properties adjacent to the holdings of this company, and it would be advisable that these claims and the equipment be purchased. This purchase can be made for \$893,000.

"If the present policy is to be continued and the properties are to be operated to the best advantage, it is necessary that the company shall have additional working capital with which to purchase and equip new properties, complete such equipment as is now under way, and for other corporate purposes. The amount required to take care of these present and future needs has, after careful consideration, been fixed at \$2,732,000. This sum, together with the present indebtedness to the Guggenheim Exploration Co., and the purchase price of the Gold Run property and equipment, will make the aggregate indebtedness of the company, including all of its floating debt, \$5,000,000. This indebtedness should be funded and it is now proposed that its payment be secured by the issuance of eight serial promissory notes covering a period of eight years.

"Disregarding future possibilities, the present holdings of the company are capable of yielding sufficient net profits in the next eight years to retire this indebtedness, and leave a surplus for dividend purposes. If the company is successful in acquiring additional properties, which it is intended to acquire with the working capital thus provided for it, the result will be an increase in the life of the company, in its earnings, and in yield to its stockholders."

BOSTON CREEK.

According to the "Northern Miner" all engineers who have visited Boston Creek are inclined to take its claims as a mining camp quite seriously. "It is true that there are but two good prospects developed, but these two are quite good. There is plenty of free gold; and the character of the ore deposits coupled with geological conditions are favorable for the development of veins sufficiently wide and of a grade high enough to mine at a handsome profit."

There are two prospects being worked at Boston Creek, one within three-quarters of a mile of the track, at Boston Creek, a station just established, 51 miles north of Cobalt, and the other three miles south of Pacaud Township.

The first and more important of these two prospects is the property of the R. A. P. Mining, Prospecting and Developing Company. The R. in the syndicate stands for Mr. E. M. Richardson, the A. for Mr. W. B. Albright, both of New York, and the P. for Mr. J. A. Papassimakes, who is also manager of the company's affairs at Boston Creek. There are two claims upon which work has been done by the R. A. P. Syndicate at Boston Creek.

The other working property is the Miller Independence, a Dayton company. This company purchased the McDonough veteran claim from Mr. Fred Connell and his partner, McDonough, and they have already completed all payments.

The company has been handicapped in their construction by the severe weather, the depth of snow and in the fall the difficulty of getting material over a bad road. Under the circumstances they have made excellent headway. The compressor should be running in three weeks time in the power house, good camps have been built and ground is now being broken for the erection of the Nissen stamp. There are about twenty men working under the direction of Mr. Adams, previously at the Dome staff.

GYGES PORCUPINE MINES, LTD.

Speaking of the La Palme, Three Nations merger, The Northern Miner says: "The name of the new company will be Gyges Porcupine Mines, Limited, not Dominion Porcupine. It will be capitalized at 2,000,000 shares of par value of \$1. 500,000 shares of the new company will go to the Three Nations Mining Co. and 400,000 to the La Palme, as reported. On the new directorate the Three Nations Mining Co. will be represented by one director and the La Palme by one director, while the remainder of the board will consist of men very well known in mining circles in Toronto. A sufficient quantity of treasury stock will be underwritten to pay off debts, which amount to about \$170,000, and provide working capital, and if there are no hitches in the program work will be commenced as soon as weather conditions permit of the efficient overhauling of the surface plant, which has now been lying idle for some time.

LA ROSE IN DELORO.

Work has been begun on the Maidens McDonald claims in Deloro Township by the La Rose Mining Company, Mr. G. C. Bateman of Toronto having taken an option on the property for the La Rose.

A SUDBURY ORE CHUTE

By Albert E. Hall.

Some time ago experiments were carried on with various types of chutes and chute gates to determine which was the most satisfactory for use with the heavy nickel belt ores. Types of gates that were being used successfully in other important mining camps were tried out at the various mines. For example the finger chute gate that works so successfully in some mines when installed in the nickel district proved to be a failure. Both air operated and hand operated gates were experimented with and the bottom of the chutes were tried at various slopes. The

material spilling out on the track. This was due to the fact that the cross timber did not fit tight against the bottom of the chute. This difficulty was easily remedied by placing two angle irons on the chute lip and putting a board across fitted against the chute bottom.

A more serious difficulty then arose however. It was found that when the bottom of the chute was made steep enough to make the material slide easily, that when the car was loaded and the timber dropped to stop the flow of muck that the muck would continue to flow sometimes and bury the car on the track or at least cause some incon-

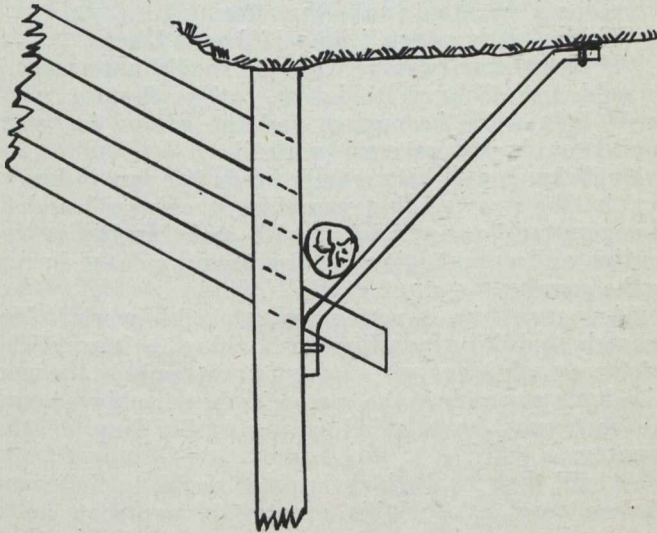


Fig. 1—Side view of front part of chute as originally designed.

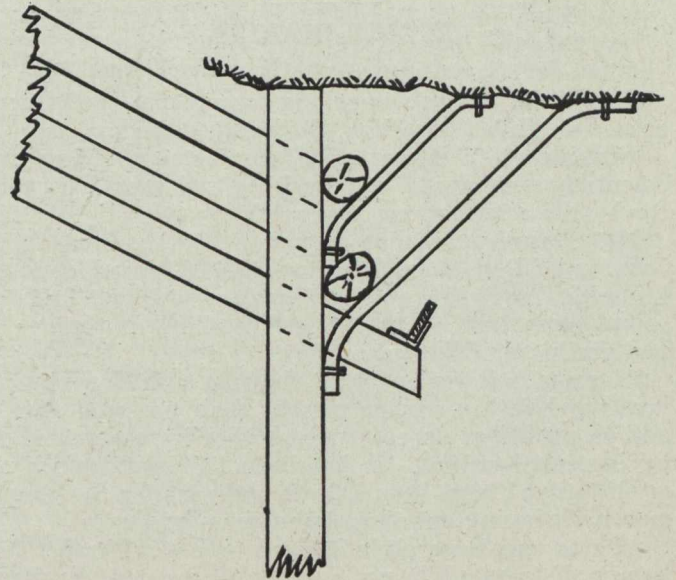


Fig. 3—Chute with double set of rails.

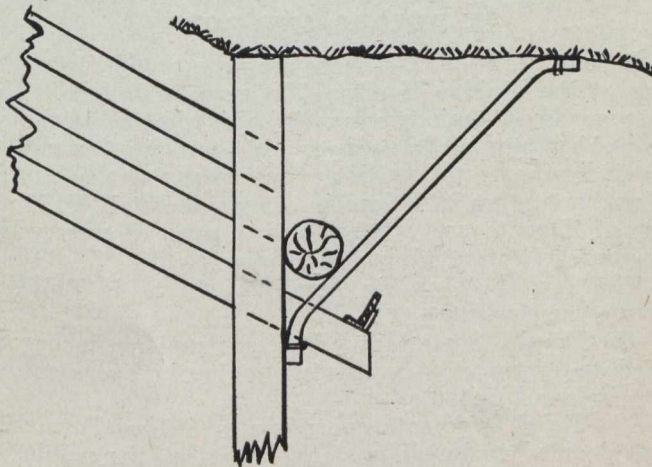


Fig. 2—Chute with board to prevent spillage of fine material.

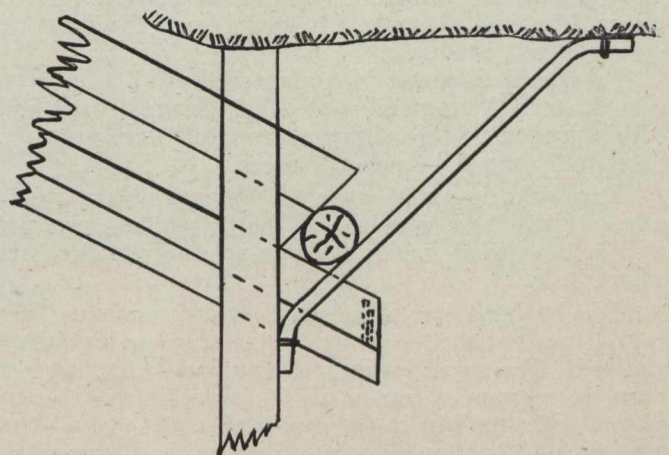


Fig. 4.—Chute with side timbers lengthened.

type of chute that was finally selected as being the most satisfactory was what is known locally as the Minnesota chute. This gate consists of two irons, usually 25 lb. rails, inclined at 45 degrees with the posts of the chute. Across these two rails a timber is placed which closes the front of the chute. The whole arrangement was fully described in the *Engineering & Mining Journal* some time ago. It was not long however before improvements began to suggest themselves and these as yet have not been described.

The Minnesota chute had not long been in use when it was found that considerable trouble was caused by fine

venience. There was also danger of the trammers being injured. It was impossible to block the top of the chute up as the muck is broken by the machines into large pieces and there must be enough room at the chute mouth to allow these to pass into the car. A second set of irons was therefore placed above the original gate and a timber placed across these. This device proved most effective. It both protected the trammers working on the chute from the top and stopped the muck from flowing over the lower timber when the car was full and the lower timber had been dropped. On the other hand since it was possible to raise the upper timber big pieces could be negotiated alright.

The construction of the chute was changed as follows to try to improve it in some respects. Only a few chutes of this construction have been tried so that it cannot be said just how successful they will be but they appear to work very well. The bottom timber on each side of the chute was continued out to the lip edge instead of being cut off flush with the post as had been done. The idea of this was to stop fine material from coming off the lip at its side and falling on the track. The rest of the side timbers were also lengthened being continued out so that their ends formed a line parallel to the gate irons but leaving enough room between the irons and the side timbers to allow the chute timber to be operated. This idea prevents any pieces from coming over the sides of the chute and thus protects the trammers. It does not however, permit of an extra set of rails being put on the chute.

PROFIT-SHARING.

New York, Feb. 18th.

Charles M. Schwab, speaking to magazine publishers at Aldine Club, New York, Wednesday, said:

"Brains are a bigger asset than money. They are essential to success of any business and should be paid for by the corporations who profit by them."

Mr. Schwab said that he had paid Vice-Pres. Arch Johnson of Bethlehem Steel Co. \$600,000 in addition to his salary last year, and that another assistant had received more than \$1,000,000 as his share of profits he had produced. He continued:

"I am a believer in profit-sharing with department heads and with workmen who by their personal efforts add to profits of an enterprise either by economies or by increased output. It has been the gratification of my life that I have been able to make money for young men by bringing out their latent possibilities.

"I was once severely criticized by a stockholder for having distributed 15 per cent. or 20 per cent. to managers of departments before we had paid dividends. This stockholder characterized it as useless extravagance. I asked him whom he considered the most successful profit producer.

"Andrew Carnegie," he answered.

"Exactly," I replied. "Well, he gave 50 per cent. of his profits, and I can speak authoritatively on this, because I shared in some of them."

"Profit-sharing will settle the labor problem eventually. It will be a survival of the fittest; the producer will be rewarded, while the non-producer will remain where he is.

"Big business has eliminated small business. There is no hope for success of any business unless highly specialized. The small business cannot exist, for big business by economies has made it impossible. The employee will supplant in earning capacity the small business man. Thus by his own efforts, without capital, he will secure the competency for which we all strive.

As an instance of specialization of business, Mr. Schwab told of having spent \$10,000,000 in development of the South American ore mines, without having moved a ton of ore. He is now building ten ore ships of more than 17,000 tons each.

England and Germany, he declared, had stood still in production of steel, while the output of the United States during the last year was 24,000,000 tons.

"I expect to see this output increased to more than 40,000,000 tons in 1916," Mr. Schwab said. "In 1901 I built the first steel railroad car and now more than 5,000,000 tons of steel are going into construction of these cars."

He was called on to tell the "Bob" story when he was manager of one of the Carnegie plants.

"A Carnegie manager was a mighty big man in any town he was in," Mr. Schwab assured his hearers. "He was a bigger man than most of you would believe. I was riding in the carriage with 'Bob' the negro driver, one day, and as we passed a woman and a little child were standing by the road.

"'There goes Mr. Schwab,' the woman said to the child. I was impressed that she too knew what a big man I was. But the child soon put my feet back on the ground. Turning to her mother she inquired, 'Which one, mamma?'"

Mr. Schwab said he had been offered fabulous sums for Bethlehem plant—sums he had never dreamed of. He said he talked the matter over with his wife and asked her if he should take the offer.

"Half of it is yours," he said he told her.

"There are two reasons why you should not accept," he said Mrs. Schwab told him. "The first is, what could I do with the money, and the second is, what would you do without your work?"

Mr. Schwab said his greatest joy in life was in knowing that he was creating something that would add to the country's commercial wealth and furnish an incentive and opportunity for the young men of brains in the country.

"Any man who is not interested in his work," Mr. Schwab said in concluding, "should give it up. The aristocracy of this or any other country should be the men who have succeeded, the men who have achieved and the men who have aided in the upbuilding of the country.

He said that the Bethlehem plant could, in the event of war, turn out for this country 50 per cent. more guns and ammunition than the Krupp works in Germany.

IN DELORO AND ROBB.

Porcupine, Feb. 19.—There are now two shifts working at the Maiden-MacDonald claims in Deloro. Mr. George Sweet took two men in with him to his claims in Robb yesterday to uncover some test pits for a New York Syndicate to examine. The camps at the Kilroy Hamilton claims in Deloro in charge of Mr. E. P. Monteg of Toronto are finished and a gang of men went this week to start mining development.

The new shaft on the Jamieson claims in Robb is down twenty feet.

The Empire State Mines Limited has been incorporated to operate the property previously operated by the Deloro Limited.

The Rand Syndicate operating in Deloro Township has decided to install a steam plant, as the result of the work done by hand has been so encouraging. A contract for 5,000 feet of diamond drilling on the Chisholm Vet was made this week.—Porcupine Herald.

BOSTON CREEK MINING CO.

A new company has been incorporated with a share capital of \$2,000,000, under the name of the Boston Creek Mining Co., to develop some claims in that section, says The Cobalt Nugget. This will be the second mining company formed to develop Boston Creek claims. The other one is the Miller-Independence. The R. A. P. Syndicate is operating, and the work on the latter property is farther advanced than on any other property in the district.

THE SLOCAN DISTRICT, BRITISH COLUMBIA, IN 1915

By E. Jacobs

(Continued from last issue.)

The zinc-concentrating mill at Rosebery was erected about eight or nine years ago by the owners of the Monitor and Ajax mines primarily for treatment of ores from those properties, but also with the expectation of doing business as a custom plant for concentrating lead-zinc ores of Slocan district. It was operated for a short time and then closed, and had remained unused until, after the destruction of the Ivanhoe mill at Sandon, of which he had been lessee, Mr. J. P. Keane arranged to continue in the Rosebery mill the custom concentrating business he had established at Sandon. The chief change made in the mill plant by Mr. Keane was the substitution of Wilfley tables for the Luhrig vanners included in the original equipment of the mill. Under the new auspices the first car of concentrate made was loaded and billed out on October 30, 1915. The product was from Lucky Jim ore; it contained 42 per cent. zinc. The shipment was consigned to the zinc smelting works at Kenosha, Kansas, U.S.A.

Near New Denver—During 1915 work was continued on the Capella; a little ore was taken out from the Molly Hughes and shipped to Trail; two men worked on the Fairy Queen, a promising prospect on Trout Creek, on the west side and near the head of Slocan Lake; six men were employed at the Apex, in Denver canyon, at which the lower tunnel is in 450 ft. and a raise connects with the upper tunnel 235 ft. above where quartz containing silver and gold was being extracted in the latter part of the year; tunnel-driving was continued on the Marion; a contract was let for driving 150 ft. in No. 2 crosscut adit of the Hartney, and leasers took out a little ore from the California.

Silverton and Four-Mile Creek—Milling operations were resumed by the Standard Silver-Lead Mining Co. about the middle of 1915 after a suspension of production since August, 1914. By the end of 1915, there had been shipped to Trail 7,910 tons of silver-lead ore and concentrate containing 8,481,000 lb. of lead and 747,000 oz. of silver, and to the United States 4,406 tons of zinc concentrate containing 3,789,000 lb. of zinc and 102,000 oz. of silver. About 6,000 ft. of development work was done, of which less than 2,000 ft. was drifting and crosscutting in the Alpha mine, situated at a higher elevation than the original Standard mine. No important body of ore has yet been found in the Alpha by the Standard Co. Of the older levels of the Standard—Nos. 3, 4, and 5—most development work in 1915 was done on No. 4, which was extended, crosscuts were driven from it, and raises made. Work done on Nos. 5 and 6 was drifting, crosscutting, and raising. Most of the large quantity of ore taken from the mine during the several years of its biggest production was mined above No. 6 level. Not less than 1,600 ft. of work was done on and from No. 7, this consisting of drifting and crosscutting about 500 ft. and as much raising. Ore was found in a raise and it was drifted on between 100 and 200 ft., while an intermediate level between Nos. 7 and 6 was driven in ore for at least 100 ft., and stopes were opened from it. The ore at both east and west extremities of this shoot was zincy, but the heart of it gave much silver-lead ore. Work was stopped in No. 8 level at the beginning of February and it was not until September that the miners were put back into this lowest level of the mine;

the adit was extended and both crosscutting and raising was done, the raise going up in ore, of which there was not more than three feet in its widest part. In January, however, it was reported that a much better shoot of ore had been encountered on this level, but no particulars have been received. At the company's concentrating mill, which was operated continuously during the latter half of the year with excellent results as regards concentration of ore, a small experimental flotation plant was put in with the object of making tests in the direction of a higher saving of the zinc in the ore. Dividends were paid by the Standard company during the last four months of the calendar year, the total amount distributed during that period having been \$250,000.

Very little information has been obtained relative to the **Hewitt-Lorna Doone** group of the Silverton Mines, Ltd., or the company's concentrating mill situated on Four-Mile Creek, several miles up the creek from Silverton. The total of silver-lead concentrate received at Trail in 1915 from this property was 641 tons. The zinc concentrate shipped contained 1,386,000 lb. of zinc. No. 8 level of the mine was in 1,800 ft. in October, this level giving a depth of 1,200 ft. An extensive area of ground in which there is known to be a large quantity of high-grade ore, has been opened by the later development of this property, there being shipping ore of good quality down to the lowest level yet opened in the mine. A flotation process has been successfully used in connection with the concentration of the Hewitt-Lorna Doone ores, but particulars have not yet been made public.

Work at the **Lucky Thought** in 1915 was chiefly in No. 3 adit and raising to the level above. A road was constructed up the mountain almost to the entrance of the mine. Silver-lead ore shipped to Trail totalled 101 tons. The property is being explored by the Consolidated Mining and Smelting Co. under option of purchase. On the opposite range of mountains, situated 800 ft. higher up than the Alpha workings, the Echo had much exploratory work done on it during 1915. A big vein, stated to be fully 100 ft. in width, extends from the Standard through the Alpha and Echo and, it is claimed, on over the divide to the Idaho-Alamo properties. When visited at the beginning of November, a lower tunnel was in 500 ft. and an upper one 100 ft. The vein filling was chiefly a black graphite rock in which ore was found to occur in bunches, but no considerable body of ore has been encountered up to the time just mentioned. Quite lately a report was published that a nice shoot of ore had been opened, but nothing definite has yet been ascertained as to this. Fourteen tons of ore was shipped from the Buffalo, and 32 tons from the Wakefield, the latter well-known old mine has been acquired by local men, who took out a car of ore early in the autumn. The Comstock, back near the headwaters of Four-Mile Creek, was worked by leasers who shipped a small lot of ore which did not reach Trail until January. South-east of Silverton there is the L. H., which, since the B. C. Copper Co. relinquished its working bond on it, has been further developed by its owners.

The Galena Farm Group of five Crown-granted claims, situated a mile and a half south-east of Silver-

ton, which had been idle for a number of years until the late Patrick Clark arranged to work it under option of purchase, was one of the mines in this part of the Slovan at which there was much activity during 1915. A crosscut adit driven 800 ft. cut the vein at 75 ft. below the old 100-ft. level and drifting on the vein was in progress in the last few months of the year. A raise has been made from the lowest to the 100-ft. level and thence to the surface to get under the old dump stated to contain about 3,000 tons of ore which it is intended to convey to the concentrating mill through the new raise and lower tunnel. The 100-ft. level, driven on the vein for 350 ft., shows the average width of the vein to be about 7 ft., all milling ore. The plan of working under consideration last October included stoping ore from the 100-ft. level to the surface and extending the lower drift as well. Later, the ore will be followed down, and if conditions shall be found to warrant such an undertaking, a crosscut adit will be driven between 4,000 and 5,000 ft. to get under the present workings at 600 ft. greater depth. Improvements made on the surface in 1915 comprise erection of a number of new buildings, repair of old boarding and other houses, construction of about one mile of waggon road to provide an easier grade for hauling to and from Silvertown than that of the old road, repair of dam and putting in a new 12-in. pipe-line about 2,000 ft., also an 8-in. line of similar length to utilize, for running the dynamo, the overflow water from the compressor. The new concentrating mill machinery and plant include crushers, sorting belt, classifiers, trommels, jigs of Hartz type, etc. Middling is reground in a Huntington mill, elevated and trolled; coarser size is sent to a moveable screen jig; smaller size to hydraulic classifier and thence to Wilfley tables, of which there are ten, making two products, namely, silver-lead and zinc concentrates.

Slovan City Mining Division.

The output of ore from mines in Slovan City division was even smaller in 1915 than in 1914—only 234 tons as compared with 505. Ore receipts at Trail in 1915 from this part of the district were as follows: From the Alice, 16 tons; Black Prince, 22 tons; Enterprise, 138 tons; Hamilton, 19 tons; McNeish, 4 tons, and Ottawa, 35 tons. The Eastmont, which in 1914 shipped 152 tons, was not on the 1915 shipping list; the Ottawa's comparatively large output of 280 tons in 1914 was also lacking in 1915. These losses in output notwithstanding, the outlook for the division at the end of 1915 was believed to be more promising than a year earlier, for there was activity on several properties which had been sent supplies for a full winter-season's needs.

The Ottawa, situated about five miles from Slovan City, had been a productive mine prior to the several years of inactivity that preceded its passing to the possession of the Consolidated Mining and Smelting Co., which acquired it in 1913 and has since developed in it some shoots of high-grade ore. Work was suspended in the autumn of 1914, shortly after the outbreak of war in Europe, but was resumed in 1915, though there has been little ore-production since. Development is being continued. The Alice S, on Springer Creek, was worked in 1915 by its owners, a New Jersey U.S.A., company. A crosscut was driven 110 ft. to the vein and development was continued by drifting both ways, altogether about 500 ft. on the vein, and a raise was made 70 ft. to the surface. Sixteen tons of ore taken out in the course of development, was ship-

ped to Trail to ascertain its value in bulk. Another crosscut was commenced at a vertical depth of 90 ft. below the upper one, with an estimated distance of 248 ft. to be driven to reach the vein. Buildings erected include houses for the accommodation of the men employed—eight were working last season—and an ore-house. A mile and a half of waggon road was made to connect with the Slovan City-Springer Creek road.

Adjoining the Alice S is the Black Prince, which Mr. J. T. Tipping is working under lease and bond; the property is on the divide between Springer and Lemon Creeks.

Development was commenced in June, and in November there was shipped to Trail a car of dry ore estimated to average 800 oz. silver a ton, 6 per cent. lead, and 22 per cent. zinc. The work done included driving the lower tunnel to cut the vein at 125 ft. deeper than the old workings; for 50 ft. a drift was in ore. When crosscutting in old workings from No. 3 a shoot of high-grade ore was encountered and men were put on stoping. A raise was made 60 ft. from No. 3 and it was intended to continue raising if the ore should be found sufficient to warrant this further development. Mr. Tipping also drove a tunnel on his own claim, the Gordon, adjoining the Black Prince.

Barber and Taylor worked on the Meteor under lease, and took out some ore of good grade; they got in supplies to allow of continuing work throughout the winter. Wafer and Johnson found ore on the Gladys, on which they had been working a year or more. Geo. Long had three men working on the Lily B; a crosscut was driven to the vein and ore was mined, with prospects sufficiently good to induce the getting in of supplies for continuing work all through the winter.

No information was obtained concerning the Enterprise on Ten-Mile Creek, except that 138 tons of ore was shipped to Trail, as compared with 50 tons in 1914. There were other properties worked in Slovan City division, relative to which particulars were not received, but generally there was expectation that more mining will be done in the division in 1916 than in any of several recent years.

ONTARIO MINING ASSOCIATION.

Last week several directors of mining companies operating at Cobalt and Porcupine met in Toronto to discuss the proposed tax on profits. It was decided that a deputation should be sent to interview Sir Thos. White at Ottawa. Col. A. M. Hay was appointed to head this deputation, the other members of which he will name. Col. R. W. Leonard will be one of the members to accompany Col. Hay.

The meetings were well attended. Among those present were: D. A. Dunlap, Alex. Fasken, W. E. Segsworth, F. C. Culver, J. C. Watson, W. R. P. Parker, Z. Gallagher, A. J. Young, A. M. Hay and R. W. Leonard.

CANADIAN MINING INSTITUTE.

A meeting of the Toronto branch of the Canadian Mining Institute was held in Toronto Saturday, Feb. 26, to discuss the proposed tax on profits. There was a large attendance, and it was the unanimous opinion that the proposed tax would be unfair and unwise. The subject will be brought up at the Ottawa meeting this week.

FLOTATION PROCESSES*

By C. Terry Durell.

Thirty years ago Carrie J. Everson of Chicago described flotation as well as it can be described to-day as follows: "The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral, or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil or any constituent of a mineral oil, together with an acid, either mineral or vegetable, or a soluble neutral or acid salt, for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed material whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing or other suitable means. The stirring or incorporation of the ore with the liquid should of course be thorough for the purpose of bringing the mineral into contact with the oil and acid as completely as possible. I do not, therefore, restrict myself to any particular proportions of the substances employed. The non-metallic matter is afterwards separated from the metal or mineral by the peculiar action of the acid or soluble neutral or acid salt operating in the presence of water to detach the gangue from the mass." In this patent (No. 348,157), she gives a list of minerals she successfully saved by this process. These include native metals, sulphides, antimonides, arsenides, tellurides and some carbonates and oxides. She used various common oils and fats as well as the common acids. She operated the process with various salts such as sulphates and chlorides of sodium, zinc, copper and double sulphates of potassium and aluminum. Mr. Ben S. Revett in *M. & S. Press* of Oct. 16, 1915, says, in speaking of this process: "I saw practically one of the first demonstrations." This was in 1889 at Sparta, near Baker City, Oregon. Speaking of Criley he says: "He kept stirring and stirring until the bubbles floated to the surface of the water and acid."

It is quite evident from this description that thirty years ago a test might have been made for any of the many present-day processes using oil.

Seldom has litigation so retarded a science by smothering it in a cloud of secrecy. It is to be regretted that this condition has been brought about by some prominent engineers attempting to gain a world-wide control of all processes of flotation after the basic patents had expired.

The essential elements of flotation can be arrived at in two ways: (1) Investigation of conditions under which different minerals float; and (2) investigation of all different processes. In Australia, the home of flotation, more flotation experiments have been carried out than in any other country.

Kenneth A. Mickle's experiments published in the *Proceedings of the Royal Society of Victoria*¹ furnish the most complete record of systematic research to learn the reasons for flotation. These experiments were carried on with different metals and minerals in the laboratory and subject to the conditions met with in the several flotation processes. He tried them with

water, oil, acid and alkali; hot and cold; at atmospheric and reduced pressure and in various combinations. Many of his experiments I have confirmed at the Colorado School of Mines. His experiments show that minerals at the surface or in the interior of liquids float or tend to float due to: (1) Liberation of gas contained in the liquid either by reduction of pressure or heat; (2) generation of gas in the liquid by means of acid, or (3) supersaturation of the liquid with gas.

He shows that minerals absorb (occlude) gas to a degree not previously suspected and that the effect of this occluded gas is that: (1) Particles are not wholly wetted by immersion in water; (2) particles tend to float when sprinkled on a liquid surface; (3) particles collect bubbles when heat or vacuum is applied, and (4) particles collect bubbles evolved from a gas saturated solution.

The Swinburne and Rudorf² experiments show that "it seems necessary that the gas should be produced at the surface of the particles themselves." Many other references might be cited to show that the whole subject of flotation depends upon gas occlusion by the minerals to be floated.

As was to have been expected, Mickle showed the gas held by flotation concentrates consists almost entirely of nitrogen, oxygen, and carbon dioxide. That is to say, the occluded gas was from the atmosphere.

These experiments have thus eliminated oil, acid, alkali, heat, vacuum, saturated gas solutions and the like as being essential elements of flotation. The conclusion that necessarily follows is that flotation depends on the fact that, **due to the occluded gas of the mineral particles, they become entangled or caught by the surface film of:** (1) the free surface of the liquid; or (2) the surface of a gas bubble; (a) above the surface or (b) under the surface.

It is well now to classify and investigate the different processes to see if a similar system of elimination will give the same results as this obtained from laboratory experiments.

Surface Tension Flotation.

One of the best known types of flotation is that which the prospector, in panning, tries to guard against. How easy it is to drain the water from the trail of fine gold in the pan and then pick it up on the surface of the water. Every vanner-man can testify as to the richness of concentrate from the settling boxes back under the machine behind the main concentrate box. This is the concentrate that dries as the belt travels down over the end of the vanner and floats on the surface as the belt dips into the water in the concentrate box. Hezekiah Bradford in his patent No. 345,951, in 1885, reverses this process by using a belt to remove the floating concentrate. It was nearly twenty years later (1904) that Macquisten used a spiral in a tube to lift and expose the pulp to the air so the metallic particles would float on the surface of the water in the tube. This was a commercial success

*Extract from an article published in the Colorado School of Mines Magazine, Feb., 1916.

¹Vol. 23 and 24, Part 2, 1911. Abstracted in Eng. and Min. Jour., Aug. 12, 1911 and July 13, 1912.

²Faraday Society paper read Dec. 12, 1905. Abstracted Eng. and Min. Jour., Feb. 10, 1906.

though oil is now used to aid the process. Henry E. Wood's machine, patented March 21, 1911 (No. 987,209), feeds dry ore gently onto the surface of water so that the metallic particles float over a lip and are saved. All of these cases come under what may be termed **SURFACE TENSION FLOTATION**. Evidently the only essential feature is that the particles to be floated be exposed to air. That is, there must be a chance for gas occlusion. The selective action, which causes the metallic particles to float while the gangue particles sink, will be taken up later.

Bulk Oil Flotation.

How "the virgins drew up gold by means of feathers daubed in pitch" is told by Herodotus. Thus that pitch, oil, grease and the like adhere to metallic particles with greater force than does water has long been known. This fact was first recognized in a patent (No. 488, British) to William Haynes in 1860. Under the Elmore patents of 1898 and 1901, bulk oil flotation was put on a commercial basis, although the many plants built in different parts of the world were doomed to failure because of the great quantities of oil necessary. Excessive oil is necessary, due to the little difference in specific gravity between oil and water as compared to the greater difference in specific gravity between water and the metallic concentrate. As no acid was at first used by the Elmore process, it is not an essential element to flotation.

The Cattermole patent in 1903 improves upon this by using less oil in what was known as the oil granule process. These granules were then removed in various ways either from the bottom of the container or driven to the surface by an upward current of water or gas. This was the forerunner of the present froth processes, but the only plant built was a complete failure. This was to treat 400 tons daily at the Central Mine, Australia. Everyone who has made a froth flotation test has, probably, at some time, added too much oil and seen these granules resting above the pulp at the bottom of the vessel. Some may rise to the surface of the liquid and drop back again. In the Cattermole process, soap and acid were used, but a test, as above, shows that granules will form with oil only, so these two things are not essential elements. The only bulk oil flotation plant that I examined was at the Lake View Mine, Kalgoorlie, Australia. It, like all others, was a failure and I was not able to determine if gas occlusion by the metallic particles is the essential element to the process. From the very nature of the process, oil of course is an essential element. Mickle's experiments showed that mineral particles deprived of occluded gas do not, as a rule, become coated with oil in the presence of water. The selective action necessary for this flotation will be taken up later.

Froth Flotation.

In taking up these processes in detail to eliminate all but essential elements to flotation, such questions as air froth or oil froth, selective or preferential flotation, and the like will not be discussed. These things as well as the forces adhesion, electric, cohesion, surface tension, etc., will be taken up under other headings later. About four years ago I made a trip to Australia and studied these processes quite carefully at the largest plants then in the world working four distinctly different methods. Since then I have seen several plants operating in the United States but with only one different method or machine—the Callow.

Delprat Type.—The Delprat and Potter processes were developed independently at the same time, patented in 1902, and are practically the same. This was the first commercially successful froth flotation. It has since proved unfortunate for the Minerals Separation Co. that the Fromont patent in the same year was only taken out in Italy and England. For this reason it was necessarily suppressed by the purchasers. Also processes where gas is generated by electrolysis like the Fields come under this heading.

As G. D. Delprat was general manager of the Proprietary Company at Broken Hill, his process was naturally used there. About 1,000 tons were being treated daily when I studied the flotation process at this property. A "push feeder" delivered 700 pounds ore per minute to a single spitzkasten where flotation took place without agitation except that of the upward current of hot acid solution being added at the bottom. By heating the solution with superheated steam, it was intended to work with a solution as near 80 degrees C., the critical temperature for flotation, as possible. The working solution temperature, however, was below 70 degrees C. The quick action and simplicity of the process was most pronounced. A marketable zinc concentrate was being produced with high recovery without retreating it or the tailing. The essential elements may be summed up as follows: gas, acid and heat in addition to the ore and water. The acid attacking the carbonates in the ore produced the bubbles in addition to the selective action which will be discussed under a separate heading. This gas made the bubbles for the froth, as no air was taken into the solution in any way except the little that might come in with the ore. None could come in with the solution as no jet or nozzle was used above the surface of the liquid, which would have carried air in, as will afterwards be described. This solution was brought in at the bottom of the spitzkasten and, being hot, could contain but little dissolved air. Since heat was necessary, its only function was to expel occluded air from the mineral particles the same as from liquid in accordance with the law of Henry.

Vacuum Type.—The Elmore vacuum machines were being used at the Broken Hill, British plant, although they had been thrown out from several other plants there. This was not due to unsuccessful operation but to litigation. No more than the following essential elements are necessary for the operation of the Elmore, the only successful vacuum process: vacuum (to liberate the air to form bubbles), acid, oil and alkali. Cast iron machines are used and so lime is required to neutralize the pulp before it goes to the vacuum machines. The acid of course is not to generate bubbles, as in the Delprat process, but it creates the selective action. In accordance with Henry's law, gas or air is liberated from the pulp by reduction of pressure to form the froth. As will be shown later, these bubbles must necessarily form on mineral particles as nuclei. The bubbles burst very readily in the Delprat process, but there is such an ebullition that any metallic particles thus dropped are caught by the bubbles below. There is no chance for this with the Elmore, so the bubbles must necessarily be more persistent. In the Delprat, the bubbles are armored with the metallic particles. To make them more persistent in the Elmore, oil, in addition to the metallic particles, is used to coat them. This toughening of the froth with oil will be taken up under a separate heading.

Mineral Separation Type.—Under this heading may be grouped all processes or machines using rapidly re-

volution paddles or stirrers to beat air into the solution. This method of forcing air into solution beyond the point of saturation was known long before our grandmothers used it to beat eggs or whip cream. It matters not whether air be beaten by being admitted to the suction of a centrifugal pump or to the periphery under pressure or beaten in by the propeller on the vertical shaft of a mineral separation or other machine. The essential elements can be enumerated as follows: air (beaten in to supersaturation), acid, oil and heat. What is the difference whether bubbles be formed from air coming out from a supersaturated solution or from a solution subjected to vacuum? Bubbles will form on mineral particles as nuclei in either case. The acid here, of course, acts as in the former case. Since heat is not always used, its only function can be to assist in expelling the air from the mineral particles. The froth from these machines is the most persistent. This is due to the greater amount of slime and the better agitation to oil-coat the metallic particles. Like butter in a churn, these fine metallic particles are coagulated by the violent agitation. The mineral particles are so well oiled that an exceedingly coherent armor for the bubbles is produced. The oil films of these bubbles are extremely thin like those of other processes. Iridescent colors indicate this. The surface tension effect of the oil is added to that of the water for further toughening the bubbles.

The DeBavay Process.—This appears to be a purely surface tension process. As originally patented by DeBavay, it probably was, but, as now used by the Amalgamated Zinc, Ltd., of Broken Hill, it even has the bubbles although all the large ones are liberated before flotation commences. The same principles apply here as in any froth flotation. The clean sand is thoroughly agitated in an acid solution, washed and then again agitated in steel tanks with water to which a fixed amount of an oil mixture (mostly kerosene) has been added. The agitators in these tanks are like ship propellers and as large. This gives thorough oiling to the particles. A montejus delivers the pulp to the top series of four each DeBavay cones. The pulp is, therefore, surcharged with air due to this air pressure, since the air dissolved by the water varies directly as the pressure. Norris has patented (No. 864,856) the idea of thus surcharging a liquid with gas, but he delivers the surcharged liquid beneath the surface of the pulp mixture. The Callow machine also uses this principle except that the air pressure is exerted on the bottom of the liquid instead of on the top as with a montejus. There are no bubbles or froth because the pulp mixture from the montejus is turned on to the apex of the cones and spreads out, flowing down the steeply inclined surfaces. The essential elements to this process are: gas (in the form of air), acid and oil. These are the same as with preceding processes. Although there is no froth, air is here the prime requisite while the acid creates the selective action. The metallic particles are so well oiled they are not easily wetted by the water while their air films and minute attached bubbles bodily lift them to the surface of the water if, by chance, they go in under instead of on the surface when they strike the water at the periphery of the cones. In a laboratory test, the metallic particles seem to jump from the bottom of a beaker to the surface of the liquid.

Callow Type.—This includes all froth flotation processes depending on the supersaturation of the liquid by air pressure in accordance with the law of Henry. The DeBavay process was taken up previous to this as

it is the connecting link between this and Minerals Separation type. It (DeBavay) uses violent agitation which beats in air and also direct air pressure which supersaturates the pulp mass.

This supersaturation is caused, according to the Norris patent, by subjecting the liquid to an air pressure of several atmospheres. In the Callow machine, it is "a hydraulic pressure varying from 15 to 40 inches" that causes the liquid at the bottom of the box to absorb air beyond the saturation point of the surface liquid at atmospheric pressure. If too much air is blown into a Callow machine, the effect is the same as the air in the pachuca tank—agitation.

The bubbles composing the froth are derived from that air which was first absorbed and afterwards liberated on a mineral particle as a nucleus in the same way that air, beaten into solution in a Minerals Separation machine, supersaturates the liquid and comes out in the form of bubbles. A jet of air turned into liquid pulp produces bubbles which effect no mineral attachment. They pass through the pulp as do those from excess air in the Callow cell. The essential elements for the Callow type may be picked out as follows: air (from supersaturation of the liquid), oil and acid or alkali. The oil, as shown above, aids in making a more persistent froth. It is mixed with the pulp previous to entering the machine. The acid or alkali is to form an electrolyte for selective action.

Liquid Jet Type.—Heretofore only two ways of getting air into solution have been taken advantage of to aid flotation. These, as mentioned above, are: (1) beating it in as is done in Minerals Separation type; and (2) surcharging the liquid with gas as is done in the Callow type. While experimenting at the Colorado School of Mines some three years ago, I developed a third way which is now being patented. One of the patents has been issued.

Common occurrences of this phenomenon are seen everywhere. On drawing water into a beaker, bubbles form and rise to the surface. Where does the air come from? A muddy overflow is caused in a settling tank by allowing the mill stream to be turned down into the tank from some little distance above. Froth forms and overflows. Hydraulic air compressors and blowers are operated on this principle by turning a stream of water down a shaft or pipe. In the same way that an air film surrounds a drop of liquid so that the drop method may be used in determination of surface tension, so does an air cylinder enclose a liquid jet. This adhesion is so great that air is carried into the liquid to the supersaturation point and it comes out in the form of bubbles.

The model I built at the Colorado School of Mines treated ore at the rate of twenty-five pounds an hour working in an acid solution with oil fed to the first cone. This type of machine produces either a scum float like DeBavay's or a thick persistent froth with well armored bubbles. The essential elements may be noted as follows: air (brought in by the liquid jets), oil and acid, or alkali.

Essentials in Flotation.—Having classified flotation into that of (1) Surface Tension, (2) Bulk Oil and (3) Froth and subdivided Froth Flotation into the different types of (a) Delprat, (b) Vacuum, (c) Minerals Separation, (d) Callow, and (e) Liquid Jet, there are found only these few essential elements as follows: air or other gas, acid, heat, vacuum, oil and alkali. These only are necessary in addition to the liquid and the ore. It is possible to still further eliminate.

(To be continued.)

ONTARIO NICKEL MINES*

By Thomas W. Gibson, Deputy
Minister of Mines.

The nickel mines of the Province of Ontario are situated in the district of Sudbury, and are of great extent and value. The ore is a pyrrhotite, carrying the nickel mineral pentlandite and also chalcopyrite. In contents it varies from 1.5 to 5 per cent. in both nickel and copper, but the latter metal is usually somewhat lower in proportion than the former. A fair average of the ores as raised would be, say, 3.5 per cent. nickel and 2 per cent. copper. The deposits occur in lenticular masses on the outer edges of a huge laccolithic sheet of eruptive rock, which surrounds an elliptical area about 35 miles long and 17 miles wide. The first discoveries were made during the construction of the Canadian Pacific Railway, in 1883. The finders shipped a quantity of the copper ore to a refining plant in the United States. Unexpected difficulties were met in its treatment, which on investigation proved to be due to the presence of nickel. Mines were opened by the Canadian Copper Company, employing American capital, and also by the Vivians of Swansea, who, however, retired from the field a number of years ago. The Canadian Copper Company and the Mond Nickel Company—the latter an English concern—are the two chief producers, the works of the former being at Copper Cliff and the latter at Coniston.

A small proportion of nickel—say, $2\frac{1}{2}$ or 3 per cent.—when alloyed with steel imparts to the latter many advantages. It greatly adds to its strength and toughness, and, in addition, imparts a high degree of non-corrosibility. Early advantage was taken of this property of nickel by manufacturers of armor-plate for battleships. These, when cemented and face-hardened, presented a great resistance to the penetration of projectiles, and the impact of the latter failed to crack them. For heavy ordnance nickel steel is invaluable, and is also used in the manufacture of cartridges and other articles of military equipment. In fact, wherever strength combined with lightness is desired, nickel-steel is in demand. The new Quebec bridge over the St. Lawrence River and the Manhattan Bridge over the East River at New York are made of nickel-steel. For coinage purposes, electro-plating of metallic objects, the manufacture of Britannia ware and for many other purposes nickel is also employed.

The development of the nickel-copper industry in the Sudbury district is going on rapidly, and the great demand for nickel owing to the present war is obliging the companies to push production to the limits of their capacity. In 1910 the quantity of nickel turned out was 18,636 tons and of copper 9,630 tons. The outbreak of the war last year disturbed conditions for a short time, but the mines were ere long again at work, and the production of 1914 amounted to 22,750 tons of nickel and 14,448 tons of copper. The production for 1915 was about 32,000 tons of nickel and 18,750 tons of copper, the united value of which at the prices of the refined metals would be not less than thirty millions of dollars. The ore after being raised to the surface is crushed to hand size and sorted, then roasted in huge heaps in the open air. The roasted ore is smelted to a low-grade matte, which is converted by the Bessemer process into a matte containing 75 or 80 per cent. of the metals combined. The Canadian Copper Company's matte carries, say, 50 per cent. of nickel and 25 per cent. of copper,

and the Mond Company's matte about 40 per cent. of each. The Bessemer matte is exported by the Canadian Copper Company to Constable Hook, N.J., and by the Mond Company to Clydach, Wales, for final separation of the metals. In addition to copper and nickel the mattes yield gold, silver, platinum and palladium. At the Mond Nickel Company's works the copper is recovered as copper sulphate, which is in demand in the vine-growing countries of Europe as an antidote to the phylloxera.

Early in the history of nickel mining the Government of Ontario offered to the Imperial authorities of the day a substantial—possibly a controlling—interest in the nickel deposits of the Province, asking the British Government in return to establish refining works and a plant for the manufacture of nickel steel. The proposition did not commend itself to the Home Government, which believed it could depend upon the ordinary channels of trade for the supply of its wants. There is a strong feeling in Canada that the refining of this important metal should not be committed to the care of a foreign country, and the Government of the Province has appointed a Commission to examine and report upon the whole nickel question.

DEVELOPING CHENEY PROPERTY AT THESSALON.

The Thessalon Advocate says: The most important event in the history of Thessalon for many years is the development of the Cheney Mine, recently purchased by the Timmins Bros. of Hollinger fame. This property which lies about 28 miles north-east of Thessalon, in Gould Township, and is accessible by good wagon and sleigh roads, has been opened up for some twenty years, having first been taken up by Mr. John McCreight, formerly of Thessalon, and sold to Mr. F. A. Cheney, of Elmira, N.Y. Mr. Cheney was making arrangements for developing the property on an extensive scale about sixteen years ago when he died suddenly and the plans for the development were not carried out. The property is now in charge of Mr. Pare, mining engineer, who is installing machinery and erecting buildings.

The Cheney is not, according to the Advocate, the only property of importance in this locality. Joining it on the east is the property owned by Mr. J. A. McEachern, on which ore carrying gold, copper and silver has been found. Mr. McEachern is taking out a few sample carloads with a view of obtaining smelter tests of the possibilities of this ore. To the south-west of these properties, on the bank of the Mississagi River, lies another vein called the War Eagle, a very wide vein carrying chalcocite and some native copper.

DELORO PROPERTIES TO BE WORKED.

Mr. Clifford E. Smith of Toronto has taken a working option on the property of the Ankerite Gold Mining Company in Deloro Township, otherwise known as the Armstrong-McGibbon group, and will shortly begin operations. Considerable exploratory work was done on these claims previous to the disastrous fire of 1911. Promising results were obtained, but adverse financial conditions brought the work to an end. Since then no work has been done. Vigorous exploration will now be undertaken.

The adjoining claims, known as the Maidens McDonald, have been acquired under option by Mr. G. C. Bateman of Toronto, and development work has been started.

*From the Financial Times, London.

THE PROPOSED TAX ON PROFITS

In introducing his proposed tax on profits Hon. Sir Wm. Thomas White said:

"There are in time of war many businesses and industries, which for one reason or another are able to maintain profits above the average return to capital in time of peace. There are others whose profits arise directly from the manufacture of munitions or the furnishing of supplies in connection with the war itself and are in some instances of abnormal character. It has appeared to the Government that persons, firms, and corporations whose profits have been such might well be called upon to contribute a share to the carrying on of the war. Their position being advantageous as compared with less fortunate fellow-citizens, it is just that a portion of their advantage should be appropriated to the benefit of the state. In this connection we have prepared a measure which I propose to introduce to the House, providing for the taxation of profits in excess of a certain percentage upon capital engaged in all classes of business and industry, including railway, steamship, public utility, financial, commercial, milling, mining, and industrial enterprises.

"We have fixed upon a rate of profit in the case of corporations, individuals and firms which may be taken as a fair annual return in normal times. We propose to impose taxation to the extent of one-fourth of the amount of net profits upon the capital derived since the outbreak of the war in excess of this fixed rate. To particularize, our proposal is as follows:

"Upon all incorporated companies carrying on business in Canada, excepting life insurance companies, which are otherwise dealt with, and those engaged in agriculture, we propose to impose a tax of one-fourth of the net profits for every accumulating period ending since the outbreak of war in excess of seven per cent. upon paid-up capital. Provision is made for determining the profits and paid-up capital made and employed in Canada in the case of non-Canadian companies carrying on business in Canada and subject to the tax.

"From my statement it will be gathered that what we propose is a very comprehensive measure of taxation, not confined to those who have since the outbreak of war made more than their usual profits, but applying to all businesses, whether in existence before the war or established after its outbreak, whose profits exceed the percentages which I have mentioned.

"No doubt in the administration of this legislation some anomalies will arise, but these are inseparable from any comprehensive scheme of taxation upon a numerous class of the community. I am confident that those upon whom the burden will fall will gladly make the contribution which it calls for to the cause for which we are contending.

Extracts from the resolutions follow:

The accounting period shall be taken to be the period for which the accounts of the trade or business have been made up, but where the accounts of the trade or business have not been made up for any definite period or for the period for which they have been usually made up, or if a year or more has elapsed without the accounts being made up, the accounting period shall be taken to be such period and ending on such a date as the minister may determine.

The profits shall be taken to be the net profits arising in the accounting period.

(2.) The profits of a non-Canadian company shall be such proportion of the net profits as shall bear the same proportion to the total amount of its net profit as the capital of the company as defined herein bears to the total amount paid up upon its capital stock.

(3.) No deductions from gross profits for depreciation or for any expenditure of a capital nature for renewals, or for the development of a trade or business, or otherwise in respect of the trade or business, shall be allowed except such amount as appears to the minister to be reasonable and to be properly attributable to the accounting period.

The capital employed in the trade or business of an incorporated company having its head office or other principal place of business in Canada shall be the amount paid up on its capital stock.

The capital employed in the trade or business of a non-Canadian company shall be such portion of the amount paid up on its capital stock as shall bear the same proportion to the amount paid up on its entire capital stock as the value of its assets in Canada bears to the value of its assets outside Canada.

The minister may determine the amount of the capital of any incorporated company issuing stock after the fifteenth day of February, one thousand nine hundred and sixteen, and if, after the said fifteenth day of February, one thousand nine hundred and sixteen, the capital stock of any incorporated company is increased or additional stock is issued, or if the stock is in any way changed or reorganized in such a manner as to increase the amount of the capital, the minister may decide whether or not it is fair and proper to include such increase or any part thereof when determining the capital stock of such company, and the decision of the minister shall be final and conclusive.

The report of House of Commons Debates shows the following, under date of Feb. 18, 1916:

Mr. Graham: Might I ask the Minister of Finance if his new tax will apply to mining companies, whose profits, of course, are terminable, in the same way as it will apply to ordinary incorporated companies?

Sir Thomas White: It will apply to mining companies; but whether or not the details will be precisely the same as in respect to other companies, is a matter which I have under advisement.

JUPITER.

At the Jupiter mine a building 30 by 30 feet is now under construction for housing of the compressors and hoist. No efforts are being spared to get the plant installed as quickly as possible; meanwhile mining operations are being pushed vigorously. The two compressors, which are said to have a capacity of seven drills each, will be electrically driven and for this purpose two 125-horse-power motors are being installed. An entirely separate building to house these and the transformers is in course of erection.—Porcupine Herald.

KOWKASH.

Porcupine, Feb. 19.—Mr. Scobie is back from Kowkash, where he has been for the last three months. He informed the "Porcupine Herald" that the King Dodds property is going ahead and that heavier machinery is going in. Mr. King Dodds is back at the property, and it is said that the O'Brien interests are examining it. Some mining activity is reported at Redmond.

MANUFACTURE AND USES OF ALLOY STEELS.

"Manufacture and Uses of Alloy Steels," is the title of Bulletin 100, just issued by the United States Bureau of Mines. Henry D. Hibbard, the author, in the introduction to the bulletin, says: "The object of this report is to give briefly information of present value relating to the manufacture and uses of the various commercial alloy steels with the hope of stimulating the demand for such steels and extending their practical use. The report is issued by the Bureau of Mines as a contribution to the increase of efficiency in the preparation and utilization of mineral resources.

"Alloy steels are included in the so-called special steels, but as the latter term is often used in the mills to designate broadly any steels intended for purposes other than those served by the regular product, it has seemed best to use the more specific term of alloy steels in this report.

"Alloy steels are bringing about a series of revolutions in various industrial fields in which steel plays an important part. Most elements that could be procured in sufficient quantity, have been alloyed with iron in various proportions, either alone or in combination with others, in the search for useful alloy steels. Those steels that have gained and maintained for themselves a place in current use are discussed in this report. Some of them have had an ephemeral life of usefulness which would no doubt have been prolonged had not some other more satisfactory steel been developed.

"Probably the first useful alloy steel was Mushet's self-hardening tungsten tool steel, patented in 1868. Fifteen years later Chromium steel, really containing chromium, was struggling for recognition for some purposes, the chief of which was for the manufacture of solid shot for piercing armor. In both of these steels the effect of the alloying element as used was in a way proportional to the amount contained. In 1882, Hadfield made his epoch-making discovery of manganese steel and demonstrated that in iron metallurgy it is not safe to take for granted anything as to the properties of an alloy of iron with other elements, basing one's opinion on past experience and knowledge, and that the effect of an alloying element may not be proportional to its content. The development of useful nickel steels followed in a few years and the field thus opened has since then been worked by many able and zealous men, with results of great importance and value."

The bulletin treats of simple tungsten steels, simple chromium steels, manganese steel, simple nickel steels, nickel-chromium steels, silicon steels, high speed tool steels, and chromium-vanadium steels.

In conclusion, the author says: "Further advance in the development of new alloy steels, as well as many new applications of those alloy steels already established, are to be expected. Trials are continually being made of new alloys of promise, some of which will doubtless win place in the list of useful alloy steels. Hadfield's iron alloy containing 5 per cent. manganese and 15 per cent. nickel, although not at present of use, may become so in the future, as its properties are rather remarkable.

"As some of the alloys in steel, as well as any heat treatment it may have received, affect the carbon contained so that its effect in the color determination is changed, the regular practice in some steel-works

laboratories is to make all carbon determinations gravimetrically by direct combustion of the whole sample with oxygen. This procedure avoids the uncertainties and errors of the color determination in analyzing heat-treated alloy steels."

A copy of this bulletin may be obtained by addressing the Director of the Bureau of Mines, Washington, D.C.

PROFIT-SHARING IN IDAHO.

The following announcement has been posted at Kellogg, Coeur d'Alene district, Idaho:

"To all employees of the Bunker Hill & Sullivan Mining and Concentrating Co., Caledonia Mining Co., Sierra Nevada Consolidated Mining Co., and Ontario Mining Co.: Hereafter, when lead is 5c. per lb., or higher, a profit-sharing bonus will be paid in addition to the regular or minimum scale of wages, as follows: 25c. per shift when lead is 5c. and under 5.5c. per lb.; 50c. per shift when lead is 5.5c. and under 6c. per lb.; 75c. per shift when lead is 6c. per lb. and over. The price of lead applying to be the average New York price for the preceding month. During January, 1916, the average New York price of lead was 5.84c per lb. and accordingly for February, 1916, a bonus of 50c. per shift will be paid all employees, and subsequent months in the same manner. When the average price of lead at New York is less than 5c. per lb. no bonus will be paid, and the regular scale applied."

DOME EXTENSION.

Cobalt, Feb. 19.—Two drills are working on the 200-ft. level of the Dome Extension, drifting on a promising vein extension from the Dome property. About fourteen men are on the pay-roll. It is understood that the company is considering the letting of a contract for a considerable amount of diamond drilling in order to test a number of known veins at depth, in hopes of picking up extensions of the Dome vein systems.

CANADIAN MINING INSTITUTE

The annual meeting of the Canadian Mining Institute will be held in Ottawa this week, March 1st, 2nd and 3rd. Undoubtedly the most interesting subject of discussion will be the proposed tax on mining company profits. Action will probably be taken by the Institute. There should be a large attendance at the meeting.

COLEMAN COUNCIL ACTS.

Cobalt, Feb. 22.—At a special meeting of Coleman Township Council, held this afternoon, a resolution was passed to be forwarded to Ottawa asking that in the levying of the proposed war tax the profits of gold and silver mining companies be not on the same basis as industrial companies. The Cobalt Town Council, at its regular meeting last night, passed a similar resolution to be forwarded to Sir Thomas White.

CORDOVA MINES.

The gold mine at Cordova is to be reopened shortly by Mr. P. Kirkegaard. Additional machinery will be purchased.

PERSONAL AND GENERAL

Dr. W. G. Miller attended the annual meeting of the American Institute of Mining Engineers in New York.

Mr. R. B. Watson is in New York.

Mr. John T. Stirling, chief inspector of mines of Alberta, is back at his office after undergoing an operation for appendicitis.

Dr. W. G. Miller, Provincial Geologist of Ontario, sailed from New York on the "Adriatic" on Feb. 17th for England. His address there will be: c/o Ontario Government Office, 163 Strand, London, W. C.

Mr. R. F. and W. E. Segsworth returned to Toronto from Cleveland last week and left for Ottawa.

Mr. A. J. Brant is at Porcupine making arrangements for development of the Korea property.

Dr. E. L. Bruce of the staff of the Geological Survey is at the University of Wisconsin.

Mr. W. E. Segsworth has returned to Toronto from Ottawa.

Mr. T. R. Finneane has returned to Cobalt.

Mr. P. Kirkegaard is reopening the gold mines at Cordova, Ont. Some new equipment will be purchased.

Messrs. E. M. Richardson and W. B. Albright of the R. A. P. Syndicate visited the property at Boston Creek last week.

Hon. Frank Cochrane, Minister of Railways and Canals, has been ordered by his doctor to take a complete rest.

Mr. Kirby Thomas and Mr. Morgan Cartwright visited the Adanae mine last month. Mr. Thomas is consulting engineer for the Adanae Company.

Mr. T. Walter Beam, of Denver, Colorado, who spent two seasons in Camp Hedley, Similkameen district, B.C., directing diamond-drilling operations on a group of mineral claims near Hedley that the New York Syndicate No. 2 was exploring under an option of purchase, has gone to Sutter Creek, Amador County, California, as manager of the old Eureka mine.

Mr. Maurice W. Bacon, of Spokane, Washington, who several months ago retired from the management of the mining operations of the Stewart Mining Co. in the Coeur d'Alene district, Idaho, was lately in Victoria, B.C., seeking Government assistance to make more accessible the copper-mining property in Quatsino division, Vancouver Island, he and his associates have been developing during parts of the last two years.

Mr. Ed. Dedolph, of Kaslo, B.C., for some time engaged by the Mines Branch of the Canada Department of Mines in research work in connection with electric smelting of zinc-lead ores at McGill University and afterward at Nelson, B.C., was in Spokane, Washington, last month.

Mr. W. E. Henry, representative at Spokane, Washington, of the Empire Zinc Co., of St. Louis, Mo.; Mr. G. S. Brooks, for some time with the Mineral Point Zinc Co., Perdue, Ill., and Mr. C. C. Mitchie, also of the Empire Zinc Co.'s staff, last month visited the Consolidated Mining and Smelting Co.'s reduction works at Trail, B.C.

Mr. Harold Lakes, formerly superintendent at the Silver Hoard mine, in Ainsworth Camp, B.C., has been appointed superintendent at the Lucky Jim zinc mine, situated on the mountain divide near the eastern boundary of Slocan mining division, also in British Columbia.

Mr. W. B. Timm has lately been investigating for the Dominion Government the deposit of molybdenite

on Lost Creek, in the southern part of Nelson Mining division, British Columbia.

Mr. W. Yolen Williams, of Spokane, Washington, who during the earlier years of the Granby Consolidated Co.'s important mining development work was the company's mine superintendent, was examining mining properties in Ainsworth mining division last month.

Mr. D. C. Stephens, superintendent of the Tacoma Steel Co.'s Marble Bay gold-copper mine at Vananda, Texada Island, B.C., has been on a visit to Tacoma and Seattle, Puget Sound, Washington.

Mr. J. R. Lockard, manager for the Canadian Collieries (Dunsmuir) Limited, has returned to Vancouver Island, B.C., from a business trip to the East.

Obituary Note.

On Sunday, February 13, the death occurred at Victoria, B.C., of Mr. George Sheldon Williams, manager and editor of the British Columbia Mining and Engineering Exchange, published in Vancouver, B.C., for the last fifteen or sixteen years. Besides his active connection with the mining publication mentioned, the late Mr. Williams was a frequent contributor to the newspaper press. He was a man of athletic habits and seemingly in vigorous health until he had a paralytic stroke several months ago. For a while he appeared to be recovering his wonted health and strength and was able to get out and about, but a relapse occurred and he rapidly failed until his death at the comparatively early age of 49 years. Interment of his body took place at Victoria under Masonic auspices on February 16.

CONSOLIDATED M. & S. CO.

The purchase of the common stock of the West Kootenay Power and Light Co. was ratified by the shareholders of the Consolidated Mining and Smelting Co. of Canada, at their meeting held in Toronto on Feb. 7. The basis of the deal is an exchange of \$75 par value of Consolidated Co.'s stock for \$100 par value of West Kootenay. This arrangement will give the Consolidated company the whole of the common stock issue of West Kootenay, amounting to \$2,000,000, and therefore control of the power company. The ratification of the deal was almost unanimous as the directors held 75 per cent. of the Consolidated Co.'s stock by proxy. The deal was favorably received. Earnings of the West Kootenay Company, after providing for preferred dividends and bond interest, have yielded quite ten per cent. on the common. Now that the Consolidated Co. has control its power supply will be cheaper. Formerly it bought power from the West Kootenay Co. No new authorization for capital will be necessary.

The purchase of the West Kootenay Company's property has an important bearing on the future of the whole smelting company's enterprise. Even after the contract with the Canadian Government for supply of zinc shall end, the cheaper power now available, it was stated by officials at the meeting, will permit of the manufacture of zinc at a profit to the company.

Another matter ratified by the shareholders was the proposal to split the Consolidated Co.'s shares into four, each new share to have par value of \$25.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Coast District.—The following information relative to mining on Princess Royal Island is of more than ordinary interest, since it indicates the entry into mining operations in this district of another experienced mining company from the United States. The excerpt has been taken from a recent publication of the British Columbia Department of Mines:

“**The D. L. S. Group at Surf Inlet**, Princess Royal Island, which has been under bond for the past two years to the Tonopah-Belmont Development Co. of Tonopah, Nevada, was purchased by that company at the end of 1915. The price paid was \$150,000 for an 80 per cent. interest, the original company, the Surf Inlet Gold Mines, Limited, retaining one-fifth of the stock. In addition to this, the Tonopah Company agreed to put up a 250-ton mill, the construction of which will be started immediately. This will mean that a new gold-producing mine, in a hitherto unproductive region, will soon be added to the shipping mines of the province.

“The Tonopah Company will have spent, by the time the mill is completed and with development and purchase moneys, close to \$1,000,000, and it is therefore to be presumed that they have, in the development work, proved up a considerable tonnage of ore.

“The orebodies consist of veins and masses of quartz containing pyrite, in sheared fissure zones in granite, and are sometimes of considerable size. The value is in gold and possibly a very little silver, occurring partly in the pyrite and partly free. It is not known what type of mill is to be erected, but it should be a comparatively easy ore to treat.”

East Kootenay.

Sullivan Mine Shipments.—So far as known, the Sullivan mine made a record of ore shipments to Trail during three recent weeks. Trail smeltery figures show that during the week ended January 27 there was received 1,324 tons of Sullivan ore, 1,321 tons during the week ended February 3, and 1,550 tons during the week ended February 10; total for the three weeks, 4,195 tons, which is nearly 1,400 tons a week for three successive weeks. There have been times at which more than 1,000 tons was received in each of two successive weeks, but not during a longer period. The weekly average for the calendar year 1915 was 856 tons of lead ore received at Trail; that for the six expired weeks of 1916, to February 10, inclusive, was 1,001 tons. It is expected that when the Consolidated Mining and Smelting Company of Canada's electrolytic zinc refining plant shall be in operation the average weekly output of the Sullivan mine, of lead and zinc ore, will show a substantial further increase. In his report for the Consolidated Company's last fiscal year, presented to the shareholders on December 28, 1915, the general manager, after making brief reference to the electrolytic zinc plant then being put in at the company's works near Trail, B.C., said: “It is hoped that this plant will be in operation early in the year. Its operation should make available a very large amount of complex ore at the Sullivan mine, and the extraction of that ore will probably lead to the development of further bodies of lead ore in the same mine.”

West Kootenay.

Ainsworth.—In comparison with the corresponding period of 1915, there is in 1916 a very marked improvement in mining conditions in Ainsworth division. Ore shipments totalling 1,784 tons have been made from seven mines during six weeks ended February 10 of this year against only 101 tons from four mines during the first six weeks of 1915. A further considerable increase in output may be expected in the spring, as soon as sufficient water shall be available for the operation of two or three concentrating plants now idle owing to there not being enough water to meet the power requirements of their respective mills.

Slocan.—Eleven mines in Slocan division and three in Slocan City are on this year's ore-shipping list. Those in the first-mentioned division are the Apex, Comstock, Galena Farm, Hewitt-Lorna Doone, Noonday, Rambler-Cariboo, Reco, Ruth, Socan Star, Standard, and Yakima; in Slocan City division there are the Black Prince, Enterprise, and Meteor. These mines have shipped ore to Trail. It is probable there are one or two others that last year shipped to United States reduction works and are continuing to do so this year, but of these there is not a similar record as in the case of those that send their ore and concentrates to a district smeltery.

Nelson.—The Provincial Mineralogist, in his Preliminary Review of Mining in the Province in 1915, states that there was a heavy decline in the lode-gold output of Nelson division in 1915. He makes brief comment on the gold mines, as follows: “A reduction of about 7,000 oz. of gold is estimated for the Nelson district, or nearly 46 per cent. This decrease is mainly due to a falling off in the production of the Motherlode mine on Sheep Creek, where the cyanide mill was operated only a short time owing to the exhaustion of the developed ore reserves at the mine. The mine is at present closed and the future plans of the company are not known. The Queen mine, on Sheep Creek, made about the same product as the previous year, and it is said that development work on the lower levels is proving satisfactory in showing the continuation of the ore shoots. The Second Relief, near Erie, milled more ore than in 1914, and the Granite-Poorman, near Nelson, again entered the list of producers. The Yankee Girl mine, at Ymir, did not ship any ore, but a low-level tunnel was driven into the vein and drifting was commenced on it. This work is now progressing and good ore is being found. It is probable a mill will be erected on the property in the near future.”

Rossland.—Ore shipments to Trail during the first half of February were about 500 tons a week less than during January, doubtless attributable to the heavy snowfall, which somewhat hindered operations above ground. The output for two weeks was as follows: From Centre Star group 5,671 tons; Le Roi, 4,424 tons; Josie (Le Roi No. 2, Ltd.), 730 tons; Velvet, 33 tons; total, 10,858 tons, an average of 5,429 tons a week, which compares with 5,945 tons a week for four weeks ended January 27. The shipment from the Velvet was the first made from that mine for several years, the property having been unworked for some time.

The report of the Josie mine for December, made by the Le Roi No. 2 Company's managers at Rossland to its London office, was made public in British Columbia about the middle of February. It shows total receipts

in the month reported on to have been \$11,098 and expenditures, \$18,729. An office note states that "Payments for 817 tons only were received during the month, although 1,317 tons of first-class ore was hoisted, of which 1,120 tons was shipped. Receipts and estimated working costs, etc., for the last three months of 1915 were as under:

	Receipts.	Expenditures.
October	\$14,922	\$15,647
November	34,700	18,700
December	11,098	18,729
Totals	\$60,720	\$53,076

Expenditures were as follows: For ore production, \$23,700; milling, \$1,700; development (including diamond-drilling), \$24,970; stores purchased but unused, \$1,747; on capital account, \$959.

Trail.—Ore receipts during the week ended February 3 totalled 8,374 tons, and for that ended February 10, 8,039 tons. These totals compare with a weekly average of 8,019 tons for four weeks ended January 27. No ore was received during the week ended February 10 from Republic mines, in the State of Washington, probably due to railway transportation difficulties caused by much more snow having fallen in the district than in ordinary winters, for in no other week since the shipment of ore from Republic mines to Trail was resumed in the summer of 1914 was there a similar experience.

INTERNATIONAL NICKEL.

In the House of Commons on Tuesday, Feb. 22, Col. John Currie, member for North Simcoe, according to a "Toronto World" reporter stated that some of our great copper deposits are controlled by German syndicates and a great part of the nickel deposits of the Sudbury district were controlled by Krupp, the German gunmaker, through trustees residing in the United States. Canada, he said, should follow the example of Australia which had terminated German ownership of zinc concentrates and copper.

"Our Government should at once investigate the International Nickel Co. and ascertain if the statements made about that corporation on the floor of the British House of Commons were justified by the facts. We had practically a monopoly of nickel, and we had the advantage of all the world in manufacturing electric steel. The Government should be able to get enough out of our nickel deposits to carry the burden of the war debt. We could make chrome steel, and, indeed, could monopolize the manufacture of cannon. No nation was so well suited for the manufacture of rifles, guns and armaments of every kind."

E. W. Nesbitt (N. Oxford) informed the House that no Germans had stock in the International Nickel Co.

Mr. Nesbitt said: "There was one point raised by the hon. member for North Simcoe (Mr. Currie) regarding which I would like to say one word. He said that the nickel industry in Canada was controlled by Germany. I know some officers of the nickel corporation, and I know that there is not a human being in Germany who has any control, or who has anything to do with the Canadian nickel interests. I think the ministers know that as well as I do. I have been told by officers of the nickel company that they would be perfectly willing to have any investigation that might be thought desirable to clear away any doubts as to German control."

COBALT SHIPMENTS.

Cobalt, Feb. 19.—The ore shipments this week are considerably lower than last. The total number of pounds shipped for the week ending last night was 491,970 pounds compared with 687,924 pounds a week ago. Six cars were dispatched from as many companies. The heaviest car came from Dominion Reduction and contained 88,000 pounds. La Rose was next with 87,140 pounds. Ore shipments for the week were:

Company.	Pounds.
McKinley-Darragh	84,924
Dominion Reduction	88,000
Mining Corporation	84,525
La Rose	87,140
Buffalo	75,385
Penn Canadian	71,996

Total 491,970
Bullion shipments for the year to date are as follows:

	Ounces.	Value.
Nipissing	409,282.56	\$233,680.01
Mining Corporation	53,774.62	30,798.77
Crown Reserve	47,000.00	28,300.00
Dominion Reduction	65,000.00	37,050.00
O'Brien Mine	36,987.00	21,542.46

Total 612,044.18 \$351,371.24

The Manitoba Government is said to have purchased in England a gas-producer plant for the purpose of testing the possibilities of Manitoba and Saskatchewan lignite coal. It should arrive about the end of the month and will be installed at the town of Souris. It is claimed that gas can be produced at a cheap rate and piped in large quantities to urban centres.

The oldest daily newspaper in Vancouver, B.C., the "News-Advertiser," says: "The time has come for a new departure in the mining industry of British Columbia. If we understand the attitude of the new Minister of Mines he will never be content with the production of metals for export in their crudest form. The smelting and refining industries are of more importance in the development of the province than the production of the ore. Primary and secondary metal industries should go together. We have not only the raw material, but the fuel and the natural water powers to produce electricity. We have the same markets for refined metals and for brass as have the people to whom we have been selling ore. We have or can have the same labor. Every metal industry creates its market for skilled and unskilled labor, for farm, for forest and fishery products, and for manufactures. This is one of the roads to a well organized population with balanced and adjusted interests and industries."

BOSTON CREEK.

The new plant at the Richardson, Albright and Passimakes' property at Boston Creek is now installed and in operation, says The Cobalt Nugget. The No. 2 shaft is down to a depth of 105 ft. and some ore is being recovered. The plant was in operation last week for the first time. The compressor is a Rand, three-drill, steam-driven, and the hoist is adequate to work to a depth of four hundred ft.

TRETHEWEY.

The annual meeting of Trethewey Mines, Limited, was held in Toronto Feb. 23. All the old directors and officers were re-elected.

MARKETS

NEW YORK MARKETS.

Feb. 21, 1916—Connellsville coke (f.o.b. ovens)—
 Furnace, spot, \$3.25 to \$3.50.
 1st half \$2.35 to \$2.50; Year 1916, \$2.25 to \$2.35.
 Foundry, prompt, \$3.75 to \$4.00.
 Foundry, contract, \$3.25 to \$3.75.
 Straits, tin, f.o.b., 42.25 cents.
 Copper—
 Prime Lake, nominal, 28.00 to 28.50 cents.
 Electrolytic, nominal, 28.00 to 28.50 cents.
 Casting, nominal, 26.75 to 27.00 cents.
 Lead, Trust price, 6.30 cents.
 Lead, outside, 6.30 cents.
 Spelter, prompt western shipment, nominal, 20.92½ to 21.17½ cents.
 Antimony—
 English brands, nominal.
 Chinese and Jap, 43.50 to 44.50 cents.
 American, 43.50 to 44.50 cents.
 Aluminum—
 No. 1 virgin, 98-99 per cent., 58.00 to 60.00 cents.
 Pure, 98-99 per cent. remelt, 56.00 to 58.00 cents.
 No. 12 alloy remelt, 47.00 to 49.00 cents.
 Nickel, 45.00 to 50.00 cents.
 Cadmium, nominal, \$1.25 to \$1.50.
 Quicksilver, nominal, \$275 to \$290.
 Platinum, nominal, \$88.00 to \$100.00.
 Cobalt (metallic), \$1.25.
 Silver (official), 56¼ cents.

Metal Products.—Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 35.00 cents.
 Copper wire, base, 29.25 to 29.75 cents.
 High sheet brass, base, 38.00 to 40.00 cents.
 Seamless brass tubing, 41.00 to 43.00 cents.
 Seamless copper tubing, 42.00 to 44.00 cents.
 Brazed tubing, 45.50 to 47.50.
 Brass wire, 38.00 to 40.00 cents.
 Brass rods, 38.00 to 40.00 cents.
 Sheet zinc, f.o.b. smelter, 25.00 cents.

TORONTO MARKETS.

Feb. 23—(Quotations from Canada Metal Co., Toronto)—
 Spelter, 25 cents per lb.
 Lead, 8 cents per lb.
 Tin, 47 cents per lb.
 Antimony, 48 cents per lb.
 Copper casting, 31 cents per lb.
 Electrolytic, 31 cents per lb.
 Ingot brass, yellow, 13c.; red, 15 cents per lb.
 Feb. 23.—(Quotations from Elias Rogers Co., Toronto)—
 Coal, anthracite, \$8.00 per ton.
 Coal, bituminous, \$5.75 per ton.

SILVER PRICES.

	New York,	London,
	cents.	pence.
Feb. 9	56½	27
" 10	56½	27
" 11	56½	27
" 12	Holiday	26½
" 14	56½	26½
" 15	56½	26½
" 16	56¾	26½
" 17	56¾	26½

" 18	56¾	....
" 19	56¾	26½
" 21	56¾	26½

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto.)

New York Curb.

	Bid.	Asked.
Butte	7½	7¾
Curtiss Aeroplane	45	50
Canada Copper	1¾	1⅞
Canada Cement	1½	1⅞
Emma Copper	60	64
Howe Sound	5½	5⅞
International Petroleum	12½	12¾
International Nickel (new)	48	47
Kennecott Copper	55¾	55¾
Maxim Munitions	5	6
Midvale Steel	7¾	8
Marconi	3⅞	3⅞
Mother Lode	21½	22
Steel of Canada	39¾	40¼
Submarine Boat	36	37
Tonopah Extension	4¾	4⅞
U. S. Light (preferred)	5½	5¾
White Motors	50	51

Porcupine Stocks.

	Bid.	Asked.
Apex	.06¼	.06¾
Dome Extension	.28¼	.28½
Dome Lake	.25¼	.27½
Dome Mines	24.00	24.75
Hollinger	26.00	26.50
Jupiter	.21½	.22
McIntyre	.93	.95
McIntyre Extension	.25	.30
Porcupine Crown	...	.30
Porcupine Imperial	.03½	.04
Porcupine Vipond	.65	.67
Preston East Dome	.04¼	.04½
West Dome	.14¾	.15

Cobalt Stocks.

	Bid.	Asked.
Adanac	.60	...
Bailey	.05¾	.06
Beaver	.37½	.38
Buffalo	...	.90
Chambers Ferland	.23	.25
Coniagas	4.25	4.30
Crown Reserve	.42	.45
Foster	.09	.09¼
Gifford	.05¾	.06
Gould	.00½	.01
Great Northern	.42	.46
Hargraves	.04	.04½
Hudson Bay	26.00	...
Kerr Lake	3.90	4.00
La Rose	.60	.65
McKinley	.45	.47
Nipissing	6.25	6.50
Peterson Lake	.25	.25¼
Right of Way	.04½	.05½
Seneca Superior	.47	.50
Silver Leaf	.02	.02¾
Temiskaming	.55	.56½
Trethewey	.14	.17
Wettlaufer	.07	.10

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS

ASSAYERS, CHEMISTS AND ORE TESTERS.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 MCGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

MILTON HERSEY CO., LTD.
Chemists and Mining Engineers
Assays of Ores Tests of all Materials
DR. MILTON L. HERSEY, President
(Consulting Chemist to Quebec Government)
JAMES G. ROSS
Consulting Mining Engineer
HEAD OFFICE: 84 St. Antoine St., MONTREAL

Phone M. 1889 Cable address "Heys"
Established 1878.

HEYS, THOS. & SON,
Technical Chemists and Assayers,
Rooms M and N, Toronto Arcade
Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montrea
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

HASSAN, A. A.,
Mining Geologist and Consulting
Engineer.
SUITE 203-204 RIGGS BLDG.,
WASHINGTON, D.C.

LEDOUX & CO.

ASSAYERS AND SAMPLERS

Office and Laboratory,
99 John St., New York.

Weigh and Sample Shipments at
Buyers' Works, representing the
Interests of Sellers in all Transactions.

We are not Dealers or Refiners.

JOHN V. N. DORR
Consulting and Metallurgical
Engineer
17 Battery Place and New York City
First National Bank Building
Denver, Colorado

HITCHCOCK C. H.
Mining Engineer
Mines examined with a view to purchase
COPPER CLIFF, ONT.

JOHNSON, MATTHEY & CO. LTD.

Buyers, Smelters, Refiners & Assayers of
Gold, Silver, Platinum, Ores, Sweeps,
Concentrates, Bullion, &c.

Offices—Hatton Garden, London, E.C.
Works—Patricroft, Manchester, England

FERRIER, W. F.
Consulting Mining Engineer
and Geologist
204 LUMSDEN BLDG., TORONTO, ONT.

SPEARMAN CHAS., B.Sc., M.A.
Mining Geologist and Engineer
Structural geology problems relating to
ore deposits, examinations, reports
petrographical examinations, radio-ac-
tive tests, etc. Box 413, Haileybury, Ont.

FORBES, D. L. H.
Mining & Metallurgical Engineer
Chuquicamata, Chile
Chief Construction Engineer for
Chile Copper Co.

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

CAMPBELL & DEYELL, Limited

Ore Samplers, Assayers
and Chemists

Cobalt, Ont.
South Porcupine, Ont.

C. G. CAMPBELL,
General Manager.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

LAWYERS

TYRRELL, J. B.
Mining Engineer,
584 Confederation Life Building,
TORONTO, - - CANADA.

Telephone Main 3813 Cable Address: "Chadwick" Toronto
Western Union Code
E. M. Chadwick, K.C. Beatty, Blackstock, Fasken
David Fasken, K.C. Cowan & Chadwick
M. K. Cowan, K.C. Barristers, Solicitors, Notaries
Harper Armstrong Offices: Bank of Toronto,
Alexander Fasken Cor. Wellington & Church Sts.
Hugh E. Rose, K.C. 58 Wellington St. East
Geo. H. Sedgewick. Toronto
James Aitchison

Phone Main 2311 Cable Address
"Segsworth" Toronto

R. F. SEGSWORTH
Barrister, Solicitor, Notary, Etc.
JARVIS BUILDING
103 Bay Street - TORONTO

MINE SUPERINTENDENT WANTED

For Pyrites Mine in Ontario

Must have good record for producing ore at low cost and be capable of handling 60 to 80 men.

Address Box L, Can. Mining Journal

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.

DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.

Telephone 213 Box 506

CORE BORING SOUNDINGS * CONTRACTORS

Smith & Travers Diamond Drill Company, Limited

Box 169, SUDBURY, ONT.

All classes of Diamond Drilling done.

Engineer's Reports on All Work, Furnished.

SMITH & DURKEE Diamond Drilling Co. LIMITED

Contractors for all classes of diamond drill work.

We make a specialty of saving a large percentage of core in soft ground.

Plans showing location of holes and surveys of holes can be supplied.

SUDBURY - ONT.

WANTED For immediate delivery at Cordova Mines, Ont.

A. C. Generator, 3-phase, 60-cycle, 6,600 volt, 400 to 600 K.V.A. preferably 200 R.P.M.

3—100 K.V.A., single-phase transformers, 6,600 to 600 volts, 60 cycle.

2—Belted Induction or Synchronous Motors, 350 to 400 H.P., 60-cycle, 3-phase, 6,600 volts.

2—Air Compressors, 100 lbs. per sq. in. pressure, delivery 2,000 cu. ft. per min. each, belt driven.

1 Lyner Sharpener, No. 5.
Quote with full particulars to **KERRY & CHACE, LIMITED, Confederation Life Building, Toronto, Ontario.**

PORCUPINE GOLD CAMP

Latest information obtained by subscribing to the

PORCUPINE HERALD

South Porcupine, Ontario

Canada \$1.50, United States \$2.00 a year.

Canadian Mining Manual

1915

Now Ready

PRICE \$2.00

263-265 Adelaide St. West., TORONTO.

ORILLIA MOLYBDENUM CO.

LIMITED

Molybdenite Ores of all kinds Treated

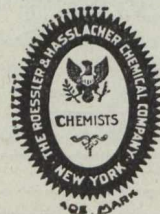
Schedule of Charges Given on Request

ORILLIA

ONTARIO

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK



Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Mining Journal

WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"

A JOURNAL DEVOTED TO MINING AND METALLURGY

SUBSCRIPTION IN CANADA, \$2.00
TO OTHER COUNTRIES, \$3.00

PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWO, .Y-FOUR ISSUES IN A YEAR

FEBRUARY 16, 1907
THE CANADIAN MINING JOURNAL



The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name

Address

When Answering Advertisements please mention THE CANADIAN MINING JOURNAL.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.
Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in

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

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers

THE ALBANY, LIVERPOOL, ENGLAND

Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moringe & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers London, Liverpool and Swansea

ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouse, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Cobalt Metal
Cobalt Anodes
Cobalt Oxide
Nickel Oxide
Cobalt Salts
Nickel Metal
Pure White Arsenic

Deloro Mining and Reduction Co., Limited

WORKS AT DELORO, ONT.
Branch Office: Room 1112 C.P.R. Bldg., TORONTO

C. L. CONSTANT CO.,
42 New Street - New York
SHIPPERS' AGENTS
FOR
Selling, Sampling and Assaying Ores, Metals and Furnace Products

Entire charge taken of shipments from the receipt of bill of lading to the collection of smelter's return

NOT CONNECTED WITH ANY SMELTER

Canadian Representative:
G. C. BATEMAN - Traders Bank Building, Toronto

The Coniagas Reduction Company, Limited.
St. Catharines - Ontario

Smelters and Refiners of Cobalt Ores
Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

Balbach Smelting and Refining Co.
Newark, N. J.

Buyers of
Gold, Silver, Lead and Copper Ores.
Lead Residues and Copper Residues.

Electrolytic Copper Refinery
INQUIRIES SOLICITED

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

This stamp



means quality

ECONOMY

In the use of EXPLOSIVES is of
SUPREME IMPORTANCE

Under existing conditions Ammonia Dynamites cost considerably less than Nitro-Glycerine Dynamites or Forcite, and are equally satisfactory under many conditions.

Why not try them.

DISTRICT OFFICES:

NOVA SCOTIA:	-	-	-	-	-	Halifax
QUEBEC:	-	-	-	-	-	Montreal
ONTARIO:	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	-	Ottawa
MANITOBA:	-	-	-	-	-	Winnipeg
ALBERTA:	-	-	-	-	-	Edmonton
BRITISH COLUMBIA:	Vancouver,	Victoria,	Nelson,	-	-	Prince Rupert

Factories at

Beloeil, P.Q.	Vaudreuil, P.Q.	Windsor Mills, P.Q.
Waverley, N.S.	James Island, B.C.	Nanaimo, B.C.
Northfield, B.C.	Bowen Island, B.C.	Parry Sound, Ont.

The Canadian Miner's Buying Directory.

- Air Hoists—**
Canadian Ingersoll-Rand Co., Ltd.
- Amalgamators—**
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.
- Assayers and Chemists—**
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
C. L. Constant Co.
- Assayers' and Chemists Supplies—**
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que
Stanley, W. F. & Co., Ltd
- Ball Mills—**
Fraser & Chalmers of Canada, Limited.
- Belting—Leather, Rubber and Cotton—**
Northern Canada Supply Co.
Jones & Glassco
- Blasting Batteries and Supplies—**
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada) Ltd.
Northern Canada Supply Co.
Canadian Explosives, Limited
- Blowers—**
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.
- Boilers—**
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
- Buckets—**
Hendrick Mfg. Co.
M. Beatty & Sons, Ltd.
Northern Canada Supply Co.
- Cable — Aerial and Underground—**
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.
- Cableways—**
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
- Cages—**
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
- Cables—Wire—**
Standard Underground Cable Co. of Canada, Ltd.
- Cars—**
Jeffrey Mfg. Co.
Northern Canada Supply Co.
- Cement Machinery—**
Northern Canada Supply Co.
- Chains—**
Jeffrey Mfg. Co.
Jones & Glassco
Northern Canada Supply Co.
B. Greening Wire Co., Ltd.
- Chemists**
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.
- Coal—**
Dominion Coal Co.
Nova Scotia Steel & Coal Co.
- Coal Cutters—**
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
- Coal Mining Explosives—**
Curtis & Harvey (Can.), Ltd.
Canadian Explosives, Limited
- Coal Mining Machinery—**
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
- Coal Punchers—**
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
- Coal Washeries—**
Jeffrey Mfg. Co.
- Compressors—Air—**
Smart-Turner Machine Co.
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.
- Concentrators and Jigs—**
Fraser & Chalmers of Canada, Limited.
- Concrete Mixers—**
Northern Canada Supply Co.
- Condensers—**
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
Northern Canada Supply Co.
- Converters—**
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
- Conveyor—Trough—Belt—**
Hendrick Mfg. Co.
- Cranes—**
Smart-Turner Machine Co.
M. Beatty & Sons, Ltd.
- Crane Ropes—**
Allan, Whyte & Co.
B. Greening Wire Co., Ltd.
- Crushers—**
Fraser & Chalmers of Canada, Limited.
Lymans, Ltd
- Cyanide Plants—**
Fraser & Chalmers of Canada, Limited.
Roessler & Hasslacher.
- Derricks—**
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
- Diamond Drill Contractors—**
Diamond Drill Contracting Co.
Smith and Travers.
- Dredging Machinery—**
M. Beatty & Sons.
- Dredging Ropes—**
Allan, Whyte & Co.
Fraser & Chalmers of Canada, Limited.
- Drills, Air and Hammer—**
Can. Ingersoll-Rand Co., Ltd
Jeffrey Mfg Co.
Sullivan Machinery Co.
Northern Canada Supply Co.
- Drills—Core—**
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.
- Drills—Diamond—**
Sullivan Machinery Co.
Northern Canada Supply Co.
- Drill Steel Sharpeners—**
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
- Dump Cars**
Sullivan Machinery Co.
- Drills—Electric—**
Can. Ingersoll-Rand Co., Ltd.
- Dynamite—**
Curtis & Harvey (Canada). Ltd.
Canadian Explosives.
Northern Canada Supply Co.
- Ejectors—**
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
- Elevators—**
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
- Engineering Instruments—**
C. L. Berger & Sons.
- Engineers and Contractors—**
Fraser & Chalmers of Canada, Limited.
- Engines—Automatic—**
Smart-Turner Machine Co.
- Engines—Gas and Gasoline**
Fraser & Chalmers of Canada, Limited.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
- Engines—Haulage—**
Fraser & Chalmers of Canada, Limited.
Can. Ingersoll-Rand Co., Ltd
- Engines—Marine—**
Smart-Turner Machine Co.
- Engines—Steam—**
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons.
- Fans—Ventilating—**
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
- Feeders—Ore—**
Fraser & Chalmers of Canada, Limited.
- Flights—**
Hendrick Mfg. Co.
- Forges—**
Northern Canada Supply Co.
Ltd.
- Forging—**
M. Beatty & Sons.
Smart-Turner Machine Co.
- Furnaces—Assay—**
Lymans, Ltd.
- Fuse—**
Curtis & Harvey (Canada). Ltd.
Canadian Explosives.
Northern Canada Supply Co.
- Gears—**
Smart-Turner Machine Co.
Northern Canada Supply Co.
- Hangers—Cable—**
Standard Underground Cable Co. of Canada, Ltd.
- Hand Hoists—**
Fraser & Chalmers of Canada, Limited
- High Speed Steel Twist Drills—**
Northern Canada Supply Co.
- Hoists—Air, Electric and Steam—**
Can. Ingersoll-Rand Co., Ltd
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
- Hoisting Engines—**
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.
- Hose—**
Northern Canada Supply Co.
- Jacks—**
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
- Lamps—Safety—**
Canadian Explosives.
- Link Belt—**
Northern Canada Supply Co.
Jones & Glassco.
- Metal Merchants—**
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.
- Monel Metal—**
International Nickel Co.
- Nickel—**
International Nickel Co.
- Ore Sacks—**
Northern Canada Supply Co.
- Ore Testing Works**
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.
- Ores and Metals—Buyers and Sellers of—**
C. L. Constant Co.
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.
- Perforated Metals—**
B. Greening Wire Co., Ltd.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.
- Pick Machines—**
Sullivan Machinery Co.
- Pipes—**
Consolidated M. & S. Co.
Northern Canada Supply Co.
Smart-Turner Machine Co.
- Pipe Fittings—**
Northern Canada Supply Co.
- Pneumatic Tools—**
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.
- Prospecting Mills and Machinery—**
Standard Diamond Drill Co.
Fraser & Chalmers of Canada, Limited

Canadian Miner's Buying Directory.—(Continued from page 16.)

Pulleys, Shafting and Hangings— Fraser & Chalmers of Canada, Limited Northern Canada Supply Co.	Pumps—Vacuum— Smart-Turner Machine Co.	Screens— B. Greening Wire Co., Ltd. Jeffrey Mfg. Co. Northern Canada Supply Co. Fraser & Chalmers of Canada, Limited	Surveying Instruments— W. F. Stanley. C. L. Berger.
Pumps—Boiler Feed— Smart-Turner Machine Co. Northern Canada Supply Co. Canadian Ingersoll-Rand Co. Ltd. Fraser & Chalmers of Canada, Limited	Quarrying Machinery— Sullivan Machinery Co. Can. Ingersoll-Rand Co., Ltd.	Screens—Cross Patent Flanged Lip— Hendrick Mfg. Co.	Tanks—Cyanide, Etc.— Fraser & Chalmers of Canada, Limited Hendrick Mfg. Co.
Pumps—Centrifugal— Smart-Turner Machine Co. M. Beatty & Sons. Can. Ingersoll-Rand Co., Ltd. Fraser & Chalmers of Canada, Limited	Roasting Plants— Fraser & Chalmers of Canada, Limited	Separators— Smart-Turner Machine Co.	Transformers— Northern Electric Co., Ltd.
Pumps—Electric— Smart-Turner Machine Co. Canadian Ingersoll-Rand Co., Ltd. Fraser & Chalmers of Canada, Limited	Rolls—Crushing— Fraser & Chalmers of Canada, Limited	Sheets—Genuine Manganese Bronze— Hendrick Mfg. Co.	Transits— C. L. Berger & Sons.
Pumps—Pneumatic— Smart-Turner Machine Co. Can. Ingersoll-Rand Co., Ltd.	Roofing— Northern Canada Supply Co.	Shovels—Steam— M. Beatty & Sons.	Tube Mills— Fraser & Chalmers of Canada, Limited
Pumps—Steam— Can. Ingersoll-Rand Co., Ltd. Northern Canada Supply Co. Smart-Turner Machine Co.	Rope—Manilla and Jute— Jones & Glassco. Northern Canada Supply Co. Allan, Whyte & Co.	Smelting Machinery— Fraser & Chalmers of Canada, Limited	Turbines— Fraser & Chalmers of Canada, Limited
Pumps—Turbine— Smart-Turner Machine Co. Canadian Ingersoll-Rand Co., Ltd. Fraser & Chalmers of Canada, Limited	Rope—Wire— B. Greening Wire Co., Ltd. Allan, Whyte & Co. Northern Canada Supply Co. Fraser & Chalmers of Canada, Limited	Stacks—Smoke Stacks— Hendrick Mfg. Co.	Winding Engines— Canadian Ingersoll-Rand Co., Ltd.
	Samplers— Canadian Laboratories. C. L. Constant Co. Ledoux & Co. Milton Hersey Co. Thos. Heys & Son.	Stamp Mills— Fraser & Chalmers of Canada, Limited	Wire Cloth— Northern Canada Supply Co. B. Greening Wire Co., Ltd.
		Steel Drills— Sullivan Machinery Co. Northern Canada Supply Co. Can. Ingersoll-Rand Co., Ltd.	Wire (Bare and Insulated)— Standard Underground Cable Co., of Canada, Ltd.
		Steel—Tool— N. S. Steel & Coal Co.	Zinc Dust— Roessler & Hasslacher.

ALPHABETICAL INDEX TO ADVERTISERS

A	F	N
Allan, Whyte & Co. 2	Ferrier, W. F. 11	Nova Scotia Steel & Coal Co. 4
American Zinc Lead & Smelting Co. 10	Fleck, Alex. 9	Nova Scotia, Province of. 8
B	Flory, S., Mfg. Co. 6	Northern Canada Supply Co., Ltd. 3
Bath, Henry & Son. 14	Forbes, D. L. H. 11	O
Balbach Smelting & Refining Co. 14	Fraser & Chalmers of Can., Ltd. 4	Orillia Molybdenum Co. 12
Beatty, Blackstock, Fasken, Cowan & Chadwick 12	G	Ontario, Province of ..........Inside Back Cover
Beatty, M. & Sons, Ltd. 3	B. Greening Wire Co., Ltd. 5	Q
Berger, C. L. & Sons. 9	Guess & Haultain 11	Quebec, Province of 8
Blackwell, Geo. G., Sons & Co. 14	H	R
British Columbia, Province of. 7	Hardman, Jno. E. 11	Roessler & Hasslacher Chemical Co. 12
Buffalo Mines, Ltd. 4	Hassan, A. A. 11	S
Boving Hydraulic & Engineering Co. 10	Hendrick Mfg. Co. 6	School of Mining. 9
C	Hersey, Milton Co., Ltd. 12	Segsworth, R. F. 12
Campbell & Deyell Ltd. 12	Heys, Thomas & Son 12	Smart-Turner Machine Co. 6
Canadian Copper Co. 9	I	Smith & Durkee, Diamond Drill Co. 12
Canadian Explosives, Ltd. 13	Imperial Bank of Canada. 5	Smith & Travers Diamond Drill Co. 12
Canadian Laboratories Ltd. 12	International Nickel Co. 9	Smith Sydney 11
Can. Ingersoll-Rand Co., Ltd. 1	J	Sullivan Machinery Co. 2
Canada Metal Co. 5	Jeffrey Mfg. Co. 10	Summerhayes, Maurice W. 11
Cohen, S. W. 11	Jones & Glassco 10	Stanley, W. F. & Co., Ltd. 6
Consolidated Mining & Smelting Co. 14	L	Standard Underground Cable Co. of Canada 3
Coniagas Reduction Co. Ltd. 14	Ledoux & Co. 12	T
Constant, C. L. & Co. 14	Lymans, Ltd. 3	Tyrrell, J. B. 11
Curtis's & Harvey ..........Outside Back Cover		
D		
Dept. of Mines, Canada. .... .....Inside Front Cover		
Deloro Mining & Reduction Co. 14		
Diamond Drill Contracting Co. 3		
Dominion Coal Co., Ltd. 9		
Dorr, Jno. V. N. 11		
Dwight & Lloyd Sintering Co., Inc. 7		

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials, such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1913 was valued at \$53,232,311. Ontario has the largest mineral production of any of the Provinces.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs \$5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

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

HON. G. H. FERGUSON,

Minister of Lands, Forests and Mines,

Toronto, Canada.

Printing and Publishing

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 263-5 ADELAIDE ST. WEST,
TORONTO

OR

Canadian Mining Journal, 263-5 ADELAIDE ST. WEST,
Toronto

EXPLOSIVES

For Every Class of Work

CURTIS'S & HARVEY

(CANADA) LIMITED

400 St. James Street

Montreal