

Technical and Bibliographic Notes / Notes techniques et bibliographiques

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

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

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

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

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

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

G. M. Dawson

THE MINING REVIEW

Established 1882

Vol. XIII.—No 12

1894—OTTAWA, DECEMBER—1894

Vpl. XIII.—No. 12.

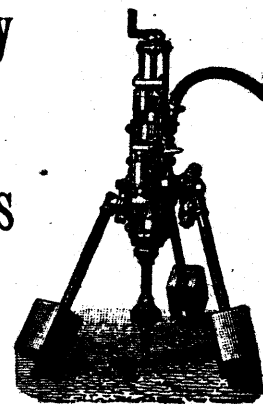
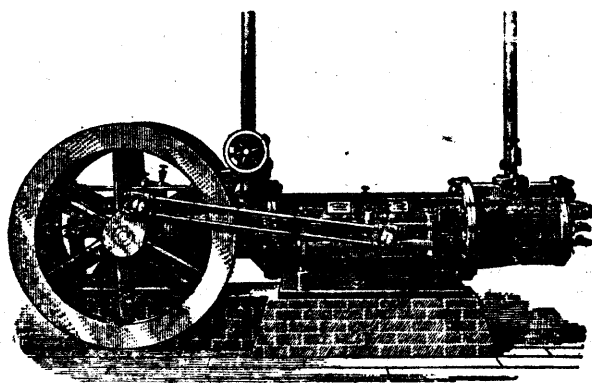
CANADIAN RAND DRILL CO. SHERBROOKE, QUE.

Mining, Tunneling & Rock-Working Machinery

STRAIGHT LINE COMPRESSORS.

DUPLEX, COMPOUND & CONDENSING COMPRESSORS

With MEYER or CORLISS VALVE GEAR
For ECONOMICAL PLANTS.



THE JENGKES MACHINE CO., Sole Agents,

16 VICTORIA SQUARE, MONTREAL.

HALIFAX-HOTEL, HALIFAX.

639 CORDOVA STREET, VANCOUVER.

ALL KINDS OF RUBBER GOODS for MINING PURPOSES

MANUFACTURED BY

* THE CUTTA PERCHA AND RUBBER MFG. CO. OF TORONTO, LTD.

OFFICE 61 & 63 FRONT ST. WEST TORONTO. FACTORIES AT PARKDALE.

Steam & Air Hose, Rubber Bumpers and Springs, Fire Hose, Pulley Covering, Rubber Clothing & Boots

PUMPING WATER BY COMPRESSED AIR

We take pleasure in announcing that by arrangements made with J. G. POHLE,
we are enabled to furnish our Customers with the

POHLE AIR LIFT PUMP

PROTECTED BY NUMEROUS
CANADIAN AND FOREIGN
PATENTS.

This Department of our business will be under the personal supervision of Dr. POHLE, the Inventor and Patentee.

It has been estimated by competent experts that under favorable conditions and large diameters
of water and air pipes, 1,000,000 of water can be raised 100 ft. high with one and a-half tons of good coal.

WE WILL BE PLEASED TO FURNISH COMPLETE DATA AND ESTIMATES.

INGERSOLL ROCK DRILL CO. OF CANADA

164 ST. JAMES STREET WEST, MONTREAL, CAN.

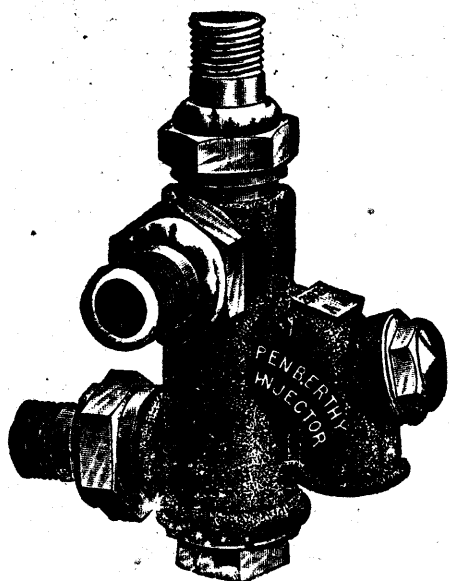
136 LIBERTY ST. FRISBEE LUCOP MILLS: NEW YORK.
MAKERS OF WET or DRY PULVERISERS GRINDING TO ANY DEGREE OF FINENESS OR
GRANULATION as desired. **SUITABLE for** GOLD, SILVER, COPPER or OTHER ORES
Correspondence invited. GRAPHITE, MICA, CEMENTS, PHOSPHATES &c

80,000 IN USE

LIFE and PROPERTY are
ENDANGERED

BY THE USE OF
CHEAP . . .
BOILER APPLIANCES.

... THE **PENBERTHY** STEAM . .
SPECIALTIES



Are SAFE, because . . .

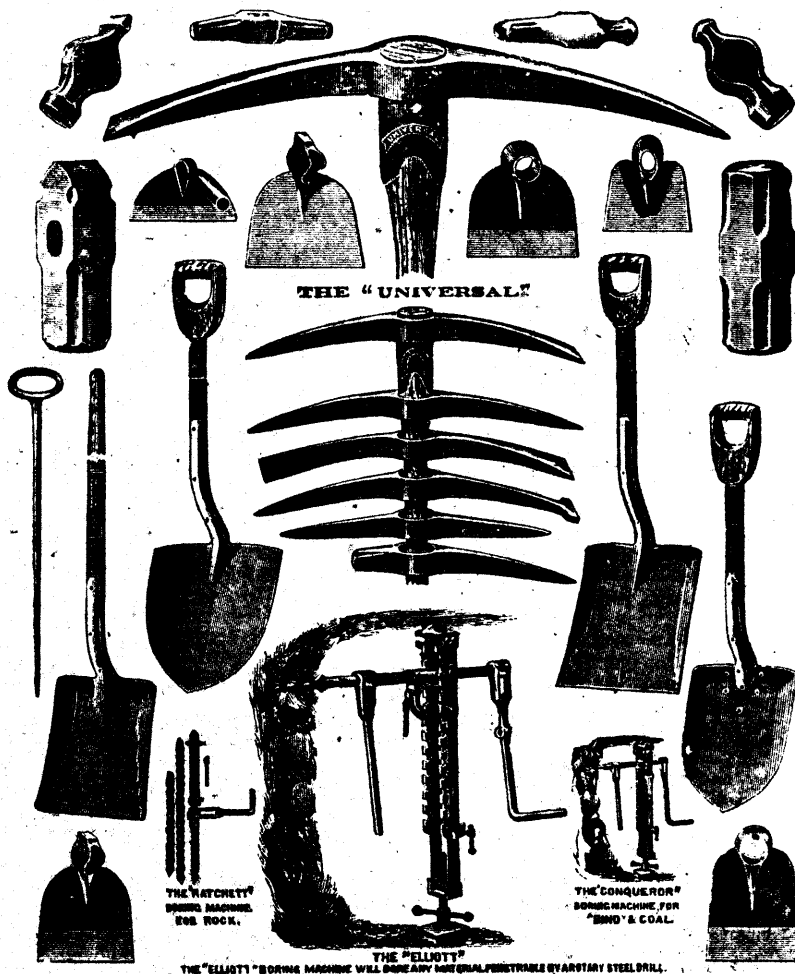
WELL MADE and
THOROUGHLY TESTED

PENBERTHY VALVE DRIP WATER GAGE
XL EJECTOR or JET PUMP
SAFETY CRANK PIN OILER
AUTOMATIC INJECTOR, Etc.

Send for Catalogue **PENBERTHY INJECTOR CO.**

Branch Factory at Windsor, Ontario.

DETROIT, MICHIGAN.



THE "UNIVERSAL"

THE "HATCHETT"
BORING MACHINE,
FOR ROCK.

THE "CONQUEROR"
BORING MACHINE, FOR
"BOND" & COAL.

THE "ELLIOTT" BORING MACHINE WILL BORE ANY SIZE ORAL PISTONS BY VARIOUS STEEL DRILL.

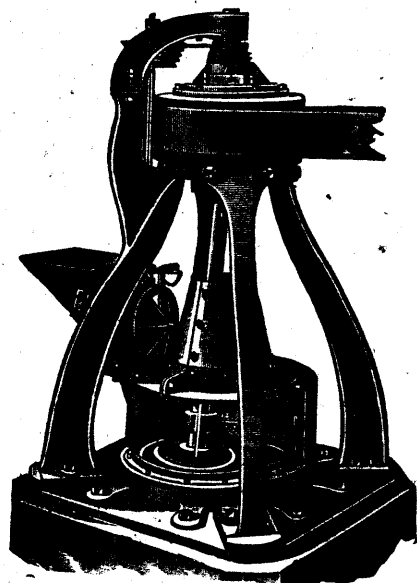
SPECIAL TOUGH MINERS DRILL STEEL.

THE HARDY PATENT PICK CO. Limited
SHEFFIELD, ENGLAND

THE GRIFFIN MILL

The Only Perfect Pulverizer

OF
QUARTZ,
GOLD
OR SILVER
ORES,
PLUMBAGO,
PORTLAND
CEMENT,
PHOSPHATE
ROCK,
FOUNDRY
FACINGS,
And All Other
Refractory
Substances.



Will work either wet or dry, and deliver a finished product. Capacity, 3 to 4 tons per hour on Phosphate Rock, 1½ to 2 tons per hour on Portland Cement, Quartz or Ores, depending on hardness of material to be pulverized and fineness of product. Grinds from 30 to 250 Mesh with equal facility.

NO JOURNALS IN GRINDING CHAMBER. BALL RIGID ON SHAFT HAVING DIRECT POSITIVE ACTION ON MATERIAL. MINIMUM POWER PRODUCES MAXIMUM AMOUNT OF PRODUCT. IT IS ABSOLUTELY GUARANTEED IN EVERY RESPECT, BOTH AS TO CONSTRUCTION AND CAPACITY. FIRST COST, WEAR, AND OPERATING EXPENSE MUCH LESS THAN STAMP MILLS. LA RGE NUMBER OF MILLS IN USE ON DIFFERENT MATERIALS WITH POSITIVE SUCCESS IN EVERY INSTANCE.

Correspondence solicited, and illustrated descriptive pamphlet furnished on application to

BRADLEY PULVERIZER CO., 92 State St., Boston, Mass.

NOVA SCOTIA STEEL AND FORGE CO. LTD.

MANUFACTURERS OF HAMMERED AND ROLLED STEEL FOR MINING PURPOSES.

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

A FULL STOCK OF MILD FLAT, RIVET-ROUND and ANGLE STEELS ALWAYS ON HAND
SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS.

CORRESPONDENCE SOLICITED.

WORKS & OFFICE: NEW GLASGOW, N.S.

AUSTEN BROTHERS.

RAILWAY, COLLIERY AND GOLD MINERS' SUPPLIES.

No. 124 HOLLIS STREET, HALIFAX, N.S.

ALL GOODS AT MANUFACTURERS PRICES.

MACDONALD & CO., LIMITED.

— MANUFACTURERS AND DEALERS IN —

PUMPING MACHINERY, IRON PIPES, FITTINGS, &c., &c.,
FOR MINERS' USE.

Call or Write us for Prices.

HALIFAX, N.S.

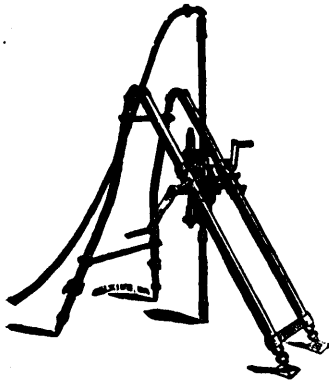
I. MATHESON & CO
ENGINEERS AND BOILER MAKERS
 NEW GLASGOW
 NOVA SCOTIA

ENGINES, *
 BOILERS, *
 QUARTZ CRUSHING *
 MILLS, *
 WINDING GEAR, *
 PUMPING M'CHY *
 STEEL SHOES & DIES. *
 WRITE FOR PRICES.

THE BEST PLACE IN CANADA * FOR *
GOLD MINING MACHINERY

TRURO FOUNDRY & MACHINE CO
GOLD MINING MACHINERY
 Engineers
 BoilerMakers' and Founders
 TRURO N.S.

WITH LATEST IMPROVEMENTS
WINDING ENGINES
 Special Mixture, Shoes & Dies
 With the **BEST RECORD** IN THE WORLD
 Wearing quality unsurpassed
ROTARY SAW MILLS.



"M" Drill—Hand Power.
Capacity—300 ft. depth.
Removes 1 1/4 inches solid core.

DIAMOND DRILLS FOR PROSPECTING MINERAL LANDS.

The Sullivan Diamond Drill is the simplest, most accurate, and most economical prospecting drill for any kind of formation, hard or soft, in deep or shallow holes.

The Diamond Drill brings to the surface a solid core of rock and mineral to any depth, showing with perfect accuracy the nature, quality and extent of the ore-bearing strata, and with great saving in time and expense over any other method.

Complete stock of all sizes, driven by hand or horse power, steam, compressed air or electricity. For sale by

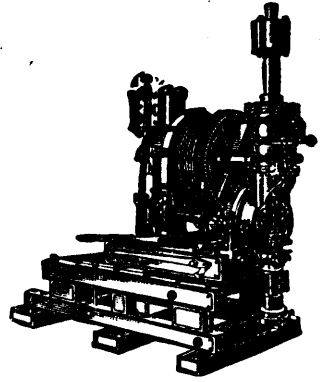
SULLIVAN MACHINERY COMPANY,

Successors to DIAMOND PROSPECTING CO., 54 & 60 N. Clinton St., CHICAGO, ILL., U.S.A.

MANUFACTURERS AND DEALERS IN

Sullivan Diamond Prospecting Drills, Channelling Machines, Rock Drills, Hoists and other Quarrying Machinery.

Hoisting and Hauling Engines, Cages, Tipples, and other Coal Mining Machinery.
Contractors for Prospecting Mineral Lands with the Diamond Drill.



"N" Drill—
Capacity—2,000 ft. depth.
Removes 1 1/2 inches solid core.



SEND FOR CATALOGUE.

ELECTRIC BLASTING

VICTOR ELECTRIC PLATINUM FUSES.

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

"PULL-UP" BLASTING MACHINE.

The strongest and most powerful machine ever made for Electric Blasting. No. 3 fires 30 holes. No. 4 fires 50 holes. No. 5 fires 100 holes. They are especially adapted for submarine blasting, large railroad quarrying, and mining works.

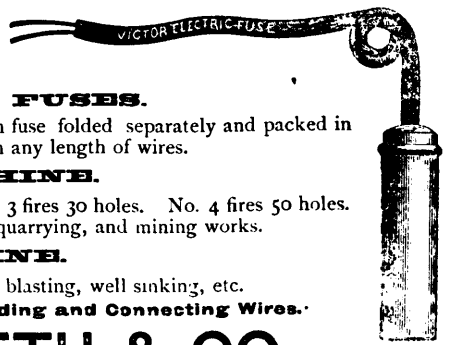
VICTOR BLASTING MACHINE.

No. 1 fires 5 to 8 holes; weighs only 15 lbs. Adapted for prospecting, stump blasting, well sinking, etc. Standard Electric Fuse and Blast Tester, Wire Reels, new design. Loading and Connecting Wires.

Manufactured only by

JAMES MACBETH & CO.,

128 MAIDEN LANE, NEW YORK CITY.



HAMILTON POWDER CO.

Manufacturers of Sporting, Military and Blasting

GUNPOWDER, DUALIN, DYNAMITE and ECLIPSE

Dominion Agents for Safety Fuse, Electric Blasting Apparatus, Etc.

OFFICE: 103 ST. FRANCOIS XAVIER STREET, MONTREAL.

Branch Offices and Magazines at all Chief Distributing Points in Canada.

JEFFREY

Roller Chains, Steel Drag, Steel Cable and Special Chains

FOR

ELEVATING AND CONVEYING MACHINERY

FOR HANDLING MATERIAL OF ALL KINDS

POWER TRANSMISSION MACHINERY.

SHAFTING, PULLEYS, FLYWHEELS, CLUTCHES, BELTS, BOBBS, HOOPS.

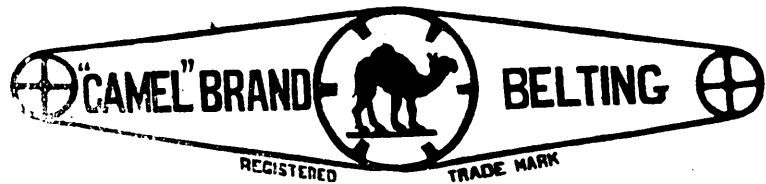
WIRE CABLE CONVEYORS.

For long and short distance conveying.

THE JEFFREY MFG. CO. 163 Washington St. COLUMBUS, OHIO. NEW YORK.

Send for Catalogue.

REDDAWAY'S PATENT



Specially adapted for Heavy Drives in Damp or Exposed Places, in Mines, Saw Mills, Paper and Pulp Mills, etc.

CHEAPER, LIGHTER, MORE PLIABLE & MORE DURABLE THAN DOUBLE LEATHER.

W. A. FLEMING, SOLE AGENT FOR CANADA.

57 St. Francois Xavier St., MONTREAL. - Victoria Chambers, OTTAWA.

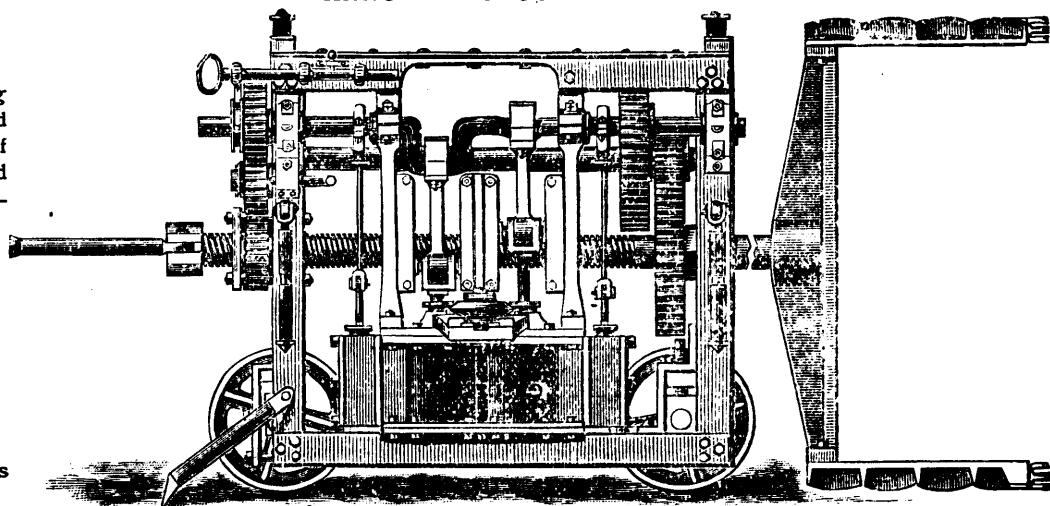
STANLEY'S PATENT COAL-HEADING MACHINE.

ANNULAR GROOVE MACHINE.

A FULL CUT MACHINE

is also supplied, this being specially constructed for rapid driving, and by means of which an average of one yard per hour can be cut in favourable seams.

Saves Money
Saves Time in Heading
Saves Timbering
Produces more large Coal
Ventilates its own Heading
Improves Quality of Work
Facilitates Ventilation
Avoids the use of Explosives



The following is one of the most recent Testimonials received:

"August 27, 1894

"I have three of your Annular Groove Head'g Machines, and I find I can drive at about *three times the rate of hand labour*. As the use of explosives is unnecessary, all the roof remains unshaken, and a *much larger percentage of round coal is obtained*.

"With the Full Cut Machine I cut at the rate of thirty-five yards in six consecutive eight-hour shifts, and when in good ground *seven yards a shift have been cut*."

CATALOGUE, showing various Types of Machines with Prices and full Particulars; also Copies of Testimonials on Application.

STANLEY BROS., Coalowners & Engineers, NUNEATON, ENGLAND

MINING AND MILL MACHINERY.

Steam Engines, Rock Crushers, Boilers, Derricks, Steam Pumps, Water Wheels, Brass and Iron Castings of every description.

ALEX. FLECK, VULCAN IRON WORKS, OTTAWA.

OTTAWA POWDER CO., LIMITED.

ESTABLISHED 1891.

MANUFACTURERS OF DYNAMITE AND TRIOLINE.

Dealers in Safety Fuse, Platinum Fuses, Detonators, and all Blasting Supplies.

PRINCIPAL OFFICE: BUCKINGHAM, QUEBEC.

ALL ORDERS PROMPTLY ATTENDED TO UNDER GUARANTEE OF EXCELLENCE.

CARRIER, LAINÉ & CO.,

FOUNDERS, MACHINISTS AND BOILER MAKERS,
LEVIS, QUE.

Engines, Boilers, Steam Pumps, Hoisting Gear and all Machinery for Miners, Contractors and Quarrymen. Also Builders' Castings, Stoves, Stove Fittings, Hollowware, Flour and Saw Mill Machinery, Marine Engines and Boilers, etc., etc.

WRITE FOR OUR PRICES.

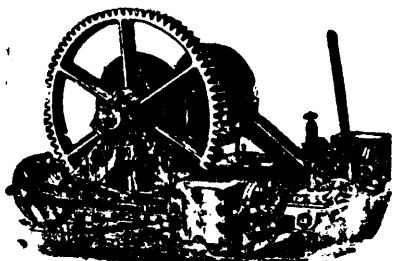
MILLER BROS. & TOMS,

MANUFACTURERS OF

STEAM ROCK DRILLS AND HOISTING ENGINES,

Mining and Contractors' Plant, Etc., Etc.

110-120 KING STREET, MONTREAL, QUE.



SCHOOL OF MINING,

KINGSTON, ONTARIO.

Faculty:

WM. L. GOODWIN, B.Sc. (Lond.) D.Sc. (Edin.) F.R.S.C.

Director and Professor of Chemistry.

WILLIAM NICOL, M.A.,

Professor of Mineralogy, Metallurgy and Assaying.

R. CARR HARRIS, C.E.,

Professor of Engineering.

WILLET G. MILLER, B.A., Lecturer on Geology and Petrography.

WM. HAMILTON MERRITT, M.E., F.G.S., Associate Royal School of Mines, England,

Lecturer on Mining Engineering, The Economic Geology of Ontario, and The Discovery and Winning of Minerals.

WILLIAM MASON, Lecturer on Freehand, Mechanical and Office Drawing, Topography and Surveying.

JOSEPH BAWDEN, Barrister at Law, Lecturer on Mining Law.

T. L. WALKER, M.A., DR. ISAAC WOOD, M.A., Laboratory Demonstrators.

THE SCHOOL PROVIDES THE FOLLOWING COURSES OF STUDY:

1. *A Course of four years leading to the Degree of MINING ENGINEER, (M.E.)*
2. *A Course of three years, for which a Certificate in ANALYTICAL CHEMISTRY and ASSAYING is given.*
3. *A COURSE OF EIGHT WEEKS, (January and February), for Prospectors, Mine Foremen and others interested in Mines and Minerals.*

Lecturers are sent to any mining centre where a sufficient number of students is guaranteed, to conduct **SHORT COURSES** in Blowpipe Analysis, Chemistry, Mineralogy, Geology, Prospecting and Mining.

The different courses are made thoroughly practical by work in the well-equipped Chemical, Assay, Mineralogical and Petrographical Laboratories. A Mining Laboratory, furnished with Mills, Separators, Concentrators, etc., is in course of construction. It will be open for work in Session 1894-5. Surveying is practised in the field during the warmer months of the Session.

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,
SCHOOL OF MINING, - KINGSTON, ONTARIO.

If you want

BAGS

FOR PACKING

ASBESTOS, PHOSPHATES, ORES, &c.,

Send to us for Samples and Prices.

Every Quality and size in stock.

Specially strong sewing for heavy materials.

Lowest prices compatible with good work.

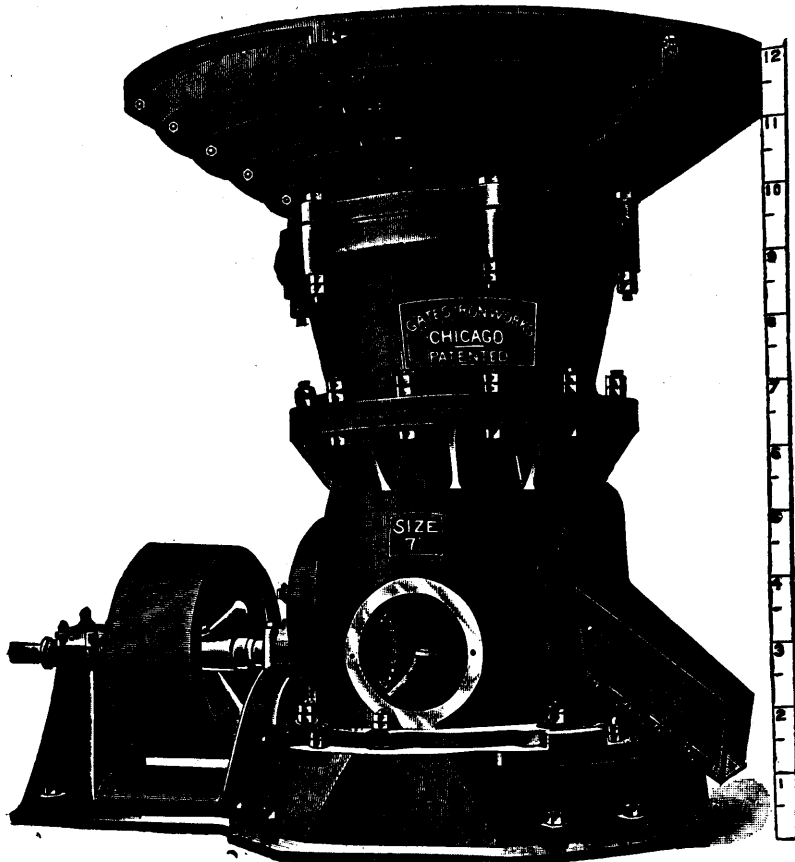
We now supply most of the Mining Companies, and those who have not bought from us would find it to their advantage to do so.

THE CANADA JUTE COMPANY (Ltd.)

17, 19 & 21 ST. MARTIN STREET,

MONTREAL.

The Gates Rock and Ore Breaker.



THE HIGHEST TYPE OF ROCK BREAKING MACHINERY!

The Gates Gyratory Breaker is used on every Continent, having been adopted by the largest Mining Companies in the world. It has supplanted all other forms of breakers.

We manufacture also, STAMP MILLS, CORNISH ROLLS, CONCENTRATORS and all classes of MINING MACHINERY.

Address for Catalogues **GATES IRON WORKS,**
 50 P. South Clinton St.,
 CHICAGO, U.S.A.

BRANCH OFFICES:
 136 Liberty St., New York.
 237 Franklin St., Boston.
 173a Queen Victoria St., London, E

INGERSOLL ROCK DRILL CO. OF CANADA,

St. James Street West, Montreal,

Canadian Manufacturing Agents for Gates' Rock and Ore Breakers

FOR SALE

NEW AND SECOND-HAND

Mining Plant, Machinery, TOOLS, ETC.

The Property of the British Phosphate Co. Ltd.

Glen Almond, Buckingham, Que.

- 1 Bullock Diamond Drill, complete, with bit set with 8 carbons, core lifter, core barrel, 200 ft. coupled drill rods, wire rope, hose, diamond setter's tools, etc. Capable of boring to 1,200 ft.
- 1 80 h.p. Jenckes Multitubular Boiler and Smoke Stack.
- 1 30 h.p. Waterous Engine Co's Multitubular Boiler.
- 1 Worthington Duplex Steam Pump, 5¼ in. x 3½ in. x 5 in.
- 1 do do do 4½ in. x 2¾ in. x 4 in.
- 1 Ingersoll Steam Hoist.
- 1 Inclined Shaft Pit Head Framing, complete, with guides 150 ft. long, large diameter sheaves, side stopping levers, safety catches, two cages to carry mine dumping cars, flexible steel winding rope ¾ in., etc., etc.
- 1 Set Double Beam Wharf Weighing Scales, 230 x 43, 5 ft. x 6 ft., weighing up to four tons.
- 1 Set Wharf Hopper Scales, weighing up to 3,600 lbs.
- 1 Hardwicke Steam Pump.
- 1 Ingersoll Air Compressor, 12 in. x 18 in.
- 1 Compressed Air Receiver, 12 ft. x 1 ft. 6 in.
- 1 Pile Driver and Fittings complete, (monkey 1,600 lbs weight.
- 3 3 in. Seargeant Drills and Tripods.
- 1 2½ inch Eclipse Drill and Tripod.
- 1 Tunnel Column for ditto.
- 1 No. 4 Sturtevant Blower.
- 1 No. 00 do do
- 1 Machine Lathe and Tools, complete.
- 1 12 h.p. Horizontal Engine, by Low, of Ottawa.
- 1 Steam Rotary Hoisting Engine, Drum, Brake and Wire Rope.
- 1 No. 5 Cameron Sinking Pump.
- 40 Side-dumping Mine Cars and Carriages, 12 in. gauge, constructed of hardwood and iron.

As well as sundry other machinery and plant.

- 4000 lbs. Drill Steel, 1 in., 1½ in., 1¼ in.
- 1600ft. Iron Track Rails, 25 lbs to the yard.
- 10¾ Karats of Carbons for diamond drill, unused.
- 2900ft. ¾ in. Wire Rope, new.
- 3700 lbs. Iron, (new) round, square, and flat, assorted sizes.

3 Electric Blasting Batteries.

Also a large quantity of wrought iron piping, 4 in., 3 in., 2 in., 1½ in., 1¼ in., 1 in., pipe fittings, steam hose—miners' tools, fire bricks, building bricks, blacksmith's coal, several end-dumping cars, car wheels and axles, rope sheaves, derrick masts, booms, etc., explosives, screens, machine steel, wire ropes, stoves, etc., etc.

The whole of the above in good condition and working order, conveniently situated at the wharf of the British Phosphate Co. Ltd., on the River du Lievre, nine miles from Buckingham, Que.

Inspection invited and further information forwarded upon application to

J. B. SMITH, Manager,

British Phosphate Co. Ltd.

Glen Almond, Buckingham, Que.

STAMPS!

PRITCHARD & ANDREWS,
173 & 175 SPARKS STREET.

GENERAL ENGRAVERS,
Rubber Stamp Manufacturers,
SCALE MAKERS AND BRASS WORKERS.

Brands, Steel Stamps, Time Checks
and Tags.
Stencils and Ink, Scales and
Weights.

RUBBER STAMPS FOR OFFICE WORK.

CANADA ATLANTIC RAILWAY.

THE SHORT FAVORITE ROUTE
BETWEEN

Ottawa and Montreal

6 TRAINS DAILY 6
EXCEPT SUNDAY.

PULLMAN BUFFET PARLOR CARS.

Close Connections at MONTREAL with Trains for
QUEBEC, - HALIFAX, - PORTLAND
And all Points EAST and SOUTH.

FAST THROUGH SERVICE BETWEEN
OTTAWA, NEW YORK and BOSTON,
And all NEW ENGLAND POINTS.

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

E. J. CHAMBERLIN, General Manager.
C. J. SMITH, Gen. Passenger Agt

BALBACH
SMELTING & REFINING
COMPANY,

EDWARD BALBACH, JR., - PRES'T.
J. LANCELOTH, - - VICE-PRES'T.
Newark, New Jersey.

Smelters and Refiners of
Gold, Silver, Lead, and
Copper Ores.

Bullion and Argentiferous Copper
Matte Received on Consign-
ment or Purchase.

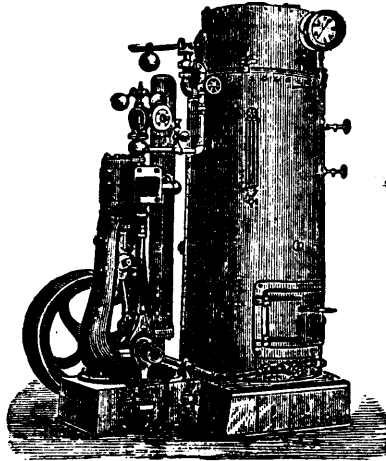
Smelting and Refining Works:
Electrolytic Copper Works:

NEWARK, N. J.

Enena Fe Sampling Works:
Agency, **SABINAS COAHULLA,**
Mexico.

BERTRAM ENGINE WORKS CO.

Successors to Doty Engine Works Co., and
John Doty Engine Co., Ltd.

MANUFACTURERS OF
MINING MACHINERY

Marine and Stationary Engines and
Boilers.

Hoisting and Vertical Engines.

Ore Crushers.

Stamp Mills and

General Machinery.

We Guarantee First-Class Work and
Prompt Shipment.

Prices and Estimates on Application

BERTRAM ENGINE WORKS CO.

Bathurst and Niagara Sts.,

TORONTO, CANADA.

BUTTERFIELD'S HINGED PIPE VISE

MADE IN TWO SIZES.

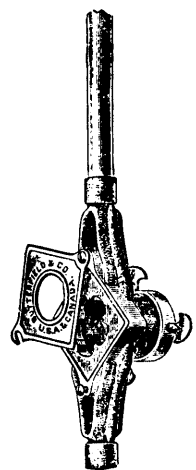
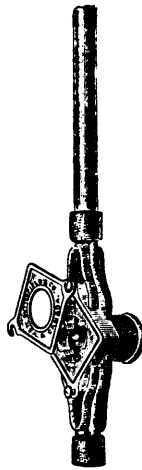
No. 1 Holds from 0 to 2½ inch pipe.

No. 2 Holds from ½ to 4½ inch pipe.

SIMPLEST AND BEST
IN THE MARKET : :

Butterfield & Co. are makers of all Tools for
working Water, Gas and Steam Pipe,
Stocks and Dies and all
kinds of Taps.

—MANUFACTURED BY—



BUTTERFIELD & CO., ROCK ISLAND, P.Q.

WIRE ROPES

Crucible Cast Steel Ropes
for Hoisting, Inclines,
Mining, &c.

WIRE ROPE

Seimans-Martin for Trans-
mission of Power, Ele-
vators, Hoists, &c.

Galvanized Ropes for Derrick Stays, Ships' Rigging, &c.

WRITE FOR CATALOGUE AND PRICES.

MANUFACTURED BY THE

B. GREENING WIRE Co., LTD

HAMILTON, CANADA.

John E. Hardman, S.B.

MINING ENGINEER,
Oldham, Nova Scotia.

Can be consulted on all matters pertaining to the profession.
The development and management of Gold Properties a specialty.

TO USERS OF THE DIAMOND DRILL.

Diamond Drill Bits set Promptly by an Efficient Man All Work Guaranteed.

Bort and Carbon Diamonds for sale. Same terms as New York. Prospecting with American Diamond Drill at per foot or by the day.

McRae & Co.,
OTTAWA.

**CROSBY
STEAM . ENGINE . INDICATORS**

Catalogues supplied which comprise other trustworthy instruments for the Control, Regulation and Economy of Steam.

AGENCY: 751 CRAIG STREET, MONTREAL, QUE
J. & H. TAYLOR.

**SPECIALISTS IN MICA,
MINERS' AGENTS,
RICHARD BAKER SON & CO.**
6 & 7 CROSS LANE, LONDON, ENG.

R. C. CAMPBELL-JOHNSTON

(of Swansea, India, and the United States.)

**METALLURGIST, ASSAYER,
AND MINING ENGINEER.**

Properties reported on. All assays undertaken. Furnaces and concentrating plants planned and erected. Treatment for ores given. Ores bought and sold. Box 40, Vancouver, B.C.

**T. D. LEDYARD,
DEALER IN MINES, &c.**

57 COLBORNE STREET, TORONTO.

Specialties:

BESSEMER IRON ORES PARTICULARLY LOW IN PHOSPHORUS
ASBESTOS.

**F. CIRKEL,
MINING : ENGINEER.**

(Graduate, Academy of Mines, Aachen, Germany.)

Reports on Mica Deposits, Asbestos, Phosphate

78 QUEEN STREET,
OTTAWA.

**E. E. BURLINGAME'S
ASSAY OFFICE^A CHEMICAL
AND LABORATORY**

Established in Colorado, 1886. Samples by mail or express will receive prompt and careful attention.
Gold & Silver Bullion Refined, Melted and Assayed, or Purchased.
Address, 1736 & 1738 Lawrence St., Denver, Colo.

J. LAINSON WILLS, F. C. S.

MEMBER INSTITUTION MINING AND METALLURGY
LONDON, ENGLAND.

12 Old Slip, New York.

INVESTIGATION OF MINING PROPERTIES
ANALYSES, ASSAYS, &c.

C. V. M. TEMPLE

(Formerly President Megantic Mining Co., P.Q.)

MINES AND MINING LOCATIONS FOR SALE.

CORRESPONDENCE SOLICITED.

Office and Residence:

47 ST. GEORGE ST., TORONTO, ONT.

CANADIAN REPRESENTATIVE:

HENRY DE Q. SEWELL, Dominion and Ontario Land Surveyor,
Mining Engineer, etc., Port Arthur, Ont., A. M. Inst. C.E.

LONDON REPRESENTATIVES:

LANE GAGGE & ANDREWS, Solicitors, Arundel St. Strand, London.

R. C. CAMPBELL-JOHNSTON, (of Swansea, India and the States), Metallurgist, Mining Engineer, Vancouver, B.C.

Crabb's Patent Clip

FOR

Endless Rope Haulage

The latest and most efficient Clip in the market; does not damage the rope; cheap, simple and substantial in construction, and certain in action on rising and falling gradients; automatically attaching and detaching itself at Crosses, Junctions, and Terminals; drags the tub or wagon on the centre line; requires no adjusting, it being always in position to receive the rope; can be adapted either to the top, bottom or side of the tub. A sample one forwarded for one month's trial, purchase or return, to any Colliery in the United Kingdom, carriage paid. Further particulars and testimonials may be had on application to

G. H. CRABB,

Bunker Hill, Fence Houses,

DURHAM, ENG.

LEDOUX & COMPANY,

9 Cliff St., New York.

**Engineers, Metallurgists &
Assayers.**

Public Ore Sampling and Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or Copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highest bidder. Send for circular giving full particulars

Mines examined and sampled. Assays and Analyses of all kinds.

WYATT & SAARBACH,

Consulting, Analytical and Technical Chemists

12 OLD SLIP, NEW YORK.

(Near Hanover Square.)

W. de L. BENEDICT, E.M.,

Mem. Am. Inst. Min. Eng.

Mining Engineer and Metallurgist,

REPORTS ON MINES AND MINERAL LANDS.

PHOSPHATE A SPECIALTY.

No. 18 Broadway, Rooms 617 & 618,
New York.

EBENE. OLCOTT,

Consulting Mining Engineer & Metallurgist.

18 Broadway, New York City.

Cable Address: - - - "Kramolena."

Mines examined and reported on. Will act as permanent or special advising engineer of mining companies.
Special facilities for making working tests on ores

WM. HAMILTON MERRITT, F.G.S.

Associate Royal School of Mines, &c.,

MINING ENGINEER and METALLURGIST,

Will report on Mines and Mineral Properties.

ADDRESS:

15 Toronto St., Toronto, Ont.

F. H. MASON, F.C.S.

First-class Certificates in Chemistry and Metallurgy from the Royal School of Mines, London—Late Chemist and Assayer to the Newbery-Vautin (Patents) Gold Extraction Company, Limited.

Assays & Complete Analyses of all Minerals

**THE ASSAY OFFICE,
ARLINGTON PLACE, - TRURO, N.S.**

Irwin, Hopper & Co.,

MINERS AND SHIPPERS OF
MINERALS.

BOARD OF TRADE BUILDING,
MONTREAL, CAN.

Asbestos, crude and manufactured. Phosphate, Mica,
Plumbago, Soapstone, &c.

MICHIGAN MINING SCHOOL

A State School of Mining Engineering, located in the heart of the Lake Superior mining region, giving practical instruction in Drawing, Blue-printing, Mechanics, Mechanism, Properties of Materials, Graphical Statics, Mechanical and Electrical Engineering, Shop-practice, Analytical and Technical Chemistry, Assaying, Ore Dressing, Metallurgy, Plane, Railroad and Mine Surveying, Hydraulics, Mining, Mineralogy, Petrography, General, Economic, and Field Geology, etc. Has Summer Schools in Surveying, Shop-practice, and Field Geology. Laboratories, Shops and Stamp Mill well equipped. Tuition free. For Catalogues apply to the Director Houghton, Mich.

ROBIN & SADLER
MANUFACTURERS OF
Leather Belting
SPECIALTIES
DYNAMO BELTS
WATERPROOF BELTING
MONTREAL TORONTO
2518 & 2520 NOTRE DAME ST 129 BAY ST.

BOOKS OF INTEREST

TO

Engineers, Mechanics, Etc.

Mathematical Instruments,
Squares, Scales, Compasses,
and a full line of
Engineers' Drawing Supplies.

**W. DRYSDALE & CO.,
BOOKSELLERS AND STATIONERS.**
237 St. James St., Montreal.

**ORFORD COPPER CO.,
Copper Smelters**

Works at Constable's Hook, N.J., opposite New Brighton, Staten Island. Copper Ore, Mattes, or Bullion purchased. Advances made on consignments for refining and sale. Specialty made of Silver-bearing Ores and Mattes.

—SELL—

INGOT AND CAKE COPPER.

President, **ROBERT M. THOMPSON,**
Treasurer **G. A. LAND.**
Office 37 to 39 Wall Street, New York.

H. H. FULLER AND CO.

41-45 UPPER WATER STREET, HALIFAX, N.S.

WHOLESALE AND RETAIL DEALERS IN

BUILDERS', BLACKSMITHS' and GENERAL HARDWARE.

MINING AND MINE SUPPLIES A SPECIALTY.

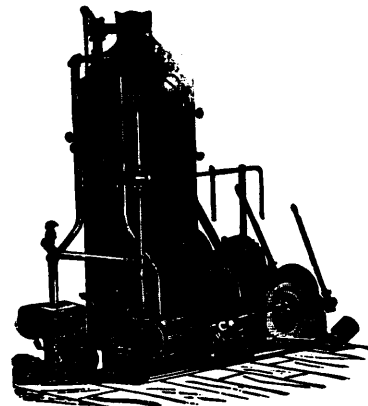
SOLE AGENTS FOR NOVA SCOTIA FOR

**BOSTON BELTING CO'S RUBBER GOODS,
REEVES WOOD SPLIT PULLEYS.**

CORRESPONDENCE SOLICITED.

P. O. Box 178. Shipments promptly and carefully attended to.

M. BEATTY & SONS, WELLAND, ONT.



HOISTING
ENGINES.
—
ENGINES
FOR
Mines
AND
Inclines.

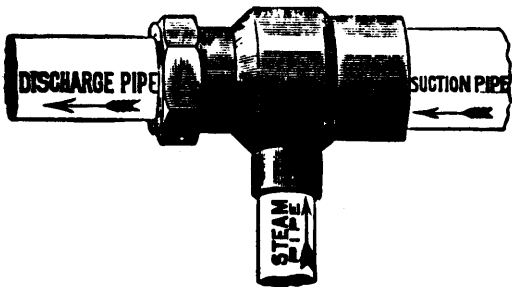
Horse-Power Hoisters,
Stone Derrick Iron,
Centrifugal Pumps,



DREDGES, DERRICKS, STEAM SHOVELS,
SUSPENSION, CABLEWAYS,

AND OTHER CONTRACTORS PLANT.

J. G. STEWART, MONTREAL.



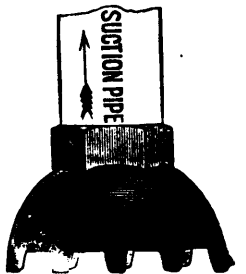
VAN DUZEN'S STEAM JET PUMP.

From 5 to 40 Dollars Each.

SAVES YOU BUYING A \$500.00 PUMP.

For the following uses:
For pumping cold water, liquids other than water, and air and vacuum pump. For paper mills, chemical, gas and sugar works, tanneries, mines, quarries, irrigating, draining, etc.

Send for Catalogue and Price List. **GARTH & CO., MONTREAL.**



Pumps & HYDRAULIC MACHINERY

FOR MINING, ALL CLASSES

**NORTHEY, LD.
TORONTO**

THE MINING REVIEW

Canadian
Established 1882

Official Organ of The Mining Society of Nova Scotia; The General Mining Association of the Province of Quebec; The Asbestos Club; and the Representative Exponent of the Mineral Industries of Canada.

B. T. A. BELL, Editor.

Published Monthly.

OFFICES: Victoria Chambers, Ottawa.

VOL. XIII., No. 12

DECEMBER, 1894.

VOL. XIII., No. 12

The Broad Cove Coal Co.

After no inconsiderable difficulty, the result apparently of the care and discretion exercised in its distribution, we have been fortunate enough to obtain a perusal of the prospectus of this company issued from its head office, 70 Kilby St., Boston, Mass. Through the medium of this neat and nicely gotten up little pamphlet, Mr. Wm. Penn Hussey and his friends seek to induce the investing public to subscribe a small matter of \$600,000, divided in equal proportions into 6% 1st mortgage bonds, preferred cumulative stock and common stock, in a coal area situated in Inverness County, Cape Breton Island. The pamphlet opens with a portrait of the great Mr. Hussey himself, the promoter in chief of the enterprise. Mr. Hussey, who is described as a coal merchant of Davensport, Mass., might be unknown to 999 out of every 1,000 investors, and it was, therefore, very thoughtful of him to adopt this way of making his features familiar to those to whom he offers such an unrivalled chance of getting rapidly rich. He would be the more readily recognized by residents in the vicinity of Broad Cove had he carelessly fingered in his hand, while being photographed, one or two of those \$1,000 bills with which he sought to dazzle the simple country folk of Inverness during recent visits to their midst. Following his picture comes a map of North America, shewing the position of the company's mine and harbor, with steamship lines radiating from the latter to the principal ports of Canada and the United States. A study of this map, by people unacquainted with this part of the world, is calculated to leave the no doubt desired impression that, as a shipping point Broad Cove is easily first, with Sydney and other shipping ports in Cape Breton, simply nowhere. For instance, the distance from Broad Cove to Montreal is shewn by this map to be less than the distance from Sydney to Broad Cove! Ergo, what an overpowering advantage will Mr. Hussey's company possess over other mines, in supplying the principal market in Canada. The distance from Sydney to Broad Cove is represented by about eight hours steaming. From Broad Cove to Montreal, according to the Hussey map, it must be, say, seven hours steaming. It can thus at once be seen that Mr. Hussey's steamers can easily make at least two round trips per week as against one round trip in nine or ten days, which is the best that can be done at present from Sydney. Surely Mr. Hussey has made his estimate of cost of carriage to Montreal, \$50. per ton unnecessarily high.

Incidentally we may point out that the company's property (which consists, we understand, of 2 square miles) is painted in black on a pink ground and is made to dwarf into insignificance by comparison the whole adjacent island of Prince Edward! Fronting this remarkable map is an equally remarkable picture of Broad Cove Coal Mines and Harbor. By any one acquainted with the locality and with the piece of water, separated from the ocean by a strip of sand, and known as McIsaac's Lake, the rich humor of this picture of thriving industry will be readily appreciated, shewing as it does a steam tug towing two whaleback barges out of a snug harbor, upon whose sheltered waters lie

other tugs and barges, with a few square-rigged sailing vessels scattered about.

Coming to the letter-press, our attention is at once arrested by the opening paragraph which pompously gives out that "The Queen of England has leased this property to the Broad Cove Coal Company, Limited, for a period of 80 years, with privilege of renewal, with a "royalty of ten cents per ton." Why! what has Mr. Fielding been up to again? This puts the lease of the Whitney Syndicate, for granting which he got such particular fits from his political opponents, altogether into the shade! It is true Mr. Whitney got a 99 years lease, as against Mr. Hussey's 80 years, but on the other hand, Mr. Hussey has privilege of renewal (for another 80 years?) and only pays 10 cents per ton as against 12½ cents paid by Mr. Whitney—verily, a greater than Whitney is here!

Perhaps, after all, it is unjust to lay upon Mr. Fieldings' shoulders the blame for this second shameful bartering away of the province's mineral wealth. Mr. Hussey has been to England, presumably upon business connected with this company, and while there, is it not conceivable that he obtained this concession directly from Her Gracious Majesty—perhaps letting her in "on the ground floor" as a quid pro quo? We really should like to know how Mr. Hussey came by this lease.

The quantity of coal possessed by the company is briefly given as over one hundred million tons. This is rather a large quantity for two square miles but then, we are told, they have 65 feet 10 inches of splendid coal (with or without interlying strata not mentioned) and, when further on, we learn that this coal can be mined for, at the outside, 50 cents per ton and freighted to any port in Canada you like for another 50c., it can at once be seen that here is a gilt-edged chance of knocking the Dominion Coal Company into smithereens and making millionaires in next to no time of Mr. Hussey and of any one who is lucky enough to have stock in the company allotted to him.

Then follow testimonials and reports from persons more or less competent to be quoted as authorities. The testimony here given is very favorable and we seek not to detract from the value thereof, merely remarking that every other company that has done business in the island, has possessed a small stock of equally favorable certificates among its archives. A collection of testimonials such as is here presented is rather calculated to produce "that tired feeling" to which allusion is made so frequently in a certain class of current literature. By the way, Mr. Hussey cleverly steals some thunder from the Dominion Coal Co. by quoting Mr. Revere, who is described as "the expert of the Whitney Syndicate" as responsible for the statement that "by the use of electric or compressed air-cutters coal can be mined "and shipped f. o. b. for less than fifty cents per ton." This brief dictum, of which we should imagine unauthorized use is made, is perhaps more valuable than a lengthy one from Mr. Wm. H. Wiswell, a "gentleman of high social and financial standing who was, we believe, one of the vendors of the property to whose opinion in that capacity and as County and City Treasurer of Halifax" is hardly worth the space accorded to it.

Leaving unnoticed, but for a smile in passing, the confident statement that Broad Cove coal can be placed alongside Boston at \$1.88 per ton duty paid, as also the prospect held out to consumers of bituminous coal in New England of a saving to them, to be effected by the beneficent operations of this company, of no less a sum than \$11,250,000 per annum, we finally come to what is perhaps the "bonne bouche" of this delectable prospectus, viz., the "estimated profit." The page devoted to the working out of these is calculated to rouse enthusiasm, even in the breast of Her Gracious Majesty, if, as we have already surmised, she has really been let in on the ground floor by Mr. Hussey. The receipts are based on an estimated shipment of 300,000 tons per annum, to be delivered at points left to the imagination (which at this stage should be equal to almost anything) at \$3.60 per ton—not a cent less. Good business! Then follow the disbursements to be deducted. Mining and shipping are placed at 50 cents per ton, royalty, thanks to the special dicker with Her Gracious Majesty, only 10 cents per ton, freightage all round 50 cents per ton, (the method by which this average is arrived at is one of the most ingenious and at the same time most charmingly simple processes we have met with in our experience to date). Commissions, insurance, wear and tear, salaries and &c., are all rigorously deducted. \$125,000 is laid by as a sinking fund for redeeming bonds, 6 per cent. is paid on \$800,000 of bonds, 8 per cent. on \$1,100,000 of preferred stock, no less than 30 per cent. on \$1,100,000 of common stock, and yet, behold! a surplus of \$81,000 yet remains as "undivided profits."—Ye Gods! was the like ever seen or heard? And this, Mr. Hussey is careful to point out, is regarded as "a conservative estimate" and he adds "this output can be easily doubled the second year"!

From the tenor of our foregoing remarks in notice of the Broad Cove Coal Company, our readers may have concluded that we don't "take much stock" in it. Well, honestly, whatever opinion we may have of their property (and we want it to be distinctly understood that we do not seek to impugn for a moment the value of their coal area, either as regards the quantity or quality of coal therein) we have a very poor opinion of their prospectus. From a great deal of silly bombast and fudge, some reliable truths can doubtless be picked, but the whole thing is an aggravation in style, so to speak, of Mr. Hussey's favorite habit of flourishing \$500 and \$1000 bills in the faces of the farmers of Inverness County—presumably as evidence of his limitless wealth. Both are very bad form. While we desire to encourage to the utmost legitimate enterprise in mining by whomsoever it may be started, we feel it our duty to raise our voice in protest against the use of any illegitimate means that may be taken to induce investors to embark their money in mining ventures, and we certainly think we are justified in using the term illegitimate in respect to this prospectus, which plays battledore and shuttlecock with millions, and which teems with reckless and misleading statements. When the Broad Cove Coal Company withdraws or modifies its Hussey pamphlet, we shall be glad to say and do all we can in favor of an enterprise which, with proper handling, deserves and no doubt will command success.

The Coal Trade of Cumberland and Pictou Counties, N.S.

The record of the work done during the year 1894 shows that the business depression was more severely felt in these counties than in Cape Breton. The expansion, however, in the case of the latter county in the Montreal market being largely due to lower freights and improved terminal facilities. The sales of the companies during the past season were about as follows:—

Acadia Coal Co	205,000 tons.
Intercolonial Coal Co.	212,000 "
Canada Coals and Railway Co.	90,000 "
Cumberland Railway and Coal Co.	410,000 "
Other mines	500 "
Total	917,500 "

The sales of Pictou and Cumberland mines for the year 1893. were:—

Nova Scotia	433,856 tons.
New Brunswick	204,932 "
Prince Edward Island	40,443 "
Quebec	238,507 "
United States	9,297 "
Total	927,035 "

The trade of these counties has been marked by no new features of special interest. The depression in iron-making and the general quietness in manufacturing lowered the demand for coal, but advantage was taken of the labor troubles in the United States to increase the shipments of coal in that direction.

The Intercolonial Coal Company sent 69,151 tons to Montreal, a slight decrease over the preceding year. The shipments of coal from the Springhill mines to the United States *via* Parrsboro amounted to about 40,000 tons, compared with about 8,000 tons during 1893. A few thousand tons were also shipped from Pictou to United States ports. Sales to other points present few features of interest.

The sales to New Brunswick and local sales felt the general lessened demand for coal for railway freight movements. St. John, Prince Edward Island, and all points purchasing Cumberland and Pictou coals were subjected to a competition on the part of the Dominion Coal Co. of a keener nature than was the case with the former Cape Breton collieries. This, while a disadvantage to the competing mines on account of reduced profits, correspondingly pleased the consumer. From the standpoint of a disinterested observer, competition between several companies for a market naturally secured against outsiders appears to be a most unbusinesslike proceeding. The fair price for a coal at any given point is readily deducible from the cost f. o. b., freight charges, and a reasonable profit. In a market taking, for instance, 100,000 tons a year any competing companies could readily agree upon a proportionate delivery at an agreed price, which would yield a reasonable profit and still supply consumers with a fuel at a rational price. However, the cheapening of freights will tell against the sales of Pictou coal in Halifax, and of Cumberland coal in St. John, unless the Intercolonial Railway can be induced to lower its present rates, which are excessive, between Pictou and Halifax, and capable of reduction between Springhill and St. John.

At the Acadia colliery the work of extracting the coal on the 3,000 feet lift was carried toward completion. The levels from the 4,000 feet landing are well advanced. It is proposed to raise the coal from the 4,000 to the 3,000 feet lift by means of a hoisting engine placed on the latter lift driven by compressed air. During the month of November the bank head took fire and was totally consumed, putting an end to hoisting coal for several months. The belt screen erected at the Foord pit some time ago will be utilized in the new bank head.

Thorburn.—Work at the Vale colliery has been dull during the year, and no points of interest are to be recorded.

In the Third seam work has been vigorously carried on and several connections have been made with the Cage Pit seam, and two tunnels are driving to the Main seam. The coal from all these seams will find an outlet at the Third seam slopes.

McGregor Pit.—In this mine the lift is now down 3,000 feet, and the workings placed in excellent condition. As a large amount of gas is given off in the new lift no explosives are used.

Intercolonial Colliery.—In the Main seam the operations of the year have been confined principally to the 3,600 feet lift. On the 4,000 feet lift levels have been driven preparatory to regular work. Arrangements have been made to re-open No. 4 slope, which commands a large area of coal in the eastern part of the area. It is expected that the coal within reach of this slope and the available pillars will serve to fill their orders for several years without calling upon the deep workings now being opened.

At the Scott pit, which it will be remembered was damaged by lightning igniting gas in it while it was standing idle last summer, repairs have been made, and work will be done in the way of development during the winter.

A little work was done on the East River Pottery seam during the spring.

In Cumberland County the Springhill mines maintained their output. The management have had the gratification of finding that their barge towage system has worked well during the winter between Parrsboro and St John, and has shown that Parrsboro is practically available as a winter shipment port.

In Nos 1 and 2 slopes the extraction of the pillars in the upper lifts has been carried almost to a finish, and before long the extraction of coal in these slopes will be carried on in a systematic manner. This desirable condition of affairs has been kept steadily in view for some time past, and its attainment will doubtless be felt in a reduction of haulage expenses, etc. In the north slope work has been regularly continued and a large amount of coal won. Improvements have been made in the airways, slopes, roads, etc., of all the mines, and everything possible done to meet the difficulties imposed by the angle of the seam, the pressure, etc.

At the Chignecto, Scotia, Maccan, and Minudie collieries a little work has been done, and a few hundred tons of coal mined. The Chignecto and Minudie mines will raise coal for local sales during the present winter.

Joggins Mines.—At this colliery the water has been removed from No. 1 slope in order to work the coal, which is said to improve to the westward. At No. 2 slope a return has been made again to the system of longwall. Some work has been done at No. 3 slope. New boilers and a new winding engine have been added to the plant. Improvements have been made which will facilitate the handling of the coal at the pit heads, and the wharf has been raised ten feet so that vessels can load at all stages of the tide. The improvement effected at this mine will enable it to materially increase its output during the coming season.

Coal Dust an Explosive Agent.

In a recent work by Donald M. D. Stuart, M.E., of Bristol, England, is given a minute description of the Camerton Colliery in the district of Radstock, seven miles from Bath, and of an explosion that occurred there in November 1893. A special interest to coal miners generally centres in the latter for the district has been worked for 100 years, always with open lights, never found to give off inflammable gas, and explosions were unknown.

The exceptional conditions that led to the disaster are detailed, the roof of the main airway and hauling road had settled and was being brushed for height. A shot that was lightly stemmed in the stone, blew out, or as the miner expressively says "gunned" in the direction of a pile of dust on the roadside, and doubtless, as supposed by the author, caused a thick cloud of dust to rise, which the heat of the burning gunpowder flashed into flame. The resultant gases from the burnt dust expanded in both directions from the shot hole and in their course developed centres of maximum violence which revived and further extended the initial explosion. These centres the author styles as separate explosions and he explains them in a novel manner that commends the book to students of the subject. The explosion was propagated 279 yards with the air current, and 1278 yards against it, terminating when the ground was wet and damp.

In addition to a description of the pit and the explosion, the author gives extracts from the report of the Royal Commission, and refers to the writings of previous investigators; but this portion of his book is somewhat disappointing, although he expresses a hope that the observations and views his volume embodies will be found to contribute to a

thorough (*sic*) understanding of the danger arising from coal dust in the working of a mine.

In the introduction it is stated the records of mining show that explosions cause greater destruction of life and property than any other class of accident; now Blue Books make it clear that the average loss of life by "falls of roof and sides" alone in British coal mines far exceeds the loss by explosions. In many years it has more than doubled. Issue has also to be taken with the statement in the preface that the Camerton explosion was the first in a non-gaseous mine, and again in the conclusion that "it is the only one which recorded observation has shown must have been due to the coal dust." Putting aside English explosions which have occurred in intake airways where not a trace of inflammable gas had been seen either before or after the explosion, there is the case of Pocahontas in Western Virginia, 1884, and the explosion in the Ritchie Grahamite mine fully described and discussed in our last issue (p. 229). Both as absolutely free of gas as Camerton. In fact it might be questioned, from all the proof supplied, whether Camerton is totally free. It is a new pit, rapidly opened at some depth, through faulted ground, shut in by latter geological systems and might well contain pockets of gas. The very general immunity of the district with a consequent want of practice in the detection of gas would unfit the miners to readily detect exceptional exudation of the absence of gas. A proof is offered, but it is not satisfactory, it is the position of the unfortunate victims on the intake side of the shot. Their open lights would furnish proof merely of the absence of more than five per cent. of gas. A careful series of tests, say by Shaw's machine, which our readers will remember detects one-tenth of a per cent., would be of course conclusive.

Exception is taken (page XVIII) to a dust explosion being considered analogous to an explosion of gunpowder in a very long cannon, and questions and answers touching this analogy are quoted from the Commissioner's Report, but it is evident the drift of the comparison has been missed by the author. The object of the artillery being to avoid imparting to his explosive a detonating wave, but to find a powder that will take an appreciable length of time to explode grain by grain proportionate to the length of the cannon, and so impart a progressive impulse to the projectile.

Reference is also made (page XX) to dry dust taking fire in an intake airway without exploding as proof of the absence of danger. Illuminating gas issuing from a burner is lit time after time with perfect safety, because it is pure, but intimately mix it with air, an explosion follows. So with the dust, concentrated it burns but when disseminated in air in due proportions it explodes. The probability is that all other allied organic substances, when very fine and very dry will do the same. There is no mystery about it, given only the necessary conditions and an explosion will follow. There is this, however, it is not often that all the necessary conditions exist in a coal mine, and only in comparatively recent years has it been recognized that the required concatenation of circumstances may occasionally arise.

To avoid these exceptional occasions watering the coal dust has been proposed and the author very properly remarks that to make this precaution sure, the process must be effectively done; to simply dampen the dust and the danger would remain. It was evidently so at Spring Hill, Nova Scotia, where water was used but not in sufficient quantity to prevent the vaporisation of the water and the disturbance of the dust. We in Canada are deeply interested in this question for there is no doubt but that the primary explosions of gas in the Wellington, Spring Hill, Foord, Drummond and Sydney mines, would have proved comparatively harmless had dust not aggravated them.

How to avoid the danger due to dust is still a question, it is useless to talk of wetting thoroughly or removing the dust throughout a pit, all attempts at doing either are shams. The dust may be wetted thoroughly of course about each shot hole, but will it always be done? Probably not, and therefore it will be more efficacious to avoid the use of an ex-

plosion that supplies one of the conditions necessary to produce disaster from this cause. Gunpowder of all explosives used is the most to be dreaded, for not only does it generate a high temperature, but its so-called explosion is not a detonation with instantaneous decomposition, it is only a very rapid inflammation. Not so rapid either but that when a blown out shot occurs there are projected many unburnt grains mingled with the heated gases and dust of those that are first consumed and it is probably these unburnt grains that then igniting carry the inflammation into the mixture of dust and air aroused by the violence of the primary explosion in the unruptured shot hole, and so the inflammation is communicated to the dust so long as it is both dry and finely comminuted.

The Cape Breton Coal Trade, 1894.

The shipping season in Cape Breton is drawing rapidly to a close, and although, as we go to press, the steamers owned by the Dominion Coal Co. are still running from the mines to Halifax, Boston and Portland, another week or two will probably see the practical closing down of the shipping wharves until the opening of navigation in 1895. The new pier in Louisburg harbor has been under construction for a few weeks, and the railway is rapidly nearing completion, but it is not likely that the pier will be far enough advanced in construction to admit of vessels being loaded before other ports are open again.

The season of 1894, so far as the Dominion Coal Co. is concerned, has been remarkable rather for great activity in reconstruction and development than for anything extraordinary in the ordinary business of shipping coal. Not that there has been any falling off—on the contrary the total shipments from the company's piers for the year will show a comfortable increase of about 90,000 tons over the previous year, and thus a new "best on record" will have been established. At the same time, it cannot be denied that, as regards the quantity of coal shipped, the season has been something of a disappointment. This time last year it was confidently expected that the season of '94 would see a shipment from the company's mines of well over one million tons, but on the 31st instant the total will fall short of the seven figures by about 60,000 tons. Picnics and breakdowns must be blamed for this shortage. (N.B. By "breakdowns" we mean accidents to machinery, &c., and not the dancing, which is such a prominent feature at the picnics.) Putting the picnic scourge aside, there can be no doubt that the shipments would have easily topped the million, had one or two of the collieries, upon which such attention was bestowed last winter, done anything like as well as was anticipated, and it is, after all, a comforting reflection for those interested to console themselves with, that the failure to fulfil prophecies was due, not to a lack of demand for coal, but to unexpected difficulties and hindrances at the works, temporary difficulties which can and will be surmounted before another shipping season is upon us. The demand for coal has been unprecedented, and this too in the face of great depression in business generally the wide world over. Not only was the company unable to take full advantage of the demand for foreign coal in the United States in May and June, occasioned by the protracted labor troubles in that country, but they were also forced at quite an early period of the year, to cease booking orders in Montreal, so great had been the quantity of coal contracted for up to that time. This state of things carries with it great encouragement and hope of better times in the future.

The following list of shipments from the various piers is made up to the 30th November, and with it, for the purpose of comparison, we give the shipments at the corresponding date last year. It will be seen that a substantial increase is shown all round, save and except at the Caledonia mine, upon which so much money and skill were expended last winter and which was expected to show a clean pair of heels to the others in the race for first place

Colliery.	30 Nov., '94.	30 Nov., '93.
Caledonia	107,249	152,057
Glace Bay.....	137,117	113,712
Gowrie.	125,782	205,525
International.....	219,795	184,762
Reserve.....	193,071	161,636
Victoria	107,429	90,000

From the International pier are shipped the outputs of the International and Old Bridgeport Mines and also of the new shaft at "Dominion No. 1," which is yet in a state of comparative infancy. The Gardener Mine, the coal from which was shipped at this pier, has been closed down and definitely abandoned. During November about 5,000 tons of Caledonia coal were hauled to Sydney and shipped at the International Pier, so that the shortage at Caledonia apparent from the above table of shipments, must be reduced by this quantity.

The International Pier itself is one of the chief points of interest on the company's works and has been quite a show place during the year. It was entirely rebuilt last winter of Georgia pine upon creosoted piles and is without a doubt the finest structure of the kind in Canada. A description of it has already been given in these columns, and reference has also been made to the hoisting and loading plant—entirely novel to the coal trade of this country—which has been erected upon it by the Ludlow Manufacturing Co., of Cleveland, O. Without going into a detailed description of this interesting machine, we may state briefly, for the benefit of those who have not seen it, that it is built of steel and consists of a tower revolving on an arch, which spans the width of the pier at a sufficient height to allow the rolling stock to pass underneath. The whole rests upon four four-wheeled trucks, by means of which it can be propelled up and down the wharf to any position desired. Thus, when a vessel has once been moored alongside no further shifting on its part is required, as the tower can be propelled from one hatch to another. The tower containing the boiler and the machinery, resembles a tea pot with a long spout. The spout in this case is the steel boom or derrick over which runs a steel rope with an hook attachment at the end. The latter takes hold of an iron tub (of 5½ tons capacity) which is loaded at the mines in the same way as an ordinary hopper and is brought in on a flat car—two tubs to a car. The tub is then hoisted a few feet and the tower and derrick with the suspended tub, revolve upon the arch until the tub is poised over the vessel's hatch; the tub is lowered as far down into the hold as is needful, and by a patent device worked by the engineer from the tower, the bottom of the tub, (which is cone shaped, like the bottom of a bottle) drops down a couple of feet or so and the coal quietly and easily runs out all round the tub. It can be at once seen that hereby a great saving of coal is effected as compared with the old method of shipping by "drops" or "shutes," and it can justly be claimed for this process that the run of mine coal shipped in this manner, will look as well in the hold of a vessel as screened coal shipped by the old fashioned methods just mentioned, of course there are drawbacks and perhaps the chief one so far encountered has been the comparative slowness with which coal is shipped. The plant was completed at too late a period in the year to admit of a thoroughly exhaustive test, but it is computed that 150 tons an hour is about as much as one tower can be relied upon to handle, using the 5 ton tubs. It is not yet known whether the management think sufficiently well of the plant to adopt it outright. If their verdict is favorable to it, they will probably place two towers on each side of the wharf (which is divided into two arms by the return track for empties running down the centre) and these four towers should be good for a shipment of 5,000 tons in the ten working hours, placing the capacity for each tower at 150 tons per hour, and deducting 1,000 tons for inevitable delays from one cause or another. Another drawback to the new plant is that it is only available for large vessels, *i.e.* for vessels with hatches large enough to admit of the tubs being lowered into them, but the disadvantage can be met by building another smaller wharf at which the lesser craft can be loaded from hoppers in the old way, or by loading

them at the company's other piers in the harbor. An experiment is to be made with a ten ton tub, and as the labor and time consumed in handling would be practically the same, a great deal will be gained if the larger tub can be used.

But it is at and around the mines that the greatest amount of work has been done, and more particularly at Glace Bay, the centre of the company's works, and the head quarters of Mr. David McKeen, the resident manager. For anyone who knew Glace Bay a year ago and has not seen it since, the place has been altered and built up almost beyond recognition, of course the Dominion Company are responsible for most of the new buildings which comprise, among the most noteworthy erections, new general offices, railway station, freight sheds, machine shops, roundhouse, warehouses, houses for officials and miners houses. A lot of work has also been done around the Old "Roost" pit where the well known "Hub" seam is being re-opened. But apart from the buildings erected by the company, there has been a great general "boom" in the building line at Glace Bay, merchants and business men having recognized the fact that the town is destined within a very short time to occupy the foremost position in the country, from a business standpoint. Looked at merely from a residential point of view, it has no charms for us. It may thrive exceedingly and we hope it will be cheerful, but we fear it never, never can be beautiful.

And while Glace Bay has been growing apace, an entirely new town has sprung up within a few miles from it, at "Dominion No. 1," the new colliery which occupies a breezy and healthy position between the company's railway and Lingan Bay. It is separated only by the railway from Old Bridgeport, which is practically absorbed by it, the Old Bridgeport pit being evidently destined at an early date to form but an humble adjunct to its younger and more vigorous neighbour. A large number of very neat and comfortable miner's houses have been erected by the Rhode and Curry Company, of Amherst, and a novel feature has been introduced on the Old Bridgeport side in the shape of a "Miner's Hotel" or large boarding house, where men who do not reside permanently on the docks, can get comfortable accommodation on moderate terms. Space will not permit us to describe the buildings connected with the mine itself. Suffice it to say that "Dominion No. 1" is being equipped with the best and most efficient appliances for mining and hoisting coal in large quantities.

At the other collieries but little has been done in the way of further development and yet they have not only done well during the last year, but have done better than their more fancied neighbours, upon which such lavish expenditure had been made. A "*laudator temporis acti*" will no doubt indulge in many a chuckle and "I told you so" over this result, and it will be "nuts" to scoffers at new fangled notions to note that the good old Reserve (where an endless rope for hoisting from the slopes has been used with marked success) has the best record for steady work of all the company's mines and has shipped over 200,000 tons, a record beaten only by old Sydney Mines. But, perhaps, our old fashioned friends will be wise to wait another year or two to see what Caledonia and Dominion No. 1 are going to do when they really get into their stride, before committing themselves to a definite judgment in favor of the "good old ways."

We mentioned at the start that the railway to Louisburg was nearing completion. This important undertaking—the boldest stroke of all in the company's policy—has been actively prosecuted throughout the year under the able supervision of Mr. H. F. Donkin. The weather has been almost abnormally favorable to rapid progress and within a few weeks the company's through line, laid with 80-lb. steel rails, from Sydney Harbour *via* the collieries to the waters of historic old Louisburg, will be an accomplished fact. A regular daily passenger and freight service is carried on between Sydney and Port Morien (late Cow Bay), *via* Bridgeport and Glace Bay.

Before closing our very inadequate summary of the Dominion Coal Co.'s operations for the year just ending, it may not be altogether out of

place to make brief mention of a too prominent feature which has gone a long way to mar a season that has been not without many encouraging and satisfactory signs of progress and enlightenment: we allude to the great increase in drunkenness and its attendant evils around the mines. If a sober calculation were made of what the workmen lost in earnings during the past year (to say nothing of the great loss of profits to the company) through the machinations of the rum fiends, who serve the devil by dispensing liquid poison to the miners, boys as well as men, it would stagger even people who have given this question much thought. It behooves the management to handle this growing evil with firmness and decision, and it likewise behooves the respectable majority of the workmen themselves to give a loyal and hearty support to efforts that may be made to subdue this hydra-headed enemy, which is sapping the moral and physical forces of the rising generation.

Having finished with the Dominion Coal Co. we turn for a moment to the old times and the old methods, and heartily congratulate the General Mining Association upon the splendid work they have accomplished at their Old Sydney mines. We understand their shipments for the year will total something like 220,000 tons, the best year they have ever had, and the best record ever made by an individual mine in the island. Working harmoniously side by side with their powerful rival, they show that able and economical management, working on the old, well-worn lines, has by no means lost its effectiveness. Arrangements have been made to improve their shipping facilities before next spring, and it will take the Dominion Coal Co. some time yet to "wipe the eye" of this conservative old corporation.

At the small colliery with the high-sounding name at New Campbellton, work on a small scale has been carried on with all the activity inseparable from the management of Mr. Burchell, and if he gets that 6-foot seam he is hunting for, oh, my!

EN PASSANT.

The REVIEW's heartiest greeting and good wishes for a prosperous New Year to the mineral operators of the Dominion.

A thoroughly complete index to the present volume will be furnished our readers with next issue.

A liberal and attractive programme has been arranged for the meetings of the Ontario Mining Institute at Kingston on Thursday and Friday, 3rd and 4th prox. The papers down for consideration include "Nature's Concentration Works," by Prof. W. L. Goodwin, B.Sc., F.R.S.C.; "Boron, its detection in Minerals, and Uses," by Prof. W. Nichol, M.A.; "Gold in Ontario and its Associated Rocks and Minerals," by Dr. A. P. Coleman, Toronto; "Notes on the Glendower Iron Deposits," by Mr. Willet P. Miller, B.A.; "Typical Ontario Rocks" (illustrated by lantern microscopic views), by Mr. W. P. Miller; "Examples of Nature's concentration of valuable minerals," by Mr. T. L. Walker, M.A.; and one from Mr. Peter McKellar, F.G.S.A., Fort William the title of which has not been announced. The sessions will commence at eleven in the forenoon of each day and be concluded at the afternoon meeting on Friday, when in the evening the members will be entertained to a public dinner given by the citizens of the limestone city. As, by arrangement with the railways, specially reduced fares are available to members and their friends, a large attendance is expected. Anyone interested in the mineral development of Ontario will be cordially welcomed at all the meetings.

In the following week the General Mining Association of the Province of Quebec will inaugurate its fifth year with a series of meetings in the New Club Room, Windsor Hotel, Montreal, commencing on Wednesday, the 9th, at eleven o'clock. The contributors of papers include Dr. G. M. Dawson, C.M.G., who will have something of interest

to say on the recent important developments in British Columbia placer mining: Dr. Ells, Ottawa; Mr. Burley Smith, M.E., Glen Almond; Mr. John J. Penhale, Black Lake; Mr. Dwight Brainerd, Montreal; Mr. S. L. Spafford, Capelton; Mr. George E. Drummond, Montreal; Dr. Robert Bell, Ottawa; Mr. John Hardman, Halifax; Mr. Jas. T. McCall, Montreal, and Capt. R. C. Adams, of Montreal. It has not yet been decided whether to hold a dinner or a smoking concert, but one or other will be held during the week. Members attending the meeting will have the privilege of reduced fares on the certificate plan by courtesy of the Quebec Central, Canada Atlantic, Grand Trunk and Canadian Pacific Railways. The meeting promises to be the largest and most successful in the history of the Association.

Since our figures of the coal deliveries to St. Lawrence ports were published, some additional shipments have been received which make the total returns up to the close of navigation as follows:—

COMPANY.	Montreal.	Sorel.	Three Rivers.	Quebec.	Total.
G. Mining Association	74,359	8,485	3,952	22,555	109,351
Dominion Coal Co.	512,269	3,151	5,529	24,004	544,953
Intercolonial Coal Co. ...	69,151	.....	.....	.....	69,151
Scotch, English, Welsh & American Bituminous	55,849	1,932	.....	15,877	73,658
Total	711,628	13,568	9,481	62,436	797,113

Mr. John E. Hardman, S.B., President of the Mining Society of Nova Scotia, has been very ill at his home in Lowell, Mass., but is, we are glad to say, at last reports, making satisfactory progress towards recovery.

The Bureau of Mines Act has passed its second reading in the British Columbia Legislature. This measure provides for the establishment of a central office for information and instruction concerning the mining industries of that province. A museum of minerals, offices and lecture rooms, assay laboratory, appointment of a deputy minister of mines, examinations for efficiency in assaying, granting certificates to successful candidates, and the affiliation of Art and Science Societies with the Bureau. This is a higher commendable measure for which Col. Baker, M.P.P., deserves to be congratulated. There can be no question that British Columbia with her enormous areas of mineral wealth stands in need of the establishment of such an institution, inasmuch as the collation and dissemination of accurate official reports concerning the rapidly increasing mining industries will be of the greatest service in attracting capital. There seems to be, however, some difference of opinion as to the advisability of establishing now a *quasi* school of mines, at all events at Victoria. The better place would be at Kaslo with its working mines in the immediate vicinity, and its opportunities for gaining practical acquaintance with milling processes.

At a recent meeting of the Midland Counties Branch of the National Association of Colliery Managers, held at Nottingham, Mr. A. S. Douglas read a paper in which he gave the result of a series of observations on the working of a ventilating fan placed underground. Mr. Douglas said the experiments which he desired to explain were taken with a view of determining the advantages derived by the working of an auxiliary fan placed underground under ordinary conditions, working in conjunction with another fan of a larger type at the surface. The Hucknall Torkard No. 1 colliery, where both fans are working, is sunk to and works the top hard seam at a depth of 386 yards from the surface, reached by two shafts, in both of which coals are drawn. The downcast shaft is clear of any obstructions; a set of pipes, supplying steam to the underground hauling and fan engine, pass down the shaft,

and the exhaust steam from both engines delivers into the same shaft a short distance from the bottom, the difference in temperature from this and other causes being 32 degrees. The whole of the workings of the pits, comprising three districts, named respectively the north, south and west, were, prior to May 1890, ventilated entirely by a Guibal fan. In 1889 the working in the north district had progressed so rapidly that the fan was found to be incapable of producing a surplus amount of ventilation and as the workings had a considerable further distance to go, it was apparent that some means of increasing the supply to this particular district was required. After considerable thought it was decided to erect a fan underground at a point situated in the north main return. The fan erected was a double-inlet one of the Guibal type, and called the Walker Indestructible. Its dimensions are 15 feet by 4 feet, driven by a pair of 23 inch engines with a 3 feet-stroke. The power is conveyed from the engines to the fan through ten cotton ropes, the fan being geared $3\frac{3}{4}$ to 1. In May 1891 it was set to work to assist that on the surface, and since then both fans have been regularly running. Three experiments were made—(1) with the surface fan alone working; (2) with both fans working; (3) with the underground fan alone working. The experiments showed that the method worked with success. The amount of natural ventilation passing when both fans had been standing upwards of three hours was considerable, amounting in the whole of the pit to 36'226 cubic feet per minute, with a water-gauge in the surface ventilator drift of 75 inches.

In his report to the Home Secretary for 1893, the inspector of mines for the North Staffordshire district, England, says: The use of "safety" or so-called "flameless" explosives continues to increase in this district, by displacing gunpowder, those chiefly used being roborite and ammonite; trials being also made of ardeer powder and bellite. The water or gelatinous cartridge also continues in use, with geglignite and tonite. No case has come to knowledge of any injury received from the fumes produced by any of these explosives, and although inquiries have been made of the workmen in several of the pits, no complaint was heard on the subject. The wisdom of adopting those safer explosives (with electrical firing) in dusty or fiery pits is not to be doubted. The substitution of these safer explosives for gunpowder, coupled with the spreading conviction that coal dust is the most important factor in extensive colliery explosions, and that it may be the sole cause of such disasters, will have a marked effect in reducing the loss of life by explosions in coal mines.

At a recent meeting of the South Staffordshire Institute of Iron and Steel Managers Mr. J. W. Hall read a paper on "Conditions which Determine the Choice of a Steam Engine." He stated that the purchasers of engines were most apt to err in their choice under any given circumstances, either in paying too much attention to the first cost of the plant, to the exclusion of the other factors, or, less frequently, in considering nothing but the coal-bill. It was commonly taken for granted that a cheap engine meant a tolerably high fuel bill, and that to economize fuel a very costly engine was requisite. Did the cost begin and end with the engine there would be some reason for this view; but the engine and boiler must be regarded as one installation, and the cost of the whole as the basis of comparison. The higher the pressure of steam a boiler would supply, the higher was the economy of fuel it was possible to obtain from it, the limit of increased pressure being determined by prudential considerations of safety, of first cost, and wear and tear. The question of the best pressure to adopt was the first to be settled, as upon that everything else turned. The inclination to employ higher speeds, which, under suitable conditions, were also conducive to economy of fuel, was quite as noticeable as the tendency to work at high pressure; and now that most of the difficulties experienced in the earlier days—to which much of the prejudice still existing in many minds against high-speed engines was undoubtedly due—were successfully overcome by

more suitable design and proportions, and the use of a better class of material, the original objections to them had entirely disappeared. No engine could be considered fit to run at high speeds which was not fitted with sight-feeds, or, at least, continuous or automatic lubrication, to every bearing, by which it could be constantly supplied with oil while running for days and nights together, without any necessity to stop for greasing; indeed, as much care and thought was now spent by the designer on the lubricating details as upon any other part of the machine. Experience proved conclusively that a compound engine was in all cases, at all pressures likely to be employed in these days, more economical in the use of steam than a single engine using the same pressure and number of expansions. During the last ten years a type of engine, formerly almost unknown, had become very common—that was the compound condensing engine, which, particularly for engines of small size, proved exceedingly economical. It was very commonly assumed that a compound engine having two cylinders was necessarily a costly one, but for given power it frequently was cheaper than a single cylinder; and, seeing that the amount of steam consumed was less, the boiler might obviously be smaller. There was another important advantage in compound engines—namely, the much smaller relative loss of efficiency due to leakage past pistons and valves when the engine was worn. When an engine was liable to a sudden temporary demand for power much in excess of its normal output, a single cylinder met the difficulty well, and with the lowest first cost; but anything approaching economy was impossible in this case unless an automatic cut-off was employed.

The editor of the REVIEW was presented last month with a handsome silver mounted cabinet by Mr. Thos. J. Drummond, Sec.-Treas. of the Canada Iron Furnace Co., Montreal, on behalf of the Canadian iron companies, in recognition of services to the iron industry during the past year.

In a paper recently published in the *Transactions of the American Society of Civil Engineers*, Mr. G. A. Goodwin, A.M.I.C.E., sums up the comparative advantages of steam, hydraulic and electrical hoisting gear as follows: Steam requires the lowest initial outlay, and each crane being independent of the rest, a break-down at one point does not affect the whole system. New plant can also be added without trouble. Steam cranes are, however, much slower in working, and they require skilled drivers. The consumption of coal and water is considerable, and the cranes are noisy, whilst the working cost is higher than with either hydraulic or electric power. Hydraulic cranes have the advantage of being worked from a central station, so that there is but one set of boilers to fire, and the amount of fresh water required is saved. The cranes work twice as quickly as with steam, and for the same speed of lift the wear and tear is less than with electric power. One driver and stoker only are necessary, and cheap labor can be employed to work the cranes, though one skilled mechanic is necessary to look after the plant. The machinery is noiseless, and the cost of working is less than that of steam, but about the same as electric power, whilst its upkeep costs less than either of these systems. Its initial cost is, however, much greater than steam, and a little more than electric power. Electric cranes have also the advantage of a central power station, the machinery works quickly, only one driver and stoker are required. Like the hydraulic system, the plant can stand idle with a minimum of loss, and the cranes are fairly noiseless in working. In the case of a breakdown, however, all the plant would be stopped, and the drivers have to be men of above average intelligence. The upkeep costs slightly more than in the case of hydraulic machinery.

At the monthly meeting of the Leeds Association of Engineers a paper was read by Mr. J. Clark Jefferson, A.R.S.M., Wh. Sc., on "Balancing the Load on Colliery Winding Engines." The most economical and perfectly developed type of steam engine, he said, was probably the marine engine. The very opposite was the case with most winding

engines, owing to their intermittent action and the great alteration in the loads. The latter drawback was due to the variation in the lengths of the coiling and uncoiling ropes during the raising of coal, necessitating, in the case of shafts of comparatively modern depth, an engine of double the power to what would be required were the load even approximately uniform. The attempts to render it so divided themselves into two classes. First, those which aimed at an actual balancing of the weight of the rope; and second, those which varied the leverage of the engine during the course of the winding, to counteract the alteration due to the changing lengths of suspended rope. The former class comprised balance chains, balance weights suspended in staple pits, or hauled up and down straight or curved inclines, balance ropes, the tail rope and Koepke system. All these methods (although the balancing might be perfectly effected) possessed two disadvantages. The total weight to be moved being greater, the frictional and other resistances were increased, and the deteriorating effect on the winding rope near its junction with the cage necessitated its more frequent shortening and reduced the life of the rope. Meinicke's system, in which the balance rope is attached to auxiliary ropes, which are wound and unwound from a separate drum on the winding axle, obviated this difficulty, but required a larger amount of rope. This objection was more apparent than real, since discarded winding ropes could be used up as auxiliaries. The alteration of leverage was effected by using conical or spiral drums, instead of cylindrical ones. Some degree of compensation always took place where the load was raised by a flat rope, coiled upon itself. A probable reason why conical drums had only to a slight extent been used was that the principal of designing them had not been sufficiently known. The main point in their design was not in the proportion of diameter and breadth. These might be varied within very wide limits and still agree with the conditions of keeping the load uniform. This could only be ensured by preserving a proper ratio between the large and the small diameter of the drum, such ratio being dependent only on the respective weights of the cage-empty corves, coal and the fully unwound rope.

Two pumps in the Short Mountain Colliery, in Pennsylvania, that have been buried beneath 60 feet of water for some weeks, were located recently by a professional diver, and one of them started. The company was so pressed with orders that it was compelled to do something at once to get the water out of the flooded shaft, and a diver was the only remedy. He put on his diver's suit and started down into the shaft. He was down but five minutes when he re-appeared at the surface staggering. In answer to questions, he stated that the water was at a temperature of 108°, compelling him to return after going down 20 feet. He was told that this temperature did not exist for any great distance, and went down a second time. In eleven minutes he came back, reporting that he could not find the pumps. He was instructed to go 10 feet farther down, and did so, locating the pumps. On the fourth and last trip he started one of the pumps to working, and put a weight on the wheel to prevent it from jarring shut. The other pump refused to work.

AN account is given, in the *Australian Mining Standard*, of a plain endless ropeway lately installed at the Jumbunna colliery in the Gippsland district of Victoria for the haulage of coal from the mine tunnels to the railroad. The distance is one mile and the difference of elevation only 300 feet at terminals, with an up-grade to the railroad, but surveys showed that the construction of a branch railroad would have been so expensive as to be economically out of the question, on account of sharp curves and heavy grades over intervening country. The capacity of the line is 30 tons per hour. The case is interesting because of the selection of the plain single-rope system in preference to either of the more recently developed cableways.

The English Board of Trade has issued a new code of instructions to its surveyors regarding the surface ventilation of coal cargoes. The sur-

veyors are enjoined to inspect the ventilator fittings in all coal-laden vessels, and should report any case in which they appear to be weak or improperly constructed, and all inefficient fittings should be replaced by those that are proper and efficient. The regulations prescribe that surface ventilators for coal-laden vessels should, whether placed on the upper deck, poop or fore-castle, be made entirely of wrought iron, and should be fitted with cowls.

The Logan Club Dinner (Geol. Sur. of Can.) has been postponed in respect to the lamented death of Sir John Thompson.

The second session of the Prospectors Course at the School of Mining, Kingston, will open on 8th prox. and be continued for eight weeks. The attention of such of our readers as may be interested in this work, or who may be disposed to take such a course, is directed to the following features of these excellent classes:

1. CHEMISTRY—A short course of lectures illustrated by experiments, introductory to the courses in mineralogy and assaying.—DR. GOODWIN.

2. MINERALOGY—Lectures illustrated by specimens, dealing with the general principles of mineralogy, and accompanied by practice in identifying minerals by field tests.—PROF. NICOL.

3. GEOLOGY—Lectures on the elements of geology, with illustrations from the geology of Ontario. Ore deposits will claim special attention.—MR. MILLER.

4. LITHOLOGY—The character and modes of occurrence of rocks generally—Examination of hand specimens—Special attention will be given to the crystalline rocks of Ontario, the most typical mineral-bearing rocks being well presented by specimens in the collection.—MR. MILLER.

5. DISCOVERY AND WINNING OF ORES—This course will be of particular interest to mining men and prospectors, as it will deal with the application of the principles of chemistry, mechanics, mineralogy and geology to the discovery and winning of valuable minerals, and to the usual methods and machinery in vogue to open up the deposits and exploit and prepare the ore.—MR. HAMILTON MERRITT.

6. MILLING—The class will have opportunities of learning in the mining laboratory the use of crushers, stamp mills, and other machines.—MR. HAMILTON MERRITT.

7. BLOWPIPING—A practical course intended to give facility in the use of the blow pipe for the identification of minerals.—PROF. NICOL.

8. ASSAYING—Opportunities will be given for practice in furnace methods, particularly in the use of the portable assay furnace.—PROF. NICOL AND MR. WALKER.

9. DRAWING—The elements of mechanical and free-hand drawing as applied to surveys of mining claims and mines, to mining plant, &c.—MR. MASON.

10. ADVANCED WORK—Those who are prepared for such work may attend (without charge) lectures on the chemistry of fuels, ores, fluxes and furnaces, and on advanced mineralogy and geology. Every facility will be given for work in the chemical, mineralogical, petrographical, and assay laboratories.

FEES—Every student must pay a registration fee of one dollar. For all the elementary courses (Nos. 1 to 8 inclusive) a fee of ten dollars will be charged; for any one of them two dollars. Fees for the use of the laboratories for advanced work will be in proportion to the number of hours a week; but not to exceed eight dollars.

OTHER EXPENSES—Good board can be had in the city at from \$3 to \$4 a week. The other items of expense (for books, &c.,) need not be large.

The annual report of the Division of Mineral Statistics and Mines for the year 1892, has been issued by the Geological Survey. As on previous occasions, we must complain of the extreme dilatoriness of this publication. Statistics must be issued promptly, to be of service to business people.

The Quebec Crown Lands Report just published, while containing much interesting information respecting the mining industries of that province, is very incomplete in the nature of statistics there being, for instance, no mention of the quantity of chromic iron mined, during the year, altogether about 1000 tons.

This is the day of small things in gold mining, pertinently remarks the London *Mining Journal*. A quarter of a century ago anything less than an ounce to the ton was usually regarded as unprofitable, unless the surroundings of the property worked were exceptionally favorable to cheap production. It was then a question of "How many ounces to the ton?" Now we ask, "How many pennyweights will it yield?" Of course, we are speaking of quartz mining, for in working large alluvial deposits, "pennyweights" to the load open up vistas of wealth which only distant—very distant—and inaccessible fields venture to promise.

In placer mining the calculation of cents is indulged in, and one mine in New Zealand pays on a yield of a grain of gold to the yard. The cost of treatment averages 1½d. per load, and the other ½d. furnishes a handsome dividend to those interested in the property. Labor-saving machinery, the utilization of Nature's ample resources in the shape of water, the skill of the hydraulic engineer, the advance of science, and last, but not least, the application of careful business principles in the management of gold mines, have all tended to bring about these results. Many years ago the late Sir Warrington Smyth ventured to predict that if the quartz reefs of Wales would yield 8oz. to the ton, they might with economical management be made to pay a substantial return on the money invested in their development, but Professor Crookes is well content with as many pennyweights, though his recent average at Cefn Coch has exceeded ½oz. to the ton. The Alaska Treadwell property mines, mills, and otherwise treats low grade ore at a cost of 6s. per ton, and another property, worked on a smaller scale with Huntington mills, finds a gold return of 2s. 6d. per ton profitable, the whole cost of mining, treatment and management being covered by 2s. 3½d. per ton. As we said at the commencement of our article, this is the day of small things, and as even with the greatly increased production there is still a dearth of gold, it would be well if the attention of miners and capitalists reverted to some of the fields long since discarded, but which, when worked under old conditions, failed to pay because they yielded only pennyweights and not ounces to the ton. The old-fashioned gold miner was a man in a hurry to be rich, and with little capital, and less skill, he was ever ready to discard one field, and betake himself to pastures new, in the hope that a few months' labor would enable him to spend the remainder of his days in that luxurious ease which wealth is supposed to ensure.

MICA MINING.

The Phosphate King Mine, situated on lot 15, west ½ Range VIII., in the township of Templeton, operated by the Lake Girard Mica Mining System, has been opened this year with gratifying success. The main shaft worked in 1891-92 for mica has been sunk further down to a depth of 65 feet in a solid deposit of phosphate, measuring in the bottom of the shaft 8 ft. wide. Since April this year 650 tons of pure phosphate have been taken out and sold to a Montreal concern. Perfect mica crystals are frequently met with in the vein and yield a fine commercial product. It is the intention of the system to sink the shaft further down and to test the vein body thoroughly. Twelve men are steadily employed. Prospecting work in the northern part of the property has resulted in finding different valuable outcrops. One of the recent discoveries shows a solid phosphate body measuring 20 ft. long and 4 ft. wide, and operations will commence here at once. The Wallingford's mine, on lot 16, west ½ in the 8th range of Templeton, continues to turn out large quantities of mica. The shaft is now about 100 ft. deep, and has been sunk entirely in a solid mica vein, which shows in the bottom of the shaft 9 ft. in width and is still increasing. A drift in about 70 ft. depth has laid bare the vein for 60 ft. and the latter is still continuous. Fifteen persons are employed. The bulk of the material cuts from 2 x 3 to 5 x 6 inches. The mica is being sold in a trimmed state to a Boston concern and to Mr. Franchot of Buckingham. The monthly output averaged 15 tons of trimmed mica sheets.

Forty men and boys are engaged cutting the mica from the old dumps of the Blackburn mine. The quantity and quality of the mica taken out is reported to be highly satisfactory. All the mica is sold to Mr. Franchot at Buckingham.

In the township of Hull the Vavassour Mining Association continues its successful operations on the old Gow mine. This property has been in operation for over three years, more or less actively, having produced a quantity of not less than 250 tons of merchantable mica. The mine consists of four main veins of calcite, pyroxene and phosphate, running in a north north-easterly direction, with a dip of 45° east. One of these has been followed for a distance of 1,200 ft. and the thickness varies from 2 to 3 ft. and from 12 to 15 ft. Considerable work has been done, consisting chiefly of an excavation of 200 ft. and shafts of 90 and 70 ft., with a gallery of 80 ft. The principal vein was opened for a length of over 300 or 400 ft. The work seems to be stopped in the shaft owing to the difficulty of extracting with a derrick, but will probably be resumed with a more suitable plant. At present a small vein is being worked, which is about 3 ft. thick, at a depth of 30 ft., very fine mica crystals being in sight. A shop has been put up at the mine for cleaning and drying the mica. Some phosphate has been taken out, about 250 tons being on the dumps.

At the Beaver Lake mine, sold recently to the Canadian Mica Company, a road 15 miles is being constructed to Escoumains, which will be in future the point of shipment.

The shipments of mica from 1st January to 30th November are reported by the collectors of customs to have been as follows at the following ports:—

Port of Ottawa,	to United States,	\$21,790;	Europe,	nil.
" Montreal,	"	147;	"	\$4,200.
" Quebec,	"	nil;	"	120.

In the Saguenay district, the McGie mine (Block G) was worked all summer on a new deposit, and on the northeast part of the first workings, yielding a fair quantity of good mica.



Mr. John J. Penhale,

Black Lake, Quebec.

Supt. United Asbestos Co., President of the Asbestos Club.

COMPANIES.

The Anglo-American Gold and Platinum Hydraulic Mining Co., Ltd.

The officers of this company are: J. Barnett MacLaren, New Westminster, *President*, Capt. S. F. Scott, Vancouver, *Vice-President and Managing Director*, G. D. Mackay, Vancouver, and Capt. R. Hughes, Vancouver, *Trustees*. The property comprises four claims on the south fork of the Similkameen river, Yale district, B. C. The result of recent prospecting shows the average value of the gravel to be 27½ cents per cubic yard; the value of the platinum more than 6½ cents per cubic yard. There is an ample supply of water, and work will be prosecuted vigorously next season.

Acadia Coal Co., Ltd.—Reporting on the operations of the year, Mr. H. S.

Poole, M.A., A.R.S.M., General Manager, writes: "At the Albion Colliery entry was made into the rise food pit workings, looking to a separation of the crop fires, which cannot be extinguished, and the drowned deep workings. Progress was made, but work had to be postponed, the unavoidable admission of air stimulating combustion. Stone drifts 400 feet long were driven across from the deep to the main seam, and deeps driven in the deep seam to open up ground to the west of the abandoned workings. Arrangements are making to operate here by endless rope. In the McGregor seam the slopes have been sunk 600 feet, and a new lift is being won out. Total length, 2,807 feet. For steam generation the new form of Stirling boiler carrying high pressure has given satisfaction. For cleaning the coal at the slopes a picking belt is in operation, and the slack is conveyed to a bin from whence it can be drawn off, as required, by a Jeffrey's rope conveyor. No changes were made at the Yale colliery, the bottom of the basin having been reached. At the Acadia colliery air was substituted for steam in pumping from the lowest, the 9th lift, to the 6th lift, where the main steam pump is placed. Experience confirmed the advisability of substituting the modified longwall system of working the seam at the depth attained for the old plan of bord and pillar." To replace the works destroyed by fire on 20th ultimo a more modern screening arrangement will be erected at this colliery.

Intercolonial Coal Co., Ltd.—Respecting the past season's operations at the Drummond Colliery, Mr. C. Fergie, M.E., General Manager, reports: "Our surface extras consist so far of a new locomotive, the 'Henry Budden,' being a six-wheeled coupled Mogul Forney. Weight in running order, 60 tons. Dia. of cylinders, 17 inches; stroke, 24 inches. This engine is fitted with steam brake and the latest improvements in construction. To meet the requirements of ventilation of our present seam and provide for the opening out of our underlying seams a new 'Indestructible' ventilating fan is being erected with a ventilating capacity of 200,000 cubic feet per minute. Size of fan 18 feet dia. by 6 feet. Rope driving gear. Engines for driving fan are of the compound expansive cut-off type. High pressure cylinder, 17 inches dia.; low pressure cylinder, 23 inches dia. Engines constructed to work independently of each other, and in case of accident without stopping the fan. More mechanical labor saving appliances having been introduced it was found necessary to erect two more boilers: these are of the Stirling water tube safety type. Two of this class have been erected with a passive power of 300 horse. We are now about to erect a new mechanical screen, complete with picking belt, patent tippler, etc., capable of handling 600 tons per day. To meet the pumping requirements underground a Northey compound condensing, duplex, plunger pump has been erected at the 4,000 feet level with a capacity of 80,000 gallons, throwing a vertical distance of 600 feet. To further increase the already many precautions taken with our miners' safety lamps and principally to protect them in very high currents a new small air compressor has been erected in the lamp room: to this compressor a ½-inch pipe is connected, arranged so that by opening a foot valve the glass and joints are subjected to a pressure of 30 lbs. per square inch. In case of any defect the lamp is immediately extinguished. This same compressor also supplies air for cleaning the gauzes of dust. To meet the extensive requirements two reservoirs have also been built capable of containing from five to seven million gallons. Underground everything is very favorable for an extended output whenever required. To reduce the cost in handling underground and meet the requirements of a larger output in one section of the mine we have substituted a system of steam haulage for the ordinary 'back balance,' running a trip of six boxes each journey. The output for present year will probably reach 230,000 tons. For the future our new works, levels, etc., are all well advanced, and only need a brisk demand to far exceed any of our past years in the matter of output."

Canadian Copper Co., Ltd.—Official returns furnished by the head office show that this company's mines produced up to 1st December about 200,000 tons of smelting ore and 41,600 tons of matte, which is equivalent to 7,638 tons of nickel.

The Montreal and British Columbia Prospecting and Promoting Co., Ltd.—Registered at Victoria, B.C. Authorized capital, \$20,000, in 4,000 shares of \$5. Head office, Vancouver, B.C. The trustees are J. M. Browning, F. C. Innes, and S. O. Richards. Operations are to be carried on in British Columbia.

H. W. McNeill Co., Ltd.—During the year ended 1st June last this company raised 65,000 tons.

New Vancouver Coal Mining and Land Co., Ltd.—In the report to the shareholders under date of 20th ulto., the directors report for the six months ended 30th June last as follows: "The net output for the half year was 176,100 tons and the sales 175,600 tons. Prices have continued to rule exceedingly low, and trade continues dull." An interim dividend, payable on 26th inst., of £2 per cent., was declared.

General Phosphate Corporation, Ltd.—A shareholder writing from London under date of 19th inst. says: "The General Phosphate Corporation business is not by any means buried yet, and I shall probably be able to send you some spicy bits shortly. Sando's examination in bankruptcy takes place soon, and expect there will be something interesting."

The Canada Iron Furnace Co., Ltd.—The output of this company for the past year has been: Ore raised, 20,648 tons (short); charcoal made, 756,300 bushels; charcoal iron manufactured, 7,900 tons of a value of \$190,000; ore charged, 17,500 tons; fuel charged, 750,000 bushels; flux charged, 1,750 tons. 600 persons employed in all the various operations of the company.

Prince Albert Flat Hydraulic Mining Co., Ltd.—During the season this company completed an open cut 500 ft. long and 50 ft. deep to a supposed back channel of the Fraser river. Equipped with latest hydraulic plant. Ground averages 20 cents per cubic yard. Now closed for winter.

The Drury Nickel Co., Ltd.—The sale of this company's lands, machinery and mining property advertised to take place at Sudbury on 5th September, was not consummated, as the reserve bid was not reached.

Tilt Cove Copper Co., Ltd.—At the annual general meeting of shareholders held in London, E., on 28th ulto., the accounts of the working of the east mine at Tilt Cove, Newfoundland, showed that the value of the ores and regulus won during the year amounted to £73,028 0 11d., and the mining costs £20,545 9 10d.; smelting, £32,029 15 7d.; freight, insurance and Swansea charges, £20,278 15 2d.; leaving a profit balance of £174 0 4d. The revenue and expenditure for the year, however, shows a debit balance of £36,408 4 1d.

British Columbia Coal, Petroleum and Mineral Co., Ltd. The directors of this company for the ensuing year are: Lt. Col. Baker, M.P.P., *President*; Col. E. G. Prior, M.P., *Vice-President*; B. W. Pearce, A. W. Vowell, F. B. Pemberton, W. Fernie, W. Hanson and J. A. Gemmill. The company owns 11,169 acres of coal lands near Martin and Morrissey Creeks in the East Kootenay district, B.C. On the easternmost property, near Martin Creek, containing 3,969 acres, there are fifteen seams of coal, four of which are very valuable cannel or gas coal. The remaining seams are bituminous and admirably adapted for coking. The importance of this coal field will be greatly enhanced by the completion of the line of railway surveyed by the Canadian Pacific Railway through the Crow's Nest Pass, and in view of the connection of the mines with the great silver-lead country of the Slocan. Up to 1st Dec. this year about \$65,000 have been spent on preliminary development.

The Baltimore Coal Mining and Railway Co., of Albert County, N.B.

Some time ago we published a notice of the incorporation of this company under the statutes of New Brunswick. The area controlled by the company is 640 acres by statute to work, and 2,560 acres by license to search, which in time will be converted into a lease, covering such area of the above as the company may direct. Mr. Wm. Hall, M.E., formerly of the Springhill collieries, reports the various seams to be of a thickness of 5 ft., 4 ft., 4½ ft., 20 ft. and 21 ft. respectively. The officers of the company are Mr. Charles Archibald, *President*; Mr. W. F. Workman, *Secretary*, and Alex. L. Wright, *Treasurer*.

Tulameen Hydraulic and Improvement Co., Ltd.—In consequence of several

propositions to purchase the properties of this company on the Tulameen river, B.C., all work in 1894 was delayed and held over until the mining season closed. It is expected that before next season the future ownership of the mines will be arranged and work recommenced either by the present company or one of the companies in treaty with it.

Low Point, Barrasois and Lingan Mining Co., Ltd.—This English company, practically a branch of the General Mining Association of London (Ltd.), is reported to have made another sale of its property to the Dominion Coal Co. The latest deal comprises property at New Victoria, C.B., and the price paid is said to be \$10,000.

Bothwell and London Crude Oil and Tanking Co., Ltd.—This company, having failed to find oil in paying quantity, has suspended operations.

Quesnelle Quartz Mining Co.—At a meeting of shareholders held at Quesnelle, B.C., on 29th ulto., a proposition to give a syndicate a half interest in the Hixon Creek mine on condition that \$100,000 were spent on the property was submitted and adopted. The intention is to work the ore by the cyanide process, tests having demonstrated that 95 per cent. of the gold can be saved by that method. It is expected that arrangements will be concluded during the winter and that the new company will be organized and ready to begin operations next summer.

The Victoria Hydraulic Mining Co.—This company has constructed 8 miles of ditching, erected a sawmill and put in 3,500 ft. of steel pipe, with monitors, etc., at Keithley, B.C., the total expenditure on the property to date being about \$65,000. The mines have practically been sold out to the Victoria Hydraulic Consolidated Co., now applying for a special charter of incorporation from the Provincial Government. The principals of the new concern are Messrs. McKenzie and Cox, of Toronto, D. D. Mann and T. G. Holt, of Montreal, and Wm. Wilson, of Victoria. Work on a large scale will be pushed in 1895.

The Pictou Development and Mining Co., Ltd.—The gold mining property of this company at Renfrew, N.S., is under option of sale to an American syndicate.

Victoria Gypsum Mining and Manufacturing Co., Ltd.—The new board of directors of this company are: W. Gibson, Williamsport, Pa., *President*; Jas. C. Pender, Chester, Pa., *Treasurer*; W. F. McCurdy, Baddeck, C.B., *Resident Manager*; Hon. G. G. Hubbard, Washington, and H. P. Blanchard, Baddeck, *Secretary*. In 1893 and 1894 about 25,000 tons of gypsum of excellent quality were shipped.

Kootenay Hydraulic Mining Co.—At a recent meeting of the shareholders held at Nelson, B.C., J. F. Ritchie was elected president; R. J. Bealey, vice-president; G. W. Richardson, secretary-treasurer, and J. Elliott and F. M. McLeod, directors.

Wentworth Gypsum Company.—This company has recently purchased from the Canadian General Electric Co., Toronto, two electric drills and the necessary dynamo for working them. One drill is for soft plaster and is rotary; with it and one man to tend it a hole can be drilled at the rate of two feet in less than a minute. With the motor it weighs 150 pounds and is very convenient and simple. The other is a percussion drill for hard plaster, and is an improvement on the steam drill previously used. The company is also to erect two cable lifts, each 1,000 feet long and capable of supporting six tons. These will carry the plaster from the different places where it is carried to the cars which will greatly facilitate the work. The length of the cables will convey to any, who have not visited them, a comprehensive idea of the extent of the quarries worked by the company.

The Ontario Peat Fuel Co., Ltd.—The experiments with the Dickson peat fuel plant conducted during the past year by this company have proved eminently satisfactory. The methods heretofore adopted have either been simply cutting and drying the raw material, or by using extreme heat in the process of manufacture. Both plans have not succeeded, the first by reason of the light, loose and bulky nature of the article, and the second because the volatile oils of the peat, which give it real value, were dissipated by the heat, and the fuel was, it is claimed, thereby rendered almost useless. Moreover the process of manufacture was very slow and therefore expensive. The machine which Mr. Dickson has patented completes its work within a few minutes from the time the raw material is taken from the bog, produces the finished article at the rate of two tons per hour and without the application of heat. The peat is pressed to a density practically the same as anthracite coal. Its heating qualities have been amply demonstrated by comparative tests of peat and anthracite egg made by the Abell Engine Works, Toronto, running a 200 horse power engine

and all the machinery in a large shop. The supreme advantage, however, of peat fuel is its adaptability for domestic purposes. It lasts longer than bituminous coal, makes a bright, warm fire, is perfectly clean, leaves but a small percentage of ash, and it makes neither dust, smoke or cinders. It is absolutely free from sulphur and will cost in all probability much less than coal. The property acquired in the County of Welland contains about 5,000 acres, for which the company pays the sum of \$1,530 per annum for 15 years and thereafter a rental of 25 cents per acre. Peat moss covers the whole area to a depth of about 2 feet, and the company has already cut from an area of about 3 acres something like 2,000 tons. This moss later is of a very superior quality for stable bedding, and we understand a contract has been made with an American firm to purchase not less than 1,000 tons for the first year and to increase the purchase thereafter by not less than 5,000 tons annually. The price agreed upon is reported to be not less than \$4.00 per ton delivered at the company's works for all shipments made eastward, and \$5.00 for shipments to Buffalo and westward. This company, it may be said, have expressed the belief that they will require 25,000 tons the first year, and a large quantity each successive year. It is worthy of remark that the Welland marsh was thoroughly drained by the Ontario Government at great expense some thirty years ago, so that the moss is perfectly dry. The company has equipped the works with an expensive plant and arrangements have been made for immediate railway connection with the works.

American Gold Mining Co.—This company's operations in the Chaudiere, Que., were somewhat hindered this year by scarcity of water, but what washing was done gave very satisfactory results. It is the intention to open out a large tract of gold territory next season.

New Brunswick Brown Stone Co., Ltd.—The organization of this company has not been completed and the business is carried on by Messrs. Wm. Clarke & Co. In 1894 about 30,000 tons were raised of a value of \$30,000, a considerable portion being shipped to Toronto for the new city buildings.

Blue Lead Hydraulic Co., Ltd. No work was done in the past season on Hixon Creek, B.C., but may be resumed next season.

Fraser River Mining and Dredging Co., Ltd.—Forty men have been employed during the past season on this company's claims in the Yale and Lillooet districts, B.C. The plant in use comprises a clam-shell dredge assisted by powerful centrifugal pumps, used to raise the finer material, such as sand and gravel containing the gold, while the dredge is used to raise the heavier material. On the bow of a scow, 130 ft. long by 30 ft. wide and 7 ft. deep, built for greater security with watertight compartments, is laid a pair of steel rails firmly bolted on to the deck, the bolts passing through the keelsons on the bottom. On these rails on eight wheels hauls an immense carriage made of steel beams which, by a worm gearing, can be locked and held fast at any desired point, a series of counterweights holding it from tipping up as some might think it would. On top of this carriage rests a large cast-iron turntable 13 feet in diameter, firmly bolted to the carriage, and on this, mounted on six bevelled wheels, is a platform. On this platform are two immense drums which carry the chains which pass up and over the top of a 45-foot boom, from which depends the clam-shell buckets, the latter having a capacity of a yard and a half. The clam-shell is divided into four quarters, and when it is lowered down to the bottom of the river it is covering a space of about four feet. By an arrangement of poles an additional force is given to it, so that it always goes down straight into the water and as soon as the raising chains are tightened the four quarters come together with a pressure of five tons, thus gathering everything together within its radius and bringing it to the surface. Of course it is worked by steam, the power being supplied by a 200 h. p. boiler, situated about the middle of the boat, the power or steam being admitted to the centre of the plant above described. About the centre of the boat is a large 8-inch rotary pump, which pumps sand and gravel up to 6 inches in diameter at the rate of about 30 feet per second. To this is connected a suction hose, having the same diameter, which traverses the side of the scow under water and passes out to the bow, where it goes down vertically into the water. Some idea of the magnitude of the plant may be gathered when it is stated that the weight of the machinery operating the clam-shell bucket is 30 tons; the complete plant of machinery will weigh about 100 tons. The plant was put into operation on 4th instant, and will cost about \$40,000.

The Ledyard Gold Mines Co., Ltd.—Work proceeds at this company's Belmont mines with satisfactory results. A new 5-ft. Huntington mill has been ordered, it having been found to treat the ore economically. The Golden Gate concentrator is reported to be doing good work on the sulphurets. No. 1 shaft is down 70 ft., and at a depth of 25 ft. a drift has been run for 30 ft. on good crushing material.

Nelson Hydraulic Mining Co., Ltd.—The secretary writes under date of 6th inst.: "We were all ready to mine last spring when the disastrous floods which played such havoc with this country carried away our sluice boxes. We, however, managed to put temporary boxes in before the water was entirely gone, and mined sufficiently to reach bed rock. The results we obtained were highly satisfactory, the gravel averaging 80 cents per cubic yard, and when we stopped working we were in gravel that went \$8.00 per cubic yard. We are putting in a more expensive plant and hope to have a very prosperous season next year. The gold is very coarse and easy to save; the largest nugget we got was of a value of \$5.00."

Kamloops Coal Co., Ltd.—The development work on this company's property on the North Thompson River, for the year just ending, was not up to anticipations. The quality of the coal having been fully demonstrated by previous year's operations caused the company to direct its attention to the uncovering of larger seams than those found on the surface. With this object efforts were directed in the early part of the year, not to win coal, but to find larger seams, and several prospect holes were put down at great cost with no beneficial result. The capital and equipment at the company's command being inadequate, operations have therefore been suspended. Negotiations are pending for the service of a diamond drill with which to determine the thickness of the seams underlying those shown to be on the surface. Active operations will be resumed in the course of a few months.

Stratheyre Mining Co., Ltd.—Mr. W. Hamilton Mettrick, A.R.S.M., Toronto, has returned from a visit of several months' duration to this company's property in the Okanagan County, B.C., where he was preparing a report for the directors. The 10-stamp mill is running on custom's work, crushing ore from the Morning Star mine.

The Crown Pressed Brick Co., Ltd. has been incorporated under Ontario Statutes, with an authorized capital of \$100,000 in shares of \$100.00, to manufacture brick, terra cotta, tiles, drain pipe and other building materials. The incorporators are: H. L. Corbett, G. W. McCullough, H. H. Williams, E. J. Butterworth, J. G. Butterworth and M. S. McCullough. Head office, Ottawa.

Botanic Creek Gold Mining Co.—During the summer of 1894 sufficient development has been done to thoroughly prove the existence of an old bed of the Thompson river, which gradually narrowed as the tunnel progressed. In all 479 running feet of tunnelling has been done and 2,400 cubic feet of stoping, the results ranging all the way up to \$4.00 per cubic yard in gold. When operations were temporarily suspended a canon in the old bed of the river had been struck, with a somewhat steep grade on bed rock and bearing N.E.

Quesnelle Quartz Mining Co., Ltd. At a meeting of directors held on 30th ult., an assessment of one-fourth of one per cent. on the capital stock of the company was levied on the shareholders.

The Consolidated Electrical Mining Co. of Canada is the name of a new company being promoted by Dr. James Reed, of Reedstale, Que., to take over and work the Harvey Hill copper mines at West Brompton, Que., and to acquire and mine asbestos, antimony, copper and chromic iron properties in the Province of Quebec. Dr. Reed purposes utilizing the fine water power of the Palmer Falls in the Township of Nelson to drive the electric plant. He wants \$100,000 working capital.

Boston and Nova Scotia Coal Co., Ltd.—The plans of this company have been altered so as to make Mabou Harbour, 14 miles from the mines, the shipping port. This will necessitate extensive dredging in Mabou Harbour, for, while inside the main harbor there is ample sea room and plenty of water, the channel leading to it for half a mile has a depth of 14 feet only. This change has necessitated an entirely new location of the railway, as the old line was some four miles from the proposed shipping pier. This new location has been made during the past summer, the intention still being to build the line through to a junction with the Intercolonial Railway at Orangedale, a distance, by the new route *via* Cape Breton, of forty miles.

The Standard Gas and Oil Company of Essex, Ltd.—Gives notice of application for charter of incorporation under the Ontario statutes with the object of drilling for Petroleum and gas in the counties of Essex and Kent, Province of Ontario. Aead office: Windsor, Ont. Authorized capital, \$400,000, in shares of \$100. The Directors are C. Currie, J. B. Moore and C. M. Swift, of Detroit; E. H. Harris, Kingsville, and A. H. Clarke, of Windsor, Ont.

British Columbia and Puget Sound Coal Co. Has been formed at Tacoma, Washington. Capital, \$10,000, in shares of \$100. Incorporators, W. L. Kinsey, E. E. Beharrel, W. W. Clifton.

Falun Mine of British Columbia.—Organized at Spokane, Wash. Capital, \$500,000, in shares of \$10.00. Incorporators, G. S. Anderson, O. G. Seward and A. Edlund.

PHOSPHATES.

The following returns of the output and shipments of Canadian Phosphates may be interesting as showing the worst year's business in the history of the industry:

Phosphate of Lime Co. to Great Britain.....	2,693 tons
British Phosphate Co. " " about.....	600 "
Phosphate of Lime Co. to United States.....	1,200 "
J. S. Higginson, Buckingham, to United States . . .	800 "
Sold to Capelton and Hamilton, Canada	700 "
On dumps at 1st December, estimated	3,000 "
	8,993 tons

Last quotations for 80 per cent. C.I.J. Liverpool 7d. per unit equal to \$11.65 at 8½ ex., and \$8.74 Montreal F.O.B., and \$6.88 Buckingham. Low grade 60 to 65 per cent. F.O.B. cars, Buckingham ground and in bags \$5.50 equal to \$3.00 per ton unground Buckingham; 70 per cent., 6d. per unit equals \$3.70 per ton Buckingham.

The following is a comparative statement showing the prices for Canadian Phosphate realized since 1882 to date:

Year.	80 per cent.	75 per cent.	70 per cent.	60 per cent.
1882	16d. with ½ rise	15d.	14½d.	—
1883	15d.	13d.	12d.	—
1884	14d.	12d.	10d.	9d.
1885	14d.	11½d.	10d.	8d.
1886	11d.	10¼d.	9½d.	9d.
1887	11½d.	10d.	8½d.	—
1888	11½d.	9½d.	8½d.	—
1889	12½d.	11d.	10¼d.	8¼d.
1890	16½d.	13d.	12d.	9½d.
1891	14d.	10d.	9d.	8d.
1892	10½d.	8½d.	7d.	5½d.
1893	9d.	7½d.	6½d.	5½d.
1894	7d.	—	6¼d.	5½d.

Last quotation 80 per cent. in June 1894, realized 8¼d., and in August 7½d., the last quotation being as given viz. 7d.

The following statistics were presented at the Antwerp Exposition, showing the increasing importance of the fertilizer industry in Belgium. The surface covered by warehouses and manufactories in 1888 was 65 acres; in 1893 it was 73 acres. The motive-power in 1887 was 1060 horse-power; in 1893 it was 1903 horse-power. In 1887 there were 1238 men, 137 women and 24 children employed; in 1893 there were 2065 men, 33 women and 35 children employed. The wages paid in 1880 amounted to 180,000 francs; in 1887 to 900,000 francs; in 1893 to 1,612,735 francs. The production of superphosphates in 1880 was 10,500,000 kilograms; in 1887 the production was 70,500,000 kilograms, and in 1893 it amounted to 256,372,000 kilograms. These figures refer only to the concerns of the members of the "Company General" of the chemical fertilizer manufacturers of Belgium, and to the manufacture of superphosphate for the chemical fertilizers, properly so-called.

CORRESPONDENCE.

G. M. Ass'n. Shipments.

Sir:—Referring to your remarks on page 216 of November number *re* General Mining Ass'n., Ltd., we would say that in 1893 this company shipped from two mines. One of these (the Victoria), which in 1893 shipped 29,700 tons up the St. Lawrence, was sold to the Dominion Coal Co. on 1st January, 1894; so that practically the General Mining Association, working from one mine alone (North Sydney) has increased its shipments to the St. Lawrence.

MONTREAL, 15th Dec., 1894.

CARBRAY & ROUTH,
Agents.

New Find of Copper Ore.

Sir:—I was requested a short time since to examine and report on a new find of copper ore, which is of some interest, both from its location in a new section (new, as a mining section) and the unusual character of its ore. This vein is situated in a land-locked harbour off the Georgian Bay, about 10 miles below the town of Parry Sound. The vein is from 6 to 16 feet in width, quite uncovered, and distinctly seen for upwards of one mile, save when covered by the waters of the harbour. The ore may be loaded on vessels of any tonnage, direct from the mouth of either of two pits, about 1,500 feet apart. The vein is mineralized from wall to wall, and is noteworthy as containing, at some points, nearly equal amounts of chalcopyrite and dark zinblendite; at other points a pure, clean ore of either metal, and again quite appreciable quantities of molybdenite. The gangue is an amethystine quartz and spar, making a beautiful ore in appearance. I would be obliged to any reader of the REVIEW who would inform me where I can see a deposit of commercial value, carrying such quantities of zinc and copper intimately mixed, or where such ore is being treated. I will be glad to send samples of this ore to anyone interested. Another vein has lately been discovered, about 10 miles from the above, which is a conglomerate, carrying bornite and chalcocite, with considerable free gold. At the time of my visit to this vein, a little dump pit had been formed, the dirt from which gave from 2 to 8 and 10 colors to the pan. The gold was crystalline or sharp in appearance, and apparently occurred in the quartz which cemented the vein. This was mostly clear and hard, but in places contained rolled grains the size of a bean, almost an opal.

TORONTO, 15th Dec., 1894.

W. THOS. NEWMAN.

Richardson Gold Mining Co., Ltd.

Sir:—I see that in your last issue you have classed the Richardson Mine among those working twelve months. Such is not the case. The mine was closed down and no quartz crushed for over two months during the past summer. This was while new plant was being erected.

As it is hardly fair to class nine and a half months work from this mine with twelve months production from other properties, I would take it as a favor if you would kindly have it rectified.

ISAAC'S HARBOR, N. S., 7 Dec., 1894.

C. F. ANDREWS, Manager.

LEGAL.

Tilley vs. Walker—This suit, of which some note was made in our last issue, came up for trial at Hull, Que., on 27th ulto. The three witnesses examined by Mr. Brooke, counsel for the plaintiff, were Mr. J. Burley Smith, Manager of the British Phosphate Co.; Sanborn Smith, laborer; and W. J. MacKenzie, merchant, of Buckingham. MacKenzie testified that he knew the defendant and the mine in question, that he did not consider the defendant solvent, and in fact his financial position was very bad; that he had about two years ago sued Walker for an amount of six hundred and odd dollars, for due bills of wages given by Walker to various of his employees, who had turned them in for payment of goods purchased at his (MacKenzie's) store, and that this judgment had been paid in instalments, by cheque of the Hon. R. W. Scott, there being a small balance still owing. In regard to the value of the mine in question, he said that he would not give \$5,000 for it. Cross examined by Mr. Belcourt, he admitted that he had no knowledge of minerals or of graphite mining; that this mine might be worth \$100,000 or \$500,000, for all he could say; that he was aware that the defendant had a very creditable exhibit of graphite in the window of his office in the city of Ottawa; that he did not know the value of the mineral. Sanborn Smith stated that he resided near the mine in question, and had worked in it occasionally; that the mine had never yielded a revenue, and that attempts had been made to work it two or three times in the last fifteen years, but they had been given up. Cross examined by Mr. Belcourt: He understood that the mine was now being worked and that a lot of money had been spent upon it during the last year by a Mr. Hammond, of Toronto; he did not know how much or with what success. Mr. J. Burley Smith knew the mine in question, but did not know the financial standing of the defendant, he considered the mine very valuable, but not as valuable as one of the same kind which he owned a short distance from it. This closed the plaintiff's case, and the defendant examined the Hon. R. W. Scott at considerable length, who testified that during the last ten months about \$30,000 had been expended by Mr. Hammond in excavations and mining, and additions to the buildings upon the property and in putting up machinery. He considered the mine very valuable, but could not say what it was worth; he thought it ought to be worth considerably over \$100,000. Cross examined by Mr. Brooke: He was interested in this case to the extent that he was interested in the property, having a large mortgage upon it prior to that of the plaintiff. He had paid a judgment taken against Walker by the attorney questioning him, partly out of his own monies, rather than have the property brought to a forced sale; he could not specify any *bona fide* cash offer that had ever been made for the mine in question; he would not deny having told Mr. Brooke when threatened with the seizure and sale of this mine that if this property was sold at sheriff's sale, that nothing would be realized by defendant's ordinary creditors and that he himself would probably lose the amount of his claim. Re-examined: The conversation referred to with Mr. Brooke was in the summer of 1893; since that time the mine had been worked and \$30,000 had been put into it. The case was then briefly argued by the counsel of both sides, Mr. Brooke urging that judgment should be rendered for the full amount of the mortgage, inasmuch as the insolvency of the debtor had been established, and that plaintiff has a right to his judgment, and it was not in the interest of justice that he should be obliged to incur the costs of another

action in taking judgment against an insolvent debtor for the principal, when it became due. Upon the question of \$650 of interest and the costs there could be no dispute. Mr. Belcourt, for defendant, urged that the proof did not substantiate the allegations of the plaintiff, and that in any case, it not having been established that the property had deteriorated in value since the giving of the mortgage, that the principal could not be considered exigible. Judgment was rendered for the amount of interest.

Allan Granger v. Fotheringham, Askwith, McMurdo, Irving, Ellis and McCabe—A *Warning to Claim Jumpers*—This action in the Supreme Court of British Columbia, was to determine the title to the 'Bobbie Burns' gold mine in the McMurdo Basin, B.C., and for its possession and damages. The Hon. Mr. Justice Crease, in rendering judgment for the defendants with costs, said "He who comes for equity, must do equity." The plaintiff himself bore witness in the box, and the evidence was drawn from him, that while doing business as a miner and a mine dealer, he obtained employment from the Mining Recorder in copying out the government mining records at Golden and at Donald; that it was May, 1893, while copying out such records at Golden, that he discovered the slip made on the 12th May, 1893, through the laches of Harry Cummins, the surveyor employed on Fotheringham's behalf, to complete the survey, notices, affidavits and certificates required by the act, as preliminary to obtaining the Crown grant of the 'Bobbie Burns.' He claims that he was allowed by the Mining Recorder, at the same time that he was so employed—living, too, for some time in his house, having constant access in the course of his duty to the government to the records—to practise his calling as a mining agent; in other words allowed to look out blots in mining titles—a permission which the Mining Recorder, who appeared as a volunteer witness at the trial, had no right whatever to grant, and plaintiff as an honorable man while in such employ had no right to accept. The Recorder, if he had such a right, could have exercised it himself. Now, no person in government employ is allowed to expose or himself take advantage of discoveries which he makes to the prejudice of others in the course of such employ. It is no answer to say that the public have free access to and can freely search all mining records—that is perfectly true and proper, *sub modo*—but a public officer, entrusted with the charge of public mining records, can only (except in exceptional cases, such as a record coming in at night in a race to record some new discovery, where five minutes may make all the difference) allow anyone to come in and search such records, or make his own, except within reasonable hours in the day, and then only, for very obvious reasons, in the presence of the Recorder or someone duly authorized in his stead to protect the records, which are frequently the only title which the working miner has to sometimes a vast amount of property. Any trifling with, or irregularity or favoritism in the keeping, or giving access to the records at unusual times, if known, will breed such a distrust among the mining population as will seriously affect their confidence in that department; a result which is earnestly to be deprecated, as it would be followed by all manner of evil consequences to the mining interests of that part of the country. While honest working and expenditure of capital, which was undeniably the case here in the opening and exploration of the mining ground, and in the employment of labor, should be within lawful limits encouraged. While mere colorable working, or neglect of working, should, under the stringent provisions of the Act in that behalf, be followed by forfeiture of the privileges which the holders have been proved by experience unworthy to retain, it is of the utmost public importance in a mining country requiring the safe investment of capital for its development and the steady employment of labor, that the practice of jumping claims by persons—who, not working themselves, make a business of hunting for accidental or unintentional slips in records happening to men more engaged in hard work underground, than accustomed to clerical work, hard-working (prospectors, who undergo infinite labor and hardships in bringing hidden wealth to light)—should be discouraged, as they always have been by this court. They are the parasites who always hang about rich mining camps. Long experience in mining camps, including British Columbia itself, from Cariboo downward, shows that there is no more fertile source of insecurity of investments (and money is a sensitive plant) ill-blood, ill-feeling, not unfrequently culminating in violence and bloodshed—than the practice of what is known to miners by the terms of jumping claims. For the reasons already given, and after a most careful consideration as a jury, as well as judge, of all the sections of the Gold Mining Acts, evidence and arguments adduced on both sides, I find myself constrained to, and accordingly do give judgment for the defendants, with the usual accompaniment of costs.

Phosphate Milling and Shipping Co. vs. Montreal Warehousing Co.—In the Superior Court, Montreal. This was an action to recover damages for the loss of a barge. The court held that the plaintiffs had proved the following facts: That while the barge Alice Pacy, belonging to them, was moored alongside the steamship Amyrinthia, in the harbour of Montreal, and was discharging her cargo of phosphate into the Amyrinthia, the barge Saturnary, which was then being towed by the tug W. C. Francis, violently struck and collided with the Alice Pacy, which was in such a position as to be unable to escape the full force of the collision, she being caught between the steamship and the barge, and this collision was caused by the unskilful and negligent manner in which the barge Saturn was navigated. The barge Alice Pacy was so injured by the collision that she began to take in water and had to be towed ashore and grounded, and, in fact, became a total loss. At the time of the collision the barge Saturn was under hire to the defendants and was under their control, and they were responsible for the damages. The court further held that the collision was not one of those which a barge might be expected to sustain in the ordinary course of navigation. As to the value, it was shown that the plaintiffs had paid \$1,250 for the barge, and at the time of the collision it was worth at least \$1,000. The defendants had failed to prove that the loss of the barge was owing to her unseaworthiness or to the negligence of the plaintiffs in mooring or overloading her. Under all the circumstances the plaintiffs were entitled to recover \$1,000, value of barge; \$20, expenses; and \$2.15, difference between amount realized by sale of wreck and auctioneer's charges, making a total of \$1,022.15, for which amount judgment was rendered in their favor by Mr. Justice Ouimet.

Fatal Accident at Sudbury—On Monday 10th instant, at the Copper Cliff nickel mine, Wm. Martin and a number of men were employed scaling in the shaft leading down from the seventh level to the bottom of the mine. The shaft is about 125 feet in depth, and the men were on a platform of 3-inch plank, about forty feet down from the level. While at work a large mass of rock was loosened, and one of the men gave warning, but before all could get safely out of the way it fell on the plank on which Martin was standing, smashing it, and he fell to the bottom, more than 80 feet, falling into eight feet of water. His companions were quickly on the spot, and locating his position by the air bubbles, he was quickly got out, still alive, but unconscious, in which condition he remained until Tuesday evening, when he died at the Sudbury Hospital. Several ribs were broken, and there were a number of other wounds and bruises on the body, principally on the head and breast.



Mining Society of Nova Scotia.

Report of the Proceedings of the Autumn Meeting.

Continued from November issue.

The evening session was called to order in the Halifax Hotel at 8:15 p.m., (Tuesday, 6th ulto.) Mr. John E. Hardman, President, in the chair.

THE CHAIRMAN—The only thing we have on the tapis this evening is the discussion of those papers which were read at the Cape Breton meeting. The first paper is that by Mr. Blakemore.

"THE INTRODUCTION OF ENDLESS HAULAGE INTO CAPE BRETON."

MR. POOLE—Mr. Blakemore gives us so much information of value and so many details, that I venture to ask him for one or two more; I notice his driving wheel has its periphery curved like the letter C, and not merely inclined, say at 5 degrees, to one side as in many cases of endless haulage. When the inclined tread is used the rope enters on the high side, makes its three turns and comes off on the lesser diameter, slipping slightly onward as well as sideways. It is contended that this arrangement taxes the rope less severely than the plain surface. I noticed the driving pulleys of the New York Cable Tramway have their faces horizontal but grooved, and these with use and wear must in time have the entering groove reduced in diameter with a consequent tightening of the coils with each succeeding turn and give an increasing strain on the rope. Whether this strain has proved of serious moment I am unable to say; perhaps not, as the driving wheels are of exceptional size.

Speaking of the relative advantages of endless haulage compared with other systems on a grade of 1 in 12 the claim is made that it would be as easy to haul 1000 tons a day by endless rope a distance of 5 miles as the same quantity $\frac{1}{4}$ of a mile by any other system. While admitting many advantages appertaining to endless haulage, I am unable to accept the proportion as so large. With a good road, I have known a speed of not 10 but 15 miles an hour in mid-run, and with a double track, which endless haulage also requires, an equal output was met for the distance named and that on a greater inclination than 1 in 12, with reciprocating ropes, while the strain on endless haulage 5 miles in length would, it seems to me, be excessive and call for a rope of unmanageable weight.

In connection with endless haulage I may here anticipate a future hoped for report on a trial at the Albion mines where the grade will be very severe, about 30°, yet, I am assured the system can be satisfactorily adopted on such an inclination, and preparations are now being made. Much, doubtless, will depend on the make of clip used for clamping the boxes to the rope, and I would like to know the style Mr. Blakemore has found efficient on his lighter grade.

I may mention what I do not suppose is generally known, that when the tail rope system was introduced at Springhill a few years ago, no less than 27 miles and 300 yards of ropes were bought to equip the pits, and if a description of the system in use here could be obtained it could not prove otherwise than of great interest to our Society.

MR. FERGIE Mr. Blakemore puts the safe limit of speed at a maximum of eight to ten miles, where as a matter of fact we run, not at ten miles but as high as twenty miles an hour with safety on our slopes in a distance of four thousand feet. Ours is the plain haulage system, direct action, double road. We have no difficulty at all. We have no difficulty with the boxes, no difficulty with the speed. We can bring up about 120 tons an hour for a distance of four thousand feet, provided the faces give us the coal.

MR. DICK—Mr. Poole said he was at present fitting out a haulage at the Albion Mines. He might give us a paper on that.

THE CHAIRMAN—As I understood from one of Mr. Poole's remarks, the haulage system has been in use at Springhill for a long time. It would be interesting if some of the people acquainted with Mr. Cowans, would induce him to give us a paper on that subject.

MR. DICK—I expect to go there shortly. If he likes to give me the facts I could present them.

MR. FERGIE—Springhill has the tail rope system.

MR. ARCHIBALD—They have had that system in old Sydney mines for ten or twelve years.

MR. FERGIE—Mr. Blakemore said he would give preference to the endless rope haulage system in any case. I would like to have asked him, taking seams like those in Pictou where we work the coal by pillar and stall and run out our level three or four thousand feet, whether he would consider the endless rope better. I think it is not; for in our system, once we are at our boundary, our levels are being shortened every day, and the system is too elaborate where they are only going to last a few years. With the endless rope you must have a double track, and consequently drive wider levels.

MR. ARCHIBALD—I think he makes that exception; and he further says that where the roof is bad it means increased cost of maintenance.

MR. FERGIE—Where you are sending out twelve boxes to the train there would be no object in putting in the endless rope, because you would require separate attendance with each box.

MR. POOLE—His rope could not be a very heavy one.

MR. FERGIE—I agree with Mr. Blakemore that where you can put in a permanent system of haulage it is better than any other system.

MR. BURCHELL—I don't think he is in favor of it where the grade is very steep.

MR. ARCHIBALD—As to the way in which the rope is applied to the wheel, it struck me that if a certain strain was put on it, it would slip, and that would be difficult to regulate.

MR. FERGIE—You must have a special driving pulley.

MR. DICK—On the Brooklyn bridge the rope goes three and a half times around both driving drums. The drums are not in the same plane, one is slanted slightly.

MR. BLAKEMORE—Replying first to Mr. Poole's remark on the construction of driving wheel. I am acquainted with the alteration he refers to in the periphery of the wheel with an inclined tread instead of being semi-circular as in the "C" wheel. I have used both classes of wheel, but my experience is that the "C" wheel gives better results. I found that in course of time the wheel with the inclined tread grooved deeply at the lower edge of the tread, and I also found that in the earlier stages the rope was more disposed to slip than on the "C" wheel. The only objection to the latter is the side friction of the various coils of rope as they press upon one another and are forced across the tread of the pulley; but if leading pulleys are used, so as to open out the ongoing and offcoming rope a little, this side friction is reduced to a minimum; and in fact I do not know that it has any appreciable effect upon the life of the rope. I should also remark that I am now having loose segments of cast steel to form the tread of driving pulley; these being moveable, can be taken out as soon as they are grooved, and replaced by others. In this way, I believe that the "C" pulley is calculated to give the best possible results.

I notice Mr. Poole's reference to the grooved pulleys, which are such a notable feature of endless rope traction in the United States, but besides the objection I mention I would point out what is really the most important objection to their use in mines; this is, that they hold the rope almost as firmly as does a clutch pulley. Now the object of the "C" wheel is to allow the rope to slip, in the event of a tub getting off the road, or any other obstruction to the free passage of the journey. The engineman at once notices that the rope is slipping, stops his engine, and so prevents breakage. This will be impossible either with a grooved or clutch wheel.

Replying to Mr. Poole and Mr. Fergie on the broader question of the relative advantages of endless haulage compared with other systems, I may say, that whilst I am well aware that under exceptionally favourable circumstances journeys are hauled out on the single rope system at a much higher speed than 10 miles an hour, I maintain that on such a system the wear and tear, and also the risk, is much greater than with a slow haul. It should also be borne in mind that much larger engines are required for the higher speed; whereas the endless haulage can be worked with a very small engine, because, running slowly, you can afford to gear it as high as 8 to 1. But I would point out that however excellent the arrangement might be for single hauling, or even main and tail rope hauling at a high speed bringing out a journey at a time, there is a limit to the distance which any practical machinery will fetch a large output of coal, say, 1,500 to 2,000 tons a day; and that distance is unfortunately reached all too soon, in the case of a large mine; whereas, distance does not enter into the consideration of the engineer who is able to put down endless haulage. And here I wish to correct a misapprehension, probably due to inadequate explanation in my first paper on this subject; when I stated that it was as easy to haul by the endless rope system a distance of 5 miles as one, I did not say with the same machinery and appliances, but I meant, and maintain, that the system is as easily adapted to the one distance as the other. Now I put it to any practical engineer, first of all, whether it is possible to haul 2,000 tons a distance of 5 miles, or even 2 miles on the single rope, or main and tail systems, that is bringing out large journeys of coal each trip, assuming a dip of 1 in 12, but suppose it were possible, let him sit down and calculate what size engines he would require, what steam power, what strength of rope, and what size of pit tub to achieve this result; and then let me set against that the fact that a pair of horizontal high pressure engines, with 24 in. diam. cylinders and 5 foot stroke, geared one to eight, and furnished with steam by 1 Babcock, or 2 Lancashire boilers 30 x 7 feet; and a steel cable $1\frac{1}{2}$ in. diam., with tubs carrying, say 2 tons each, would easily deliver the larger quantity mentioned from a station 5 miles distant, under the conditions named, in every working day of 9 to 10 hours. Of course the longer distances to which I am able to point on the endless haulage system are not in a mine, but upon the surface, and I would refer to one with which I am well acquainted in the City of Birmingham, England; there the cable is 14 miles long, the haul being 7 miles from start to finish; the engines are placed midway, and travel the cars at the rate of 8 miles an hour. The grades are very steep, as much in places as one in six, and over the whole distance the road is undulating. At times there are as many as twenty cars, each weighing about 10 tons, without passengers, and the size of the cable is only $1\frac{1}{4}$ in. diameter. The system works perfectly, and has already far superseded in popularity and effectiveness the steam tramway and the electric tramway, which are both operated in the same city; and on the score of economy I may say, that since the introduction of this system the concern has for the first time been placed upon a paying basis; steam and horse traction both having previously been tried.

The last remark I would make is this, I have successfully installed and worked endless haulage in North Staffordshire, Eng., and South Wales, on grades as steep as 1 in 4, and as time goes on I am more than ever convinced that this method of haulage must ultimately supersede all others. It is, of course, somewhat difficult to introduce it in a mine that was not originally laid out for the purpose, as it works to the best advantage with good straight roads laid from the shaft. At the same time, there is no other system which works better round curves, if every detail is carefully attended to in the laying down. I think the most significant fact in connection with the whole subject is that in Northumberland and Durham, where the tail rope system had its origin, and where it had been adopted in nearly every important mine, to-day you find more endless haulage than tail rope, and the latter is gradually being crowded out by its successful rival.

"COAL CUTTING MACHINERY AT THE COLLIERIES OF THE DOMINION COAL CO."—DISCUSSION ON MR. J. G. S. HUDSON'S PAPER.

MR. DICK—I want to say a word or two in regard to the Stanley Header. I think it is unfortunate that Mr. Hudson is not here. The question of machine vs. hand labor is of great importance. I notice that Mr. Hudson says that they drove a heading 32 ft. 6 in. from 6 p.m. to 4 a.m. I read in the transactions of the Scottish Mining Society that at the Palace Craig colliery in Scotland they are driving a heading 11 ft. wide with a pair of Stanley headers, one 100 feet ahead of the other, and leaving a rib of coal 1 ft. thick between the headers for the purpose of ventilation. The decision they came to on the work of these headers was that it cost twice as much to drive the headings with the machine as it had cost them with hand labour, but that it did it in one quarter of the time. In driving out the preliminary headings speed is of great advantage. I would like to ask Mr. Hudson if he had any experience with the Stanley header in a seam of coal where there were slate bands. That point has never been brought out. I should like to know also how the water in the headings effected the working of the heading machine.

Regarding coal cutters, we find that the Harrison and Ingersoll machines are a distinct kind that are received with favor on this side of the Atlantic. I believe they are thoroughly in advance of any English cutter so far as pillar and stall work is concerned. This Society should appoint a committee for the purpose of investigating the relative cost and efficiency of the English and American machines in pillar and stall

working. I should like to know what percentage of the time they require in moving the Harrison and Ingersoll machine as compared with the Jeffrey machine. Mr. Hudson said that any man of ordinary intelligence could work the Harrison and Ingersoll machines. I have been told by a man using this machine in the United States that he found that of all the men put to work on the coal cutter there were only five per cent who could stand the shock of the machine. That is in variance with Mr. Hudson.

As to the efficiency of the machines, I got up a paper a year ago on this subject for the "Mineral Industry," and I found from the data I had that these percussion machines cut \$2-8 tons per day in a 7-ft. seam and 20 tons in a 3-ft. seam. In England they cut as high as 90 tons per day in a 2 ft. 6 in. seam and undercut 450 lineal feet of face. I think it is hardly possible to do it. I could not get this amount of efficiency out of a Gullet and Copley disc machine. This work was done in a long-wall seam. In one seam in Scotland the manager got a disc machine to travel along the face 9 feet every minute. I question this very much. I am simply raising this to try and find out whether the percussion machines can do that amount of work. The disc cutters cannot get through iron stone balls in the holing; it will strip the cutters off. With the percussion machines they dodge these balls.

MR. ARCHIBALD—I worked the Ingersoll machine for a while. There is no trouble about shifting. I mean it is adapted for pillar and stall work and the advantage in long wall would be this. In starting the cut there is time lost, but when you get it in it is all right. The one I work is only 500 pounds. A man could work it easily. After you get it in 3 feet there is no time lost in moving it. You could simply draw it out of the way in a minute and clear away the coal.

MR. BURCHELL—One man at Caledonia has mined 90 tons

MR. FERGIE—What power does it take to drive the Ingersoll drill?

MR. BURCHELL—Sixty pounds of pressure. We have our compressors 16x18 and I don't think they will drive any more than five.

MR. SWORD—Mr. Dick has not given the disadvantages of the long wall cutter. They cut small slot and the coal drops right where it is mined, and has to be blasted out. In the other case it rolls down on the face.

MR. BURCHELL—We have never had the coal come down in such a way that we could not get at it.

MR. SWORD—The longwall machines are all right where you have a good face and good room. You must have everything in good order or you can't get the... to work. It is expensive repairing them, while an ordinary blacksmith can do work on the other cutters. I think if the longwall cutters were such great things they would be used to a greater degree in the United States.

THE CHAIRMAN—Why is it that the disc cutters have not found favour on this side of the Atlantic?

MR. DICK—I want to know that myself.

MR. FERGIE—Where they are used in England the seams are thin. On this side they are thicker.

MR. ARCHIBALD—Because there is not longwall work in this country. In Cape Breton they are just experimenting in the Cowrie mines.

MR. DICK—They are working a seam in Scotland of the thickness of 4 inches, with a band of ironstone about 1 foot.

MR. ARCHIBALD—I think the machine they are experimenting with in the Gowrie mine has produced 150 to 200 tons per day, but of course it goes straight along.

"THE RAILWAY SYSTEM OF THE DOMINION COAL CO."

THE CHAIRMAN—I do not expect any discussion on that paper.

MR. FERGIE—I think that a number of our members wish that it had been built sooner, so that we could have gone that way to Louisburg.

"SINKING OF DOMINION NO. 1 SHAFT."

MR. POOLE—I think it would be well to show in the sketch that the irregularity in the dip is false bedding in the ply.

"THE SYDNEY COAL FIELD"—DISCUSSION ON MR. HUGH FLETCHER'S PAPER.

MR. H. S. POOLE—That Mr. Fletcher's paper is an excellent resumé of the geology of the Cape Breton coal field goes without saying, and that it will furnish for some time to come the standard text book on the subject there can be no doubt. In only one respect would I ask to have it added to, and that is in connection with the paleontology of the field. Students and summer visitors interested in the subject would desire to have directions how to readily find localities where fossils of the different horizons are likely to be met with, and Mr. Fletcher will add to our obligations by making notes to this effect. College professors and students who take vacations in Nova Scotia and find our province a fertile field for study in many formations so well exposed in coast and river sections will gladly avail themselves of the information. I understand another addition of the large map on a scale of one mile to an inch is likely to be issued by the Survey at Ottawa, and it is expected to show discoveries that have been made since the map was first issued some years ago.

MR. FLETCHER—As much had been done by Mr. Brown on the west coast of Sydney Harbour which offers such fine exposures of the rock which show fossils, and he had described so many in that section in the neighborhood of the coal seams, and as these seams could be traced through from end to end, it seemed unnecessary to mention every place where fossils could be found. One of the most interesting places is the Carson pit near Sydney. Here ended the limestone formation which contained fossil shells. So much has been published about the different parts of this shore, that a simple reference to localities such as made on the geological maps would be sufficient.

MR. POOLE—If Mr. Fletcher would kindly add a reference to localities where the different fossils could be found, strangers coming in could turn to the paper and find where they could go at once, without turning to geological maps.

MR. FLETCHER—The oversight arose from my following Robb's work. I will sometime try to remedy the defect.

THE CHAIRMAN—I would suggest that Mr. Fletcher amend that and say that he will do it immediately.

"GOLD MINING IN NOVA SCOTIA—A REVIEW OF OPERATIONS IN THE VARIOUS LOCALITIES."—DISCUSSION ON MR. RUTHERFORD'S PAPER.

THE CHAIRMAN—I have been told by one or two members to-day that they would like to say something about that.

MR. ANDREWS—One of the points raised was a comparison between the profits in mining in high and low ores. In my district of Stormont the returns given in this paper for the period of from 1862 to 1871 for the average yield of gold per ton of quartz was 1 oz. 6 dwts. and 12 grs.; from 1871 to 1881, 1 oz. 5 dwts. 4 grs.; from 1881 to 1891, 1 oz. 7 dwts. and 15 grs. He also added an aggregate statement showing the average yield over the entire period of 30 years in each locality. This statement makes the average for Stormont 1 oz. 6 dwts. and 10 grs. Underneath his first

quotation of the first ten years he makes the average yield from all localities, 1 oz. 1 dwt. and 14 grs., but continues to say, "now this must surely be considered a very remunerative yield, and it calls for special attention in connection with the remarks that occur in the reports of the Commissioner of Mines on the varying energy with which mining was carried on, &c., &c." I take exception to that. In my district the mines operated since 1891 have been low grade, from 5 to 9 dwt., yet to my own knowledge there has been more money made in mining these low grade ores, than there was in all these years when the high grade ores were being mined. Later on he says: "One of the earliest references in this connection is made in the Chief Commissioner's report for the year 1869 in which it is stated that a lode at Lawrencetown that yielded 16 dwts. per ton was raised and crushed at a cost of \$4.00.

"In other official reports it is stated that one lode at Tangier of mixed quartz and slate could be raised and crushed at a cost of \$2.50 per ton." It does not state that it was ever raised for this sum. "And in another case a yield of gold of 4½ dwts. will pay all expenses. In another locality the cost is placed at from 8 to 12 dwts." Then I see he goes outside of the province. "It is stated in the case of two gold mines in Australia, with reference to the cost, as it may be inferred from the payable yield of gold, that at one of these, 2 dwts. 21 grs. per ton proved sufficient to pay the proprietors ten per cent., and at the other the average yield in 1870 was only 4 dwts. 20½ grs., in connection with which it is remarked that the quantity of gold lost in the early stages of gold mining in Nova Scotia sufficed in Australia under careful management to give a fair profit to the adventurer." I find in going over some figures to-night we at our own place have done better than that. Since the 9th of August to the 1st of this month we have paid out \$5,504.00 for mining, carrying to mill, crushing and placing the gold in the market at Halifax. We have milled 2,372 tons, which make the actual cost delivered in Halifax \$2.27 per ton.

MR. POOLE—Does that include office expenses?

MR. ANDREWS—Yes. It does not include anything for the falling off in value of the machinery.

THE CHAIRMAN—What was the size of the vein mined during that time?

MR. ANDREWS—The narrowest part of the vein was seven to nine feet and it runs up to twenty feet. Average seventeen feet. Nine tenths of everything mined was sent to the mill. It was 120 to 125 feet below the surface.

THE CHAIRMAN—I made some remarks at the time Mr. Rutherford read his paper. Mr. Andrews' statement shows a most promising outlook for the gold mining industry of Nova Scotia at the present time. Mr. Andrews is not the only man who has succeeded in mining low grade ores successfully. There are two or three others in the province, among them the Antigonish mine at Country Harbour. I have one case in mind where the quartz vein is only twelve inches and after allowing for mining, milling, insurance, taxes and 12 per cent. for depreciation the cost is less than \$3. Up to the period at which he has confined his figures that statement at the head of the paper might be open to discussion, but in view of the figures given by Mr. Andrews the answer must be "Yes, it is worth the candle."

I am sorry that Dr. Gilpin is not here. He would bear me out in saying that he has not based his reasoning thoroughly on facts. There are several gentlemen who would say that the figures given by Mr. Rutherford are not conclusive. It is open to assail his argument because his premises are assailable. His criticism regarding the tailings is entirely wrong in my opinion. I heard I would be hauled over the coals for what I said as to the value of the sulphurets. I stated that in five districts in my experience the value of these sulphurets would not exceed \$20 per ton. I have only tested the tailings in one property in Cariboo. I would like to have additional information thrown on this subject.

MR. STUART—What depth was this twelve inch vein?

THE CHAIRMAN—Average depth 300 feet levels. The stoping was done by hand, drift by air drills. The cost of driving the levels ahead each month is included.

MR. STUART—I would like to ask Mr. Andrews whether his mining was by hand or power drills?

MR. ANDREWS—Hand drills were used in my case.

MR. MASON—I have seen palpable gold in some tailings. It is impossible to strike an average in tailings. Some of them have run two to three dwts. to the ton.

THE CHAIRMAN—A point I desire to criticise in Mr. Rutherford's paper is about the thirty per cent. waste. It is a very old story that every year we have from one to twelve men coming into this province who have just the machine to take more gold out of the tailings than nature put in them. If you take Mr. Rutherford's figures of eight dwts. obtained by milling you must assume 33 per cent. to have been lost.

The experience has been that there is no accumulation of tailings which will give \$4 to the ton. The average value of his gold is given at 15 dwts. That would make the average value of tailings 7½ dwts. That ought to prevent the patent process man coming in here.

MR. WILLIS—I was at Oxford three years and I made assays on every mill-run made in that time. The samples were taken every day once an hour. I tested these tailings in all sorts of ways. I used to concentrate. They gave from two to three per cent. in concentrates. These concentrates were worth seven to eight dollars.

THE CHAIRMAN—In Okham the sulphuret assay in bulk averaged about \$75 per ton. At the same time in Waverly the average of the sulphurets was about \$8 per ton.

VOTE OF THANKS FOR COURTESIES DURING CAPE BRETON MEETING.

The following resolution was carried unanimously: "The hearty thanks of the Mining Society of Nova Scotia are hereby tendered to the Dominion Coal Co., Ltd., and the General Mining Association of London, for the courtesy extended in opening their colliery and surface works to this Society and its fellow-guest, the General Mining Association of the Province of Quebec, for visiting and inspection at the united meeting held in Cape Breton last July; and also to Messrs. MacKeen, Blakemore and R. H. Brown, for their great personal kindness in attentions shown and hospitalities extended to the visiting members and the ladies of their party; and also to the president and members of the Sydney Club, for courtesies extended."

The meeting then adjourned to the dining room, where an oyster dinner was served; after the dinner the newly elected members were called upon and replied by songs and speeches.

Advices respecting the Winnipeg coal market report that Souris coal continues to meet with a good demand, and the new pit opened this fall is giving better satisfaction than that supplied last winter. Prices delivered to consumers in Winnipeg are as follows:—Imported anthracite, \$9 per ton for egg, stove or nut sizes; western anthracite, \$8.50 per ton for stove and furnace size; Lethbridge bituminous, \$7.50 per ton; Souris lignite, \$4.25 delivered or \$3.75 on cars here, and \$1.50 to \$1.75 on cars at the mines.

The shipments of coal from the New Vancouver Coal Mining and Land Company's collieries for November were 21,579 tons.

Mica: Its Uses, Mining and Trade in India.

By EDGAR THURNSTON, Reporter on Economic Products to the Government of India.

In view of the importance of Canadian mica mining, the following excerpts from a paper published by the Imperial Institute, (Indian Section, No. 19), will prove of interest to our readers.

The somewhat exceptional nature of the petrological conditions necessary for the formation of large sheets of mica must always be a serious contributor to the irregularity of its production, and make a local industry of a somewhat precarious nature. Moreover, large crystals, which have been formed under the most favorable conditions, may for industrial purposes, be rendered useless by subsequent changes; from the nature of the mineral it is extremely liable to depreciation. The transparency, for example, is sometimes wholly or partially destroyed by interlamellar inclusions or infiltrations of other mineral substances. In the Nellore district, large sheets of muscovite, otherwise devoid of flaw, are rendered almost useless on account of the included films of brown and black material in bands crossing one another at angles of 60°, like the dendritic inclusions in the Pennsbury and New Providence (Pennsylvania) muscovite, which Dana proved to be thin films of magnetite. Secondary decomposition by exposure to weathering agents impairs the transparency of the crystals; and being one of the weakest of rock-constituents, it suffers deformation from the slightest earth movements, and thus becomes permanently disfigured by irregular crumplings, or by fractures along the cleavage, and so-called "gliding-planes." On account of these circumstances there is always a wide, and exceedingly variable, margin of waste in mica mining; but the percentage of rejected material is subject to such great local variations, that it is impossible to give an estimate of any value for a large country, or for any considerable length of time in a limited area.

The minerals included by mineralogists in the group of *Micas* are frequently known in commerce as *talc*—a name now reserved for the foliated variety of steatite, a hydrous silicate of magnesia occurring in "micaceous" laminae and scales, which are flexible, but not elastic, as is the case with mica, and which differ from the latter mineral also in possessing a soapy touch. This confusion between the two names seems to have extended as far back at least as the 16th century, when Agricola, in an appendix to his works (1546), speaks of *talc* and *glimmer*, (the name now used in Germany for mica) in a manner which showed that they were characterized by sparkling star-like appearances as seen in scattered flakes of either mineral. The word *talc* is said to be of Arabic or of Moorish origin, and refers either to the glittering spangles, or to the phenomena of *asterism*, frequently displayed by micas (especially some phlogopites) when a candle-flame is viewed through a sheet of the mineral; and the frequent use of the substance for windows before the invention of glass may have facilitated the observation of this peculiar property. If this explanation be the true one, then the mineralogist, not the merchant, is for once in error in so limiting the definitions. But whoever may have been the original offender in introducing the not unnatural confusion, we shall, for the sake of convenience, employ only the more generally established name, *mica*, for the minerals described in this hand-book.

USES OF MICA.

The peculiar physical properties of the micas have secured for these minerals very widely extended uses in the arts—the size of the crystals, their highly perfect cleavage, their flexibility and elasticity, transparency and athermancy, chemical stability and imperfect powers of conducting electricity and properties which no other mineral can combine, and which cannot be readily or cheaply imitated by artificial means.

Use in Windows and Lanterns: The earliest use of mica was probably in windows and lanterns, and for some time the material was known as Muscovy glass (*Vitrum Muscoviticum*), the name *muscovite* being restricted to a special variety by Prof. J. D. Dana in 1850. It was, however, subsequently replaced by the cheaper artificial substance, glass; but in the early stages of glass manufacture, when the processes for annealing plates had not been devised, mica was still retained for use in places where the window would be subject to sudden shocks or violent vibrations, as, for example, in the windows of men-o'-war, where the shocks of artillery firing shattered the badly annealed glass. Since, however, the annealing of glass has been brought to such perfection, it has entirely replaced mica even for this purpose. In lanterns mica has been replaced by glass and horn; but in places where there would be considerable risk attending a breakage, mica is still retained to some extent for lantern uses.

Stoves: No artificial transparent substance has, however been devised to replace the mineral where high degrees, or sudden changes of temperature take place. It has, therefore, considerable use in anthracite-stoves, where it is desirable to obtain the cheerful glow of the fire without the direct heat. Its transparency is little affected by the repeated and alternate heating and cooling, and it is not readily attacked by the gases and vapors, although it does not so effectually resist the attacks of the gases from a bituminous coal, and is, moreover, so quickly blackened by the soot, that it soon loses its transparency. Its use, therefore, is confined to anthracite or to gas-ashbestos stoves.

Lamp Chimneys: Chimneys for oil and gas lamps with round burners are sometimes made of mica, especially those outside drapers' show windows, where glass would not stand rain-drop splashes and sudden changes of temperature, whilst a breakage would involve considerable risk from fire.

Fire Screens: In consequence of its transparency for light and its capacity for radiant heat, we find mica employed as fire screens, in the peep holes of furnaces, and as screens in the laboratory and workshop for observing the processes in a highly heated furnace without suffering from the intense heat.

Electrical Appliances: Mica has been used for vibrating plates in the photophone, Edison has employed it also for vibrating plates in the telephone, and as a substitute for glass in the reflectors of electric lamps. By far the largest demand for this mineral for electrical purposes obtains in America, the construction of dynamos and electric motors finding an important use for it on account of its excellent insulating properties and its elasticity; strips of various dimensions, but usually about one inch wide and from four to eight inches long, being used. The main drawback to use of the mineral for this purpose is its want of toughness. Perhaps one of the latest uses to which ground mica has been applied is in the manufacture of the insulators on telegraph poles.

Ornamental Uses: Probably the most extensive use of mica, at least in India, is for ornamental purposes, either in its natural state or artificially colored. In the days of ancient Rome the powdered material was scattered over the surfaces of the amphitheatre, to obtain a brilliant glistening effect. In India it is used at native festivals, marriages and in the Mohomedan maharam for processional ornaments as lamps and tinsel decorations on banners, on fans, in temples, palaces, etc. The powder is used for ornamental pottery, on curtains and cloths, in calico-printing and by the *dhobi* (washerman) to give a sparkle to cloth, to which the fine particles easily adhere. Coloured micas have also been suggested as a substitute for coloured glass, but its use in this direction must be limited, and as the coloured micas contain larger proportions

of iron, they are more susceptible to destruction when exposed to the weather. There seems no reason, however, why the quantities of amber-coloured biotites, as well as the muscovites, with inclusion of magnetic oxide in regular patterns, should not be so used in unexposed places. Natives in the Trichinopoly district of the Madras Presidency, and elsewhere, sell large numbers of pictures and portraits painted on mica sheets of various sizes. The writer is informed by the Collector of Trichinopoly that the mica used in that district for painting pictures on, etc., is purchased by the painters from the Marakoyers (class of Mussulmans) of Negapatam, who purchase large quantities of mica every year from ships arriving there from Calcutta and other sea-coast towns, for making the big taboos for the Kanthiri festival, and retail some to the painters. Mention may be made of the use of mica for ornamental purposes by the aborigines of America, where it has been found in the graves of ancient tribes of Indians, and in localities which would indicate a certain amount of commercial intercourse amongst widely separated tribes, during, what has been called by an American writer, prehistoric times, although it must be understood that the local interpretation of that term does not necessarily imply anything very ancient.

Utilization of Mica Waste: The utilization of waste mica and clippings became an important consideration in the latter development of the industry. There are a few firms engaged in the grinding of mica waste, the products being sold in different grades. Some of this is used as already indicated on wallpapers and for other decorative purposes, some is used for steam and water valve seats; the poorer qualities are sold for mixing with fertilizers, for which purpose it is claimed to aid in the retention of moisture. In consequence of this property also it has been used in an absorbent for nitroglycerine in the manufacture of one of the forms of dynamite known as "rend rock," or "mica powder." The poorer grades of pulverized mica are successfully employed, when mixed with graphite or grease, as a lubricant for carriage axles.

The substance recently named "micanite" by its inventors seems to add another, and perhaps, successful means for utilizing mica waste. The films of mica are cemented together, and moulded to make sheets—plain or curved—tubes, and other forms for electrical uses.

Under certain circumstances mica would be a convenient substitute for glass plates or celluloid films in photography, if perfectly polished and even plates could be obtained.

Used by Hindus in Medicine: Finally amongst the many uses to which this wonderful mineral has been applied, may be mentioned the use of black mica by the Hindus in medicine. According to the Sanskrit writers it is first purified by being heated and washed in milk; the plates are then separated and soaked in the juice of *Amarantus polygamus*, Linn, (*tandulia*) and *kaufika* for eight days. It is then reduced to powder by being rubbed with paddy (rice) within a thick piece of cloth; the powder passes through the interstices of the fabric and is collected for use. In this form it is called dhanpalhraka. It is further prepared for medicinal use by being mixed with cow's urine and exposed to a high degree of heat for a hundred times. The process is said to be sometimes repeated one thousand times. When this is the case the preparation is called *sahasra putta abhra* and is sold for as much as R8 per *tola*. Mica thus prepared is a powder of a brick-dust colour, and saline earthy taste. It is considered tonic and *aphrodisiac*, and is used in combination with iron in anaemia, jaundice, chronic diarrhoea and dysentery, chronic fever enlarged spleen, urinary diseases, etc. Its efficacy is said to be increased by combination with iron. Dose: grains six to twelve (U. C. Dutt, *Mat. Med. of Hindus*). Ainslie states that the Vytians consider mica to have virtue in pulmonic affections, and a dark sort to be of value in flux cases. He further mentions that the Chinese imagine it to have the power of prolonging life. Although the effects obtained or imagined to be obtained, in these cases are more probably due to the substances administered with the mica, it certainly possesses one property which cannot be claimed for all medicines—it is perfectly inert and harmless.

By-Products: Mica is invariably associated with feldspar crystals, and these have very frequently undergone considerable decomposition by the action of percolating atmospheric waters with the result that kaolin—often very pure—is produced and may be washed out for use in pottery manufacture; and, in fact, in America the Indians in the 17th century carried this mineral from the mountains of north-west Carolina to the sea-board for exportation. It has been proposed to utilize the large quantities of potash in the felspars sometimes associated with the mica for the manufacture of potash salts; but this is not likely to be practised in India or indeed anywhere whilst the wonderful beds of soluble salts at Stassfurt last.

INDIAN MINING AND TRADE.

Mica seems to have been an article of commerce for several hundreds of years. The aboriginal Indians of North America were apparently acquainted with the mineral, and have left considerable traces of excavations made for raising it. It has been commonly found in the graves of Indians east of the Mississippi, and in localities which show that a considerable amount of intercourse must have prevailed between widely separated tribes.

In India, too, the natives have long applied mica to industrial purposes, and have mined it in large quantities, especially in Bengal. European methods are, of course, now employed and need no special description. The methods formerly pursued by the natives in the Behar district have been described by Captain W. S. Sherwill (1851) as follows:—

"A small and convenient hill having been chosen as the spot for commencing operations upon, a party of the wild hill tribes, named Bandathis, the members of which party have freely propitiated the local tutelary god or goddess, both by sacrifice and by getting very drunk, ascend to the top of the hill and commence sinking a series of pits, the whole way down the profile of the hill, about three feet in diameter each, and a few feet apart. These pits are not continued vertically downwards, but in a zig-zag shape, but nevertheless not so much out of the vertical proper, as that a basket containing the mineral cannot be hauled up from the bottom of the pit to the top; the zig-zag shape of the shaft being formed by sinking the shaft first inclining to the left a few feet and then to the right a few feet, the head of each cut or notch forming a landing-place or step, and thus the necessity of ladders is obviated; the projecting of salient angles of the notches forming a perfect flight of steps from the top to the bottom of the pits, which seldom reaches to a greater depth than 40 feet, when, darkness interfering with the workman's progress, the pit is forsaken and another commenced upon a few feet further down the hill. A slight frame-work of faggots, cut from the neighboring trees, is placed over the mouth of each pit, upon which a man sits, waiting till the signal from below is given to haul up the basket containing the mica and rubbish which has been dug from the sides of the pit by the aid of a rude pick. On arrival at the surface the good and bad materials are separated; the earth and rubbish are shot down the precipitous side of the hill; the good mica, which arrives at the surface of the pit in ragged masses about 1 foot 6 inches in length, 6 inches broad and 3 inches in thickness, after having its ragged edges trimmed off with a reaping-hook-looking instrument, is placed by itself in a heap, and the bad or refuse, that is the softer kind, is also placed aside in a heap by itself.

"The mica reaches the surface in three different states, viz.: the good, hard and serviceable mineral; the soft, wet and flimsy mineral; and the chipped and powdered mineral.

"The tests as to whether the mica is good for anything, or whether, as the natives say, 'it is alive,' are its firmness, specific gravity, and the power of reflecting the countenance free of contortions; the latter test, I imagine, showing the perfect parallelism of its individual plates, and consequent likelihood to split well; the heavier the mineral and the more perfect the reflection, the more valuable is the mineral considered; all the plates not standing the necessary test, are of a soft and flimsy nature, without any of the brilliant sparkle of the better sort; the natives call this the 'dead mica,' and it appears to be in a state of decay.

"The mines are worked by Mahajans or native merchants, who reside at Patna and depute agents to the spot to superintend the mining. The excavators or miners are Bandathis or inhabitants of the hills, a race allied to the Kols, Bheels and Sonthals; they are a wild-looking set of demi-savages, slightly clad, the fore part of their head shaved, the rest of their hair standing up in wild curls; they have the high cheek bones, thick lips and small eyes of the Vindhyan races; they are also a hard-working and merry race. The miners receive as monthly wages one maund (80 lb.) of rice, and a piece of cloth, the whole valued at two rupees.

"The mines are worked during the months of January, February and March only; for during the hot months, or from the latter end of March to June, the great heat dries up all the water for many miles around the mines, and during the rainy season the pits fill with water; and subsequent to the rains the unhealthiness of the dense miasmatic jungles in the neighborhood prevent the work commencing before January.

"During the three working months about 400 maunds or 14 tons of mica, yielding upon calculation 20,000,000 transparent plates of mica, each plate being about nine inches square, are conveyed away to Patna upon bullocks, the whole being valued at Rs. 4,000 (£400). To obtain larger plates than are generally exported does not seem to be an object with the agents, who by their constantly urging the miners to wrench out the mica from its matrix, whether in large or small pieces, cause about three times the amount of mica actually carried away to be destroyed in the mines. The head Bandhati assured me that, were time allowed him, he could produce plates of almost any size.

"The largest plates are dug from the Deilwar mine where the miners have hit upon a seam of mica, running along the base of one of the small hillocks; it is thus worked in the open air only a few feet from the level of the country; this seam, however, will be soon lost as the half wild miners have no idea of propping the roof of a mine, which must very soon fall in by its own weight." (Journ. As. Soc. Beng., Vol. xx., (1851), pp. 296-298).

In describing the mines of North Hazaribagh in 1873, Mr. Mallet gave an account of the sampling of mica into different grades and qualities as follows:—

"The plates of mica are generally brought to the miners' village, and there after being slightly trimmed with grass-cutting knives (which are not particularly adapted to the purpose, but are probably the only ones the people are able to purchase), they are sorted into different heaps according to quality and size. The quality depends on the mineral being in a perfectly unaltered condition, its transparency and freedom from cloudiness caused by internal foreign matter, the absence of minor cleavages which render it liable to split into ribbons and triangles, and the planeness of its fissile surfaces. Six kinds are recognized according to the size of the plates, viz:—

1st. Sanjhla. 3rd. Rasi. 5th. Urtha.
2nd. Manjhla. 4th. Karra. 6th. Admalla.

"Some of the miners intercalate *failurtha* between *urtha* and *admalla*, and speak of another size, *barka*, still larger than *admalla*. All these terms are used rather vaguely in respect to the absolute size of the plates indicated thereby. At Dhàb and Jamtara I induced the miners to separate a quantity of the mica into different grades, and measured an average specimen of each, with the following results:—

	Dhàb.	Jamtara.
Sanjhla.	3" x 4"	4" x 3"
Manjhla.	7 x 5	5 x 4
Rasi.	9 x 6	6 x 5
Karra.	12 x 9	8 x 6

"The above four sizes include the greater portion of the mica found, it being only in the best mines that *urtha* and *asmalla* are procurable.

"The mica is sold by the load, which is built up of plates either into one frustrum of a cone and carried on the head, after being bound together with cord, or into two such, and carried in a *banghi*. A load equals 6 *paseris*, one *paseri* being equal to 5 *kacha seers* of 12 *chataks* each, or to 3 3/4 *paka seers* of 16 *chataks*; the load, therefore, being 22 1/2 *seers paka*, or 46 lb. avoirdupois. The miners informed me the price paid them by the *mahajan* were as follows:—

Sanjhla.	3 annas.	per load
Manjhla.	5 "	" "
Rasi.	7 "	" "
Karra.	12 "	" "
Urtha.	2 to 6 rupees	" "
Admalla.	4 to 9 "	" "

The selling prices being about double the above." (Records, Geol. Surv. Ind., Vol. vii. 1873), p. 42).

Dressing Mica: Under the present system of working, the blocks of mica raised from the mine are cleaned of all extraneous matter, such as quartz and felspar, in the stripping room, and when split, either for convenience of size or for the removal of material included along the cleavage-planes, the sheets are sent to be "scribed," and afterwards cut with a pair of shears into rectangular shapes along the scribing. Sheets, tin, zinc or iron, are used as patterns in scribing; and the natives after a little training become quite expert in selecting the size and shape of pattern which will give the maximum area of clear mica in the rough sheet.

Yield of Marketable Mica: The yield of marketable mica will naturally be very variable. In the Inikurti mine of the Nellore district, Mr. Sargent sent to the market 23 per cent. of the rough block mica raised from the mine. In the American mines 10 to 12 per cent. seems to be the average yield, whilst 5 per cent. is considered inferior and 33 per cent. exceptionally high. In one case, however, as much as 75 per cent. of marketable mica was turned out.

Prices of Different Qualities: Large quantities of ruby-coloured muscovite are still exported from Bengal to England and America, the former being the principal market for the rest of Europe. The prices of this mica range from Rs. 8 to Rs. 400 per maund of 80 pounds; and according to the late Mr. E. T. Hollingsworth, who exported large quantities from Calcutta, the average price of rectangular pieces may be set at Rs. 20 per square inch per maund. Thus plates 6 x 6 in. of best quality would bring 36 x 20, or Rs. 720 per maund, or 11s. 3d. per pound at 1-3 exchange. I find from data kindly supplied me by Mr. Sargent who has worked the Nellore mines so successfully, that as much as 14 or 15 shillings a pound has been obtained for large plates, whilst plates 2 1/2 inches square will bring only a few pence per pound, and up to 20 square inches at least long rectangles brought better prices on the average than squares of the same area. The demand for lower grades is at present somewhat dull owing to the quantities of small plates which have been turned out of the Canadian

mines. The American prices are stated to vary from 5d. to 24s. per pound and averaging about 7s. Whilst the price increases in such rapid ratio with the area of the plates for the smaller sizes, the ratio does not seem to be preserved for plates larger than about 6 x 8 inches owing to the few uses to which very large plates of mica are put. Some very large plates, have however, been turned out of the Indian mines. In a recent consignment of ruby-coloured mica from Calcutta there were sheets measuring 9 x 32 1/2, 10 x 29 1/2, 11 1/2 x 27 and 12 x 23 1/2 inches respectively.

Very different rentals are paid for the mines. In the Hazaribagh district they vary from Rs. 8 to Rs. 1,000, but probably average about Rs. 200 to Rs. 300.

Rentals of Mines: In the Nellore district (Madras Presidency) land has been put up to auction with the result that at Utkur in September, 1888, a piece measuring 5 acres was leased for Rs. 75 per annum, whilst in April, 1889, Mr. Lonsdale obtained 10 acres for an annual rental of Rs. 250, but the lease was afterwards cancelled on his own application and a portion of this, which was afterwards rented to Mr. Sargent for Rs. 50 per annum, has since turned out to be a most successful mine. The mine which was sold in 1888 for Rs. 75, having yielded good mica and the lessor having been credited with having made larger profits there was undue competition when the term of lease expired in November, 1890. It was put up to auction and fetched as much as Rs. 3,005 as a yearly rental, but the mine soon after stopped work, and the purchaser has applied for a cancellation of the lease. Other speculators have also taken up land in apparently the same indiscriminate manner, and have been subsequently compelled to abandon operations. There is no reason, however, why still larger quantities of mica should not be obtained in Nellore, Mysore, the Wynaad and Travancore, whilst the Bengal mines are still most decidedly successful.

Trade: The following statement shows the exports of mica from British India to foreign countries since 1886, so far as official statistics are available. It will be seen that the United States have been the principal consumers, and this agrees with the statistics of imports given in the official reports of that country, in which it will be noticed that, coincident with a falling off of production from the North Carolina deposits, there has been an increase in the quantity of imported mica, and a decided increase in the quantity exported from India. From Bengal alone Mr. Hollingsworth estimated an output this year of about 500 tons, which is about one and a-half times the total production of North Carolina from 1868 to 1887, and more than 15 times the amount raised in the United States in 1887 (*vide* "Mineral Resources of the United States," 1887). India is, therefore, the principal producer in the world, and may thus be able to fix the prices of an article for which there is a great and steadily increasing demand. This fact should be an encouragement to further exploration amongst our crystalline rocks.

STATEMENT SHOWING THE EXPORTS OF MICA FROM BRITISH INDIA TO FOREIGN COUNTRIES IN EACH OF THE FIVE YEARS FROM 1886-87 TO 1890-91, AND IN THE NINE MONTHS ENDING DECEMBER, 1891, SO FAR AS OFFICIAL STATISTICS ARE AVAILABLE.

COUNTRIES TO WHICH EXPORTED.	QUANTITIES.						VALUE.					
	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.	1891-92, 9 mos.	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.	1891-92, 9 mos.
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	R.	R.	R.	R.	R.	R.
United Kingdom.....	375	389	1180	1857	3248	790	87937	69346	193305	336151	448864	115382
France.....	96	5	10	..	8	10	15075	4300	6579	..	785	1340
Germany.....	..	..	24	51	170	69	..	..	3510	7596	34363	16417
Mauritius.....	..	..	..	1	..	..	..	..	..	25	..	..
United States.....	411	316	387	714	2947	1097	112487	80650	156418	218316	428878	233878
Arabia.....	..	..	..	..	..	10	..	..	..	..	..	84
Ceylon.....	..	..	3	..	..	..	..	..	20	..	..	..
Straits Settlements.....	..	..	..	9	11	..	..	270	..	155	..	135
Total.....	882	713	1604	2632	6384	1976	215499	154566	359832	562243	913025	367101

The Ross Rock Drill.*

By J. MACEWAN ROSS.

The Ross rock drill is a departure in principle and design from the ordinary rock drills at present in use.

An American publication states that the "percussive rock drill has been invented and developed within the latter half century." It also goes on to say that "it is distinctly an American invention, though claims are sometimes made that it had its origin in France and Germany. Rock excavations were carried on even before the discovery of America, and it is easy to understand that those who were engaged in removing rock would look for some means by which a hole might be drilled with greater rapidity than by striking a piece of steel with a hammer.

In 1683, a drop drilling machine was used in Germany, and "with ten blows it would sink a hole 1 1/2 inches deep and about 3 inches in diameter."

Mr. G. G. André states concisely the requirements of a good rock drill as follows:—

1. A machine rock drill shall be simple in construction and strong in every part.
2. It shall consist of few parts, and especially of few moving parts.
3. It shall be as light in weight as it can be made, consistent with the first condition.
4. It shall occupy but little space.
5. The striking part shall be relatively of great weight, and it shall strike the rock directly.
6. No other part than the piston shall be exposed to violent shocks.
7. The piston shall be capable of working with a variable length of stroke.
8. The sudden removal of the resistance shall not be liable to cause injury to any part.
9. The rotary motion of the drill shall take place automatically.
10. The feed, if automatic, shall be regulated by the advance of the piston at each stroke.
11. The machine shall be capable of working with a moderate degree of pressure.
12. It shall be capable of being readily taken to pieces.

Mr. J. J. Couch, of Philadelphia, invented, in 1849, a percussion drill embodying some of these features. Later in the same year Mr. Joseph W. Fowle, of Boston, invented a drill in which the drilling-tool was attached directly to the machine, or

* Transactions Mining Institute of Scotland.

† A Practical Treatise on Coal Mining, 1879, page 148.

was a continuation of the piston rod. Subsequently, Mr. Charles Burleigh constructed a drill embodying important improvements on the Fowle drill. Since then, Messrs. Ingersoll, Wood, Githens and Sergeant have brought the rock drill more nearly to the requirements stated by Mr. G. G. André.

All the early drills were what are now known as "tappet drills," that is, the movement of the valve was effected by tappets projecting into the cylinder, and struck or moved by the piston. This was the principle of the valve movement of the first Ingersoll rock drill, and Mr. J. C. Githens perfected the tappet movement, as embodied in the little giant rock drill.

The tappet construction, however, does not fulfil one of the most important conditions of a perfect rock drill, as a part other than the piston is exposed to violent shocks. Mr. Henry C. Sergeant made the first departure from tappet moved rock drills in 1873, when he constructed the Ingersoll eclipse rock drill, which, with a few alterations, is now known as the Ingersoll rock drill. He has since designed a new valve motion and a new rotating device embodying them in what is known as the Sergeant rock drill. The valve motion of the Sergeant rock drill is similar to that of the Ingersoll, with the addition of an auxiliary valve introduced between the main valve and the piston, by means of which the valve movement is made more positive.

All the rock drills referred to work on the same principle—that is, they have the drill attached to the piston, so that each upward stroke of the piston lifts the drill and the downward stroke brings the cutting edge of the drill into violent contact with the rock to be bored. This action entails great shock and vibration on the framing and working parts of the tool, necessitating great strength of construction and consequent heavy weight.

The diamond drill works on a different principle: the drill is revolved, a steady pressure is brought to bear upon it, and thus by the abrasion of the diamond surfaces upon the rock, a hole is rapidly bored.

The Ross rock drill combines the two principles—for while the piston reciprocates with a short stroke and at a high speed, the drill is always kept to its work at a uniform and carefully regulated pressure.

The casing A is bored and fitted with a phosphor bronze liner B, forming the cylinder, in which the piston works. On the outside of the bronze liner rings are cast, so as to leave annular spaces between them and the outer casing. These spaces are divided into inlet and exhaust passages for the working fluid, by suitable projections cast on the outside of the liner, and turned to fit the casing. Communication between these passages and the interior of the liner is effected by several admission ports C, and exhaust ports D, formed in the liner, and so placed that the piston, in its reciprocating movement, operates as a self-acting valve, automatically admitting and exhausting the working fluid. The piston E is a solid forging, turned and ground into the cylinder so as to work freely. It is 5 inches in length, and 2½ inches in diameter, and is slightly reduced at the centre where the actuating fluid is introduced into the cylinder. The piston weighs 4½ lbs., and is the only working part in the tool.

The principle upon which the tool works is simple. The piston is reduced in diameter at the centre, leaving a collar at each end. The inside edges of these collars form the cut-off edges, while the outside edges govern the exhaust ports.

As soon as the compressed air is turned on, the piston reciprocates with great velocity, and is cushioned at the back end of the cylinder.

The piston at each stroke strikes a centrepiece fitted into the nose of the tool, and through this the blows are conveyed to the end of the steel drill. The collar on the centrepiece bears a phosphor bronze thimble, and takes up the pressure given by the automatic feed. The collar also acts as a gauge, and keeps the centrepiece at a fixed distance from the striking end of the piston.

There is a ram attached to the back end of the cylinder, fitted with a piston working in the automatic feed cylinder. This cylinder is connected to the framing by 2 clamps, which are bored to fit the standard and the feed cylinder, and this forms a perfect universal joint. The clamp has an open jaw, fitted with a bolt and nut by means of which the feed cylinder may be fixed in any position.

As soon as the thumb cock is turned on, the piston immediately gets into rapid motion, and simultaneously the air finds its way by a small channel to the outer end of the plunger, thereby pressing the drill up to its work with a steady and unvarying pressure. All that the attendant has to do is to turn the hand wheel steadily and somewhat quickly. When the drill has penetrated to a depth of 18 inches, the plunger in the feed cylinder having travelled out that distance, the attendant slackens the clamp a little, pushes forward the feed cylinder till its outer end is near the clamp fixes it by a turn of the nut, and the drill is ready for another length of 18 inches of travel.

It will be seen that holes 3 feet in depth can be bored by this rock drill with one length of drill, and without shifting the framing in any way. The drill is clamped to the combined tripod and stretcher-bar by a single bolt. One turn of this bolt enables the workman to raise or lower the rock drill, or to swivel it in any direction.

The topscrew and nut enable the frame to be used as a stretcher bar where the roof of a tunnel or the side walls afford support. In such cases the back stay can, of course, be disconnected and laid aside.

The advantages claimed for the Ross rock drill are: a combination of efficiency, with lightness and strength of construction. The total weight of this rock drill mounted on the compound tripod and stretcher bar is 190 pounds. Great weight in the different parts is unnecessary, from the fact that the work done does not depend upon heavy blows being struck, as in the case of the ordinary rock drill, but upon a multiplicity of light blows being given by a light piston travelling with great velocity. The piston being the only moving part in the tool, liability to fracture and derangement is reduced to a minimum.

In rock drills made on the ordinary principle, the piston and piston rod are actuated in their reciprocating motion by a separate valve, which very much increases the wear and tear of the tool. The different parts of the Ross rock drill are of light weight, and are easily put together; it is exceedingly portable, and the heavy weights attached to the tripod, necessary in other types of rock drills, are entirely dispensed with.

The Ross rock drill has been thoroughly tested on a variety of rocks. With an air-pressure of 60 pounds per square inch, the 2½ inches rock drill will bore holes, 1¼ inches in diameter, in the hardest whinstone, at the rate of about 4 inches per minute; and in ordinary sandstone at the rate of 15 to 20 inches per minute.

Mr. ROSS, in reply to questions, said that the drill was always pressed against the rock by the automatic feed. The drill readily cleared itself, and was not liable to heat. It had been tried in every kind of rock, with thoroughly satisfactory results. Sandstone could be drilled at the rate of 20 inches per minute, and the hardest whinstone at the rate of 5 inches per minute.

Mr. W. ARCHIBALD (Cambuslang) said that the mechanism seemed similar to that of the Harrison coal-cutting machine, which proved a regular nuisance.

Mr. HOWIE (Larkhall) said that with drills on the Harrison principle the great difficulty and drawback was the back stroke, but this drill was entirely different. There was no doubt that the want of an automatic feed was a drawback.

Mr. ROSS said that the drill described in his paper was an entirely distinct from the Harrison machine.

DOMINION COAL CO.

A New Record for Canada—One Million Dollars Spent on Improvements and Close Upon a Million Tons Shipped in the Twelve Months.

Those people, and they were not a few, who ventured to predict that the American Syndicate had only bought up the Cape Breton mines for the purpose of closing them in the interests of American collieries, must by this time be convinced that their conclusions were, to say the least of it, premature, and they would do well in the future to act upon Mark Twain's advice: "Never prophesy unless you know." There were a few superficial observers who considered that the first year's operations of the company lent colour to such a supposition, and not a few ran about exclaiming "There, we told you so, the Emery & Gardner mines are already closed, and others are sure to follow;" but what the critics failed to see, is, at the end of the second year, perfectly obvious to the most casual observer, *i.e.*, that the company were pursuing a wise and carefully considered policy in lopping off the unprofitable branches of their concern and consolidating the whole upon a firm and reliable basis. The record of the present year shows the first fruits of this sagacious policy in a development of the best mines, a largely increased output from the whole, and a provision of the most modern and approved appliances for transporting, handling and shipping the coal. In view of the result already achieved it is a tolerably safe prediction that, in a few years, this company will so have developed its most profitable mines, and so thoroughly established its markets, as to have rendered itself tolerably independent of all competition, and one of the strongest and best paying concerns on this side of the Atlantic. This opinion is based upon a thorough knowledge of the enormous mineral resources of the company, and their advantageous position for economical working; together with an appreciation of the vigorous and intelligent manner in which the whole business of the concern is being established. And although it is no doubt a disappointment to find a 40% tariff against them upon coal exported to the United States, we venture to think that in view of the foregoing considerations even this will not prove an insuperable barrier to a large business with the New England States; and if in addition it should be found practicable to open up a trade with the West Indies and South America, there would be sufficient scope for a still greater development than has yet been contemplated. In this connection we are pleased to note that the company has recognized that, in the probable absence of any considerable quantity of back freight, the only hope for this class of trade lies in cheap transport, and they have contracted for several large vessels of the "turret" type, carrying 4,000 to 5,000 tons each, which should enable them to carry coal to the River Platte at about \$2 a ton. Their enterprise in this respect and in the opening up of a winter port at Louisburg, of which more anon, are worthy of the highest commendation, and deserve the success which they seek. These general observations are forced from us by noting the details of the year's work, which we are able to give below, and which we hope to be able to supplement in our next issue with similar details of the work done in the railway and shipping departments. We may say, just as we are going to press, the information reaches us that the total amount of coal hoisted for the year exceeds 1,000,000 tons, and the quantity shipped is about 930,000, representing an increase on the year of 200,000 tons, or 27%.

Caledonia Colliery.

The largest outlay has been at the important Caledonia mine, which has been almost revolutionized, and is now the best equipped mine which the Company possesses. The following are the additions this year:—

Chimney stack erected 125 ft. high, with 6 ft. flue.

Three Babcock & Wilcox boilers of 200 h.p. each.

One Rand compressor, capable of driving 50 coal cutting machines, working at 80 lbs. pressure.

One pair of hoisting engines, 20 in. double cylinder, 3 ft. 6 in. stroke, 5 ft. drum, to replace a smaller pair.

One iron bank-head and pit frame, covered in with corrugated iron sheets.

Two self-dumping cages.

New screening apparatus.

3,000 ft. of additional railway sidings on surface.

Additional shaft for raising and lowering workmen, 11 x 8 ft.

Endless haulage for operating the west level; capable of hauling 1,000 tons per day if required. This re-opens an old district which has been standing for some years, and which is expected to yield a large output of coal next season.

The west levels have been driven in by Stanley headers, about 900 ft. each up to date. The east deep has been carried down about 600 ft., and levels driven to the south 700 ft. and to the north 1,000 ft.—the latter connecting with the south level from the west deep. This has opened up two new districts equal to about 50 rooms. It is in these districts that the Ingersoll coal cutters are working.

A pipe line has been constructed from the compressor on the surface to the bottom of the east deep, and into these two latter levels, supplying the coal cutters with air.

A pipe line has also been laid to the back of the west levels a distance of nearly 3,000 ft. to drive the Stanleys. This will subsequently be used for coal cutting.

A large steam pump has been put in at the bottom of the shaft to raise the water to the surface, in lieu of the old lifts.

The two bank heads from east and west deeps, and the approach to the shaft are being regraded and enlarged.

Note:—The output from Caledonia mine was restricted to very little for the first few months of the season owing to the new machinery not having been completed. Since then, however, a larger tonnage has been raised than in previous years.

A concrete compressor house has also been erected.

Little Glace Bay Colliery.

Two multitubular boilers have been set up on the Jeffrey system to supply steam for driving air machinery.

One Rand air compressor has been erected which is working 12 coal cutters.

A pipe line has been laid from this compressor down the deep, and into the north and south levels.

A new pump has been fixed at the bottom of the deep, which is raising the water to the pumping shaft. This supersedes the old system of hauling it with tanks.

A hauling engine 18" x 36" has been erected on the surface for the purpose of working endless haulage below ground. And this system has been laid along the shaft level to the north, a distance of 3,000 ft. This level has been widened and a double road constructed the whole distance.

A concrete engine and compressor house has been commenced.

International Colliery.

New engine and boiler house has been erected.
 A chimney stack 100 ft. high with 6 ft. flue has been erected.
 Two Lancashire boilers 30 ft. x 7 ft. are ordered for erection at this mine.
 Also one hauling engine 18" x 36" to drive endless haulage, which it is intended to introduce here during the coming season.

Old Bridgeport Colliery.

One additional Ingersoll air compressor has been laid down, and pipe line constructed along the shaft level into the Reserve mine, from which air is taken to drive Ingersoll air cutting coal machines in Old Bridgeport mine and two Stanley headers in the new deeps.

New bank head and pit frame have been erected, and new screening machinery put in operation.

Self dumping cages have been introduced.

A new pair of hoisting engines 14½" double cylinders have been erected.

Two additional multitubular boilers.

Reservoir constructed and pipe line laid to supply water for steam purposes.

Hauling engine placed in the mine, and tail rope haulage laid down from the shaft to the extremity of the main level towards Reserve mine.

Two new deeps have been driven down by the Stanley headers, a distance of about 700 ft. This will open up a new district.

A connection has been made with the Reserve mine, which is now drained through the old Bridgeport sea level.

Reserve Colliery.

The French slope has been widened and a double track laid from surface to face, a distance of 4,000 ft. Endless haulage has been put in, the motive power being supplied by the hoisting engine previously used.

A new district has been opened up on the main slope, yielding a greatly increased tonnage. By this means the total output of the mine has reached about 1,300 tons per day during the shipping season.

Gowrie Colliery.

One additional air compressor has been erected and a pipe line laid down the deep and along the north level, to supply air for coal cutting machinery; also for pumping and hauling.

One tail rope hauling engine has been fixed in the south level, and is hauling the whole of the coal from this district.

A Mitchell long-wall undercutter has been placed in the north level, and is cutting nearly 1,000 tons of coal per week. This north district is a new one, and has been opened entirely this year.

The levels have been driven about 1,000 ft. from the deep, and the whole of this district is being worked on the long-wall system. All the coal is extracted and the roads are protected by substantial coggings, which is constructed from the fallen roof.

A new pound room has been driven at the foot of slope; also a new water way from the same in a direct line to the pumping shaft.

A range of pipe has been laid from the pump through this new road and the old road abandoned.

A new pipe-way has been constructed on the surface from Sand lake to Gowrie mine, which will yield a permanent supply of water for steam purposes; distance about 3,500 ft.

Victoria Colliery.

Two new cylinders have been put in, 26 in. diam., in lieu of 24 in. previously used.

The centre slope has been enlarged and driven down about 300 ft. and a double track laid throughout. This has been connected by new levels with the west deep. The latter has been abandoned and the whole of the coal west of the centre slope is now hauled from the latter point.

The water has been pumped out of the district which was flooded three years ago, and the output raised to 700 tons per day.

A bore-hole 8 inches in diameter is being put down from the surface to the pump room for the purpose of pumping water vertically.

Two new multitubular boilers have been erected on the surface, and the bank-head has been regraded and improved.

Dominion No. 1 Colliery.

The whole of the work here, except a small portion of the sinking, has been done this year.

A shaft 24 ft. x 10 ft. 6 in. has been sunk through the Phalen seam, a depth of about 150 ft.

Large and expensive plant is being erected, consisting of two Ingersoll air compressors.

A pair of 20" x 54" hoisting engines.

A pair of 18" x 36" hauling engines for endless haulage.

Three Babcock boilers 200 h.p. each.

One 12 ft. diam. Murphy fan, driven with 6 ft. flue, has been completed.

All the permanent erections are of brick.

Railway sidings have been constructed.

An air shaft 10 ft. in diameter has been sunk.

And below ground over 5,000 ft. of deep and level work have been driven.

Steam pump has been placed below, which is raising water to the surface.

A pipe line has been constructed from Old Bridgeport mine to supply water.

Upwards of 70 miners' houses and a large boarding house have been built adjacent to this mine.

At Caledonia, Glace Bay and International Mines:—Fifty to sixty other miners' houses have been erected, also new offices, machine and engine shops, roundhouse, warehouse and other buildings, have been erected at Glace Bay.

Caledonia, postscript:—A new long-wall undercutter has recently been started, which has given very satisfactory results, having undercut 500 lineal ft. of coal 3 ft. under, in one working day.

Shipments.

We append herewith the total shipments (approximated) of coal for the year and are able to state that, if trade admits of it, the output for the next season will be considerably in excess of that for 1894; and during the winter every preparation will be made to this end.

Caledonia	Mine	119,195 tons.
Glace Bay	"	138,417 "
Gowrie	"	127,782 "
Dominion No. 1	"	32,840 "
International	"	129,324 "
Old Bridgeport	"	54,185 "
Reserve	"	208,071 "
Victoria	"	118,429 "
		928,243 tons.

In addition to extensive outlays on mechanical appliances at nearly all the collieries now being operated, the company has commenced to re-open the celebrated Hub seam of coal, which is one of the finest in their property, and was formerly owned by the Little Glace Bay Mining Co. Operations are being carried on day and night, and it is hoped that this mine will be ready to ship coal by the opening of navigation next spring. By that time also, the new Dominion No. 1 mine will be ready to deliver something like 1,000 tons of coal per day. And the company's arrangements for transporting coal to Louisburg, as well as their new pier at the latter place, and their crane and bucket arrangements at the International Pier will be completed. We have only to say at the close of this article that, a company which has developed the mineral resources of Cape Breton in the short period of two years, to an almost unprecedented extent, and which has expended on the spot upwards of \$1,000,000 in that time, has more than justified its existence as a *bona fide* commercial undertaking, and has given hostages for the due fulfilment of its many obligations, which should be satisfactory to the most exacting critic.

COMPANIES.

(Continued from page 243.)

East Waverly Tunnel Co.—The management of this company, operating the Laidlaw's Hill gold mines, at Waverly, N.S., write: "It was intended this year to erect a steam crushing plant, but in January an extensive water privilege was secured, and the summer was devoted to developing this and bringing it to the mine. As a consequence but a limited force was employed in the mine driving levels and upraises, the combined length of all these aggregating about half a mile. In consequence of the peculiar folding of the vein which still continues, the ore fills a space of from 2 to 3 and frequently 4 ft. thick in the belt. About 500 tons are piled outside and several thousands of tons are stripped standing in the mine. A new plant will therefore be put in the ensuing spring.

Horsefly Hydraulic Mining Co.—The clean up of this company's mine in Cariboo, B.C., for the season just closed was \$26,000 net. This is the bonanza property from which great things are expected next year.

Texada Lime Co.—Owing to general depression the output for 1894 was only a little over 4,000 bbls.

General Mining Association of London, Ltd.—The output from this company's old Sydney colliery, not quite completed for the year, may be put down at 250,000 tons. 466 persons employed below ground and 220 above ground. Little addition has been made to the works during the year. A Fairbanks 20-ton track weighing scales, a new locomotive built by the Baldwin Locomotive works at Philadelphia, and 21 new coal cars of 6 tons capacity, built by Rhodes, Curry & Co., of Amherst, N.S., were added to the plant. There was also imported a ventilating fan of the Murphy pattern, 10 ft. diameter, built by the M. C. Bullock Mfg. Co. of Chicago. Early in the season extensive repairs were made to the Company's Western shipping pier at North Sydney.

Whitewater Mining Co.—No work was done on this company's gold property in the West Kootenay district, B.C. It is now under bond to a Duluth syndicate for \$71,500.

General Phosphate Corporation, Ltd.—In connection with the General Phosphate Corporation, Ltd., now in liquidation, an application was recently made for a public examination of the directors. Mr. Justice Vaughen Williams refused to grant the application, on the ground that a public examination was not justifiable, unless the report of the official receiver showed actual fraud, and the report in this case did not go that far. The Court of Appeals has just upheld the original judgment, but has given leave for a last and final appeal to the highest English tribunal, namely, the House of Lords. The decision was received favorably.

Mooseland Gold Mining Company, Ltd.—This company, operating in the Tangier district, N.S., is building a new 10-stamp mill, with all the latest improvements, to be in operation before February next.

Van Winkle Consolidated Hydraulic Mining Co., Ltd.—On account of water supply suddenly failing, this company was only able to pipe 3 months when gold to the value of \$4,489.77 was taken out. The main sluice is now 1176 feet long and is within 250 ft. of the second bench where, judging by careful prospecting, it is expected to get the rich pay. When up to this bench the company will have a face of 96 ft. in height of gravel, and having two No. 6 monitors and the requisite pipe in place, a very large quantity of gravel should be put through next season. The property is at Lytton, B.C.

The Cariboo Hydraulic Mining Co., Ltd.—This company's claim is situated on the left bank of the South Forks of Quesnelle River, about four miles above the Forks of Quesnelle. It comprises about 500 acres held under title acquired by private charter from the legislature of B. C. The ditch now under construction, will when completed, be about 17 miles long with a capacity of 4,000 miner's inches, and will operate from two to four monitors. 160 persons were employed during the past season.

Horsefly Hydraulic Mining Co., Ltd.—This company has brought water a distance of nine miles through a very difficult country for ditching, having in several places to convey the water across the depressions in pipes for several thousands of feet at a time. The ditch has a capacity of from 3,000 to 4,000 miner's inches of water, and they use from two to four monitors of large size. The works were completed and in full running order by the end of this season when very satisfactory results were obtained.

On the Origin of Gold Nuggets.

By A. LIVERKIDGEE, M. A., F. R. S.*
(Professor of Chemistry in the University of Sydney.)

From time to time various theories have been put forth to account for the existence of alluvial gold and nuggets, *i.e.*, other than the old and generally accepted one, *viz.*, that such gold has been derived or set free from mineral veins and rocks by the ordinary processes of disintegration and denudation.

The one first propounded by Mr. A. R. C. Selwyn, C. M. G., F. R. S., when Government Geologist to Victoria, has always interested me, and within the last two years I have been able to make some experiments bearing upon the matter, but before stating the results I will refer briefly to some of the theories above referred to.

Simpson Davison advanced a theory ("The Discovery and Geognosy of Gold Deposits in Australia," p. 132, London, 1860), "that alluvial or placer deposit gold has been distributed and deposited horizontally by means of an igneous liquid or perishable lava, and that quartz veins as well as some other dykes traversing constants had been the fissures of discharge,—the only unchanged existing solid remains of the ejected matter being gold, quartz and some few other minerals besides clays and ferruginous earth;" he advanced the theory because alluvial or placer deposit gold has often a fused appearance, and the metallic grains frequently present ragged and irregular surfaces, such as must have been destroyed by abrasion. He also gives other reasons, but they are equally valueless and unimportant.

Mr. C. S. Wilkinson, F. G. S., formerly Government Geologist of New South Wales, refers in a paper read before the Royal Society of Victoria, 11th Sept., 1866, "On the Theory of the Formation of Gold Nuggets in the Drift," p. 11, to Selwyn's hypothesis, *viz.*:—"That nuggets may have been formed, and generally that particles of alluvial gold may gradually increase in size through the deposition of metallic gold (analogous to the electro-plating process), from the meteoric waters which circulate through the drifts, and which must have been, during the time of our extensive basaltic eruptions, of a thermal, and probably highly saline, character, favourable to their carrying gold in solution," and states that "Daintree had on one occasion prepared for photographic use a solution of chloride of gold, leaving in it a small piece of metallic gold undissolved. Accidentally some extraneous substance, supposed to be a piece of cork, had fallen into the solution, decomposing it, and causing the gold to precipitate, which deposited in the metallic state, as in the electroplating process, around the small piece of undissolved gold, increasing it in size to two or three times its original dimensions." Wilkinson then made certain experiments to test Daintree's theory. "Using the most convenient salt of gold, the perchloride, and employing wood as the decomposing agent, in order to imitate as closely as possible the organic matter supposed to decompose the solution circulating through the drift, I first immersed a piece of cubic iron pyrites taken from the coal formation of Cape Otway, and therefore less likely to contain gold than other pyrites. This specimen (No. 1) was kept in a dilute solution for about three weeks and is completely covered with a bright film of gold."

He also used galena, copper and arsenical pyrites, antimony (*i.e.*, antimonic?) molybdenite, zinc blende and wolfram, with similar results. Brown iron ore only gave a deposit of gold powder. He found that when iron pyrites was tried with metallic copper, zinc and iron, the gold was only deposited as a fine powder at the bottom of the vessel, and came to the conclusion that organic matter was necessary to form a coherent coating of gold on the nucleus, for without the presence of wood, or similar organic matter, he found that the six sulphides were unaltered.

In his second experiment with iron pyrites, he found that the gold was deposited on it in a mamillary form, analogous to that presented by the surface of nuggets.

To sum up Wilkinson's paper, his points are (1) that gold is deposited upon sulphides in the presence of organic matter; (2) that the organic matter is essential; (3) that the coating is mamillary in some cases; (4) that gold is probably present in solution in mineral waters; (5) that nuggets are purer than vein gold and that this may be due to the nuggets having been deposited *in situ* from a solution of gold.

The next to take up the subject was Mr. J. Cosmo Newbery, in a paper "On the Introduction of Gold to, and the Formation of Nuggets in, the Auriferous Drifts" (Trans. Roy. Soc. of Victoria, 1868, p. 52). In this he admits that some nuggets and alluvial gold may be derived from the denudation of reefs, but points out that the largest masses are sometimes found at great distances from the reefs and in the sand overlying the gravel, both of which are inexplicable when the very great specific gravity of gold is taken into account. He also states that the presence of gold in pyrites which has replaced the roots, branches and stems of recent trees, is a proof of the existence of gold in meteoric waters of the Tertiary Times.

He quotes Selwyn's hypothesis, and Selwyn and Ulrich (Physical Geography, Geology and Mineralogy of Victoria, 1866) to the effect that all the large nuggets have been found on the western gold fields where extensive basaltic eruptions have taken place, while on the eastern and northern fields, where basaltic rocks are wanting or only of limited extent, the gold is usually fine and nuggets of more than one ounce are rare. He also states that Bischof has found gold sulphide to be soluble in pure water, and he has suggested that it may occur in that form in meteoric waters.

Newbery dissolved some gold sulphide in an alkaline bicarbonate and found that when a cube of pyrites and a chip of wood were introduced "at small irregular grains of gold were deposited, and states that the gold is not deposited without the organic matter (*i.e.*, the wood).

Newbery repeated and confirmed Wilkinson's experiments. Newbery points out that there is little proof in nature of pyrites having acted as a nucleus; it carries gold both internally and attached externally, but we do not meet with *gilded pyrites*, such as are obtained in laboratory experiments, and that in nature the two appear to have been deposited together.

Newbery, out of one hundred samples of pyrites, found none with any coating of gold such as is obtained experimentally, but it was present in irregular grains and small octohedral crystals; in exceptional cases pieces of gold were found projecting, but all proved that the pyrites had not formed a nucleus for the gold, but the reverse has been the case in the majority of instances, *i.e.*, the gold has been deposited first; and he suggests that the gold may have been deposited first in the drift wood, as seen when organic matter, flies, &c., fall into a gold solution, and the pyrites afterwards deposited around it.

He also refers (Laboratory Report, Melbourne, 1876) to Daintree's discovery of an enlarged fragment of gold in a bottle containing chloride of gold, and states that "Ulrich, who was present when Daintree discovered the enlarged piece of gold, says that the original piece was a small fragment which remained undissolved after making some chloride and the bottle was closed with a cork; when again observed the solution was colorless and the fragment of gold of such a size that it could not be removed from the bottle through the narrow neck."

Newbery, like Skey, found that hammered pieces of gold did not increase in size, but he had little doubt of others with a rough or natural surface doing so.

Mr. Newbery was followed by Mr. W. Skey, F. C. S., Analyst to the Geological

Survey of New Zealand, in a paper "On the Reduction of Certain Metals from their Solutions by Metallic Sulphides, and the relation of this to the occurrence of such Metals in a Native State." (Trans. N. Z. Inst., 1870, p. 227.) Mr. Skey also repeated Wilkinson's experiments and obtained the deposits of gold on various sulphides and arsenides, and further found that the presence of organic matter is quite unnecessary for bringing about the deposition of gold upon the above minerals. He also found that silver nitrate and acetate, and the salts of one or more of the platinum group of metals, are reduced by the metallic sulphides and arsenides. He points out that the metallic sulphides possess much greater reducing power than organic matter, and that a single grain of iron pyrites will reduce 8½ grains of gold. And that although organic matter may have had a share in the reduction of gold, he is of opinion that the greater portion of the deposits—especially the deep-seated ones—have been due to the deoxidising effects of pyritous minerals.

In a succeeding paper, "On the Electro-motive Power of Metallic Sulphides" (Trans. N. Z. Inst., Nov. 12, 1870, p. 232), Mr. Skey describes experiments which he made to show that when such sulphides as pyrites and galena are placed in dilute acids or saline solutions and connected by a platinum wire, the current generated is sufficient to throw down gold in separate vessel from its chloride. He points out from these experiments and Mr. Fox's statements as to the existence of currents of electricity in the earth's crust that each pyritous vein or mass with its surrounding walls and exciting solutions may constitute a true voltaic pair on a grand scale.

A third paper by Mr. Skey is entitled, "On the Mode of Producing Auriferous Alloys by Wet Process." (Trans. N. Z. Inst., 1872, p. 370). He states amongst other matters, "that when chloride of gold is added to an alkaline, argeniferous solution of this nature (silver chloride in alkaline chlorides; silver chloride in either acid or neutral solutions is not reduced by iron pyrites,) such mixed solution is capable of depositing the metals contained in it in the form of coherent alloys upon metallic sulphides." Also that such alloys can be formed by voltaic action. Further "that as the water permeating rocks is usually alkaline it seems probable that native alloys of gold and silver have been deposited from alkaline solutions by the metallic sulphides."

He further remarks, that many substances will reduce gold from solution, but the only common ones likely to occur in the interior of rocks are ferrous sulphate, organic matter and the metallic sulphides, these also reduce metallic silver from certain of its solutions, but only the sulphides will reduce the two metals simultaneously and throw them down in coherent forms.

Mr. Skey continued his investigations and published still further results in the following paper: "Critical Notes upon the Alleged Nuclear Action of Gold upon Gold reduced from Solution by Organic Matter." (Trans. N. Z. Inst., 1872, pp. 372-5.) In this paper, Mr. Skey gives the results of his attempts to confirm Daintree's and Wilkinson's experiment, but, as he says, unsuccessfully; he accordingly describes minutely the methods which he adopted, and found that when a weighed piece of sheet gold was placed in a dilute solution of sodium chloraurate with organic matter until all the gold was precipitated, that the piece of gold only increased in weight .0005 of a gramme, and by calculation he found that no more gold in proportion was deposited upon the gold plate than upon the sides and bottom of the glass vessel, and even the surface of the liquid itself—the experiment was repeated four times. He points out that the conditions in Daintree's accidental result are so vague and uncertain that it is impossible to credit the organic matter with producing the phenomena described. Neither the volume nor the weight of the undissolved gold was taken, hence he considers that the statement that after some time the fragment of gold had increased in size is of but little value, as it depended entirely upon the eye memory of the original size of the gold particle, and an ocular estimate of its increased dimensions:

In his next communication, "On the Formation of Gold Nuggets in Drift," (read before the Wellington Philosophical Society, Oct. 23, 1872—Trans. N. Z. Inst., Vol. v. for 1872, pp. 377-383). Mr. Skey says, "we cannot avoid the conclusion that gold is now being deposited and aggregated in many of our drifts, and that such depositions have been going on from remotest times." He thinks that this gold is derived from the metal disseminated through slate, sandstone or schist rocks rather than from that of our reefs, and that we may reasonably suppose it is present as sulphide and is brought into solution by alkaline sulphides from which it is again eventually redeposited as nuggets, etc., by the reducing effects of metallic sulphides—a mass of iron pyrites only two pounds in weight being sufficient to cause the deposition of a nugget such as the "Welcome" weighing one hundred and eighty-four pounds, troy.

Sir Rod. J. Murchison, (Siluria, 5th edition, 1872, p. 465) after referring to Mr. A. C. Selwyn's suggested explanation as to the formation of nuggets, and to Mr. Wilkinson's experiments, says that he "prefers to remain in his old belief, that the large nuggets found in the drift are simply the reliquia of the chief masses of gold that once occupied the uppermost parts of the reefs, and that like the blocks of many an ancient conglomerate, they have been swept from the hilltops into adjacent valleys by former great rushes of water."

Mr. Brough Smyth, F. G. S., in his work on "The Gold Fields and Mineral Statistics of Victoria, 1869, p. 361, discusses the origin of nuggets and points out that most of the large nuggets have had a great quantity of quartz adhering to them or intermixed with them, clearly indicating that the nuggets must have come from a quartz reef, or else the gold and quartz must both have been deposited together from meteoric water in the drift.

In Mr. W. Birkmyre's list of nuggets quoted by Mr. Brough Smyth, he says of the Welcome nugget, weight, one hundred and eighty-four pounds, nine ounces, (troy) that it was apparently water worn and contained about ten pounds of quartz, clay and oxide of iron.

The Blanche Barkley, which weighed one hundred and forty-five pounds, three ounces, apparently contained two pounds of quartz, clay and oxide of iron.

The next in his list weighed one hundred and thirty-four pounds, eleven ounces, contained dark colored quartz.

In fact he mentions the association of quartz with nearly all the very large nuggets and expressly states that many of the smaller ones were free from quartz; as we might naturally expect.

Brough Smyth remarks that, "much stress is laid on the fact that nuggets are sometimes found at a considerable distance from a quartz reef;" but it may be, that the reef from which the nugget has been set free may have been completely denuded away, its matrix need not necessarily have been the nearest now existing reef. He quotes Ulrich's remarks in support of Selwyn's hypothesis of the formation of gold nuggets *in situ* in alluvial deposits; (Notes on Physical Geography, Geology and Mineralogy of Victoria, by Alfred R. C. Selwyn's and Geo Ulrich, Melbourne, in 1866, p. 43), but points out that if such is the case in the present day, then the older sedimentary rocks ought, from the greater lapse of time, to contain large masses of gold. Moreover large nuggets are not confined to deep leads, but many have been found only a few inches below the surface. He also says that the statement that all the large nuggets have been found on the western gold fields where basaltic eruptions have been prevalent, is erroneous, many large nuggets have been found remote from basaltic areas, and Mr. Birkmyre's list shows that the fields most remote from basaltic areas have produced the most large nuggets; in Gippsland if not large they are numerous.

Mr. G. Attwood, in a paper on Gold from Guayra, Venezuela, S. America—

* Read before the Royal Society of N. S. Wales, September 6, 1893.

(Jour. Chem. Soc., London, 1879, p. 427-9), concludes, from an examination of one particular specimen, that gold nuggets do gradually increase in size owing to the accumulation of fresh particles of finely precipitated gold.

Prof. Whitney, in a paper, "The Auriferous Gravels of the Sierra Nevada of California," Cambridge, U. S. A., 1880.—says that "it does appear as if there was some truth in the idea that the finding of large pieces of gold in the gravel is not justified by what we see of the occurrence of the metal in the quartz. It is certain, at all events, that the form of the ordinary nugget is something different from that which is offered by the gold as originally deposited. In quartz it is either quite invisible or else it is scaly, foliated, filamentous, arborescent or crystalline, quite unlike the rounded and smooth or flattened pieces met with in alluvial deposits." He, however, points out that this difference could be produced by attrition, and he thinks it highly improbable that masses of gold in gravel could be enlarged by any chemical influence.

The bark of some of the tree trunks found buried in the blue gravel (Cal.) is largely replaced by iron pyrites and this is rich in gold, "hence we cannot deny that some gold has been deposited in the placers from solution, but this certainly does not include the nuggets and gold dust." He also says, "if the gold of placers were deposited from solution, we should necessarily find much of it crystallized and forming strings and sheets running through the porous material; whereas, as a matter of fact crystals are never found in placer gold, nor are sheets or threads. Scales, grains, pebble-like nodules, round battered masses, these are what we find."

Prof. J. S. Newbery, in a paper, "On the Genesis and Distribution of Gold," (Sch. of Mines Quarterly, III., New York, 1881), does not support Selwyn's hypothesis. He points out that a mass of vein gold was obtained, weighing ninety-five and a half pounds, and originally one hundred and forty pounds, from the Monumental Mine, Sierra Buttes, Cal., which proves that large masses do occur in veins as well as in the form of nuggets.

He thinks that the proportion of large masses from veins is quite equal to that from placers or alluvial deposits. The smaller proportion of silver in alluvial gold, he thinks, is accounted for by the greater solubility of silver in various solutions, and its consequent removal just as in the process of "pickling" by jewellers.

Other "nuggets" from veins might be cited *e.g.*, a mass of gold and quartz celebrated as Dr. Kerr's "hundred weight of gold" was found in 1851 in the Meroo or Louisa Creek, River Turon, N. S. W., at a place now known as Hargraves. Although in three pieces when discovered, it apparently had formed one mass; the three pieces weighed one and three-quarter hundred weight and yielded one hundred and six pounds, troy, of gold. Another mass of gold and quartz which yielded one hundred and twenty pounds of gold on being pounded with a hammer, was found at Burrandong near Orange, in New South Wales, in 1858. Some very large masses of gold were found in Beyers and Holtermann's quartz reef at Hill End, N. S. W. From ten tons of quartz 102 cwt. of gold were said to have been obtained. (A. Liversedge—Minerals of N. S. Wales, p. 21, London, 1888.)

Walter B. Devereux, E. M., in a paper, "On the Occurrence of Gold in Potsdam Formation, Black Hills, Dakota," (Tran. Am. Inst. Mining Engineers, 1881, p. 465), states that careful observation in the field and consideration of the facts have led him to reject the theory that the gold has been deposited in the conglomerates from solution, and he regards it as a purely mechanical constituent; but states, p. 471, that "the larger and grain of the alluvial gold the greater the amount of silver it contains."

Prof. Egleston, in his work upon "Metallurgy of Silver, Gold and Mercury in the United States," (New York, 1887, Vol. ii., p. 57) takes up the question of the origin of nuggets, and quotes a letter from Mr. Selwyn, 28th March, 1882, in which Mr. Selwyn stands by his original hypothesis as follows;—"The cause (*i.e.* of nuggets) was the percolation through the gold bearing strata of very large quantities of saline and acid thermal waters, during the period of great volcanic activity, which produced the basalts. This action accompanied, but to a great extent succeeded, the phenomena which produced the present placer deposits. This gold from meteoric waters deposited on that already in the sands, produced the nuggets. He further states that his opinion is confirmed by the fact that large nuggets only are found in the western gold fields, as at Ballarat, Daisy Hill, &c., where immense basaltic eruptions had taken place all over the district. In the eastern and northern districts, as Gippsland, Ovens, &c., where streams of basalt occur only to a very limited extent, or are altogether absent, the gold is generally very fine, and nuggets of over one ounce in weight are of the greatest rarity." Brough Smyth, however, states otherwise, (see p. 25).

Prof. Egleston urges that in cases where the "gold does come from the destruction of veins, the surfaces are rounded and worn smooth." . . . "This is an entire contradiction to the mammillary structure of the nuggets." . . . They would have been water worn on the outside, and the cavities "would have been in the condition in which they left the vein, and the edges of any crystals found there would have been sharp; while in the nuggets the mammillary form exists even where crystals or the commencement of crystallization is observed, the edges of the crystals are very often blunted or rounded, showing both deposition and solution on these edges."

Egleston also urges, as others have done, that if the gold had come from the eroded rocks, it should have the same composition as that of the veins of the district in which it is found; whereas he says it is well known that vein gold is usually poorer than the alluvial gold of the same district, *e. g.*,

	California.	Australia.	Transylvania.	Nevada.
Nuggets	800 to 980	992.5 to 966	600	333 to 554
Veins	730 to 860	..	600	333 to 554

Egleston states, "that the violence of the old placer currents was very much greater than that of the ordinary streams of these days," and that "if this were the whole process and no further action had taken place, the gold would have been found in the comminuted condition exclusively." Further "that, gold is, however, also found as nuggets, and in small particles in rocks which have never been disturbed from their original positions, but which have been decomposed to a considerable depth and it then has the same mammillary form, occupying positions which make it evident that it must have been formed *in situ*, and never have undergone any abrasive action. The nugget found in 1828 in Cabarrus Co. N. C., which weighed thirty-seven pounds and also the one found in the valley of Taschku Targanka near Miask in Siberia, which weighed ninety-six pounds, were both found under such circumstances in a decomposed dioritic rock. In some few cases it has been definitely ascertained that the gold has been dissolved and precipitated in the decomposed rocks, for it has penetrated only just so far as the decomposition has allowed it, the yield in gold ceasing entirely at the point where the rock allowed no further filtration; while in other rocks of a more porous nature in the same district the gold has penetrated to a depth not yet ascertained."

(To be Continued.)

It is estimated that the Pilot Bay smelter will employ 109 persons at an average daily wage of \$307.50, and will daily require 20 tons limestone, 40 tons iron ore, 30 tons charcoal, and 12 cords of wood, making a total daily expenditure of \$897.50.



General Mining Association

OF THE

PROVINCE OF QUEBEC.

The Fourth Annual General Meeting of the General Mining Association of the Province of Quebec for the transaction of business and the reading and discussion of papers will be held in
THE NEW CLUB ROOM, WINDSOR HOTEL, MONTREAL

ON

WEDNESDAY, THURSDAY AND FRIDAY,

9TH, 10TH AND 11TH JANUARY, 1896.

Special arrangements for reduced rates on the certificate plan have been made with the Grand Trunk, Canadian Pacific, Quebec Central and Canada Atlantic Railways.

For programme and other particulars application should be made to the undersigned.

JOHN BLUE,
President, Capelton, Que.

B. T. A. BELL,
Secretary, Ottawa.

Ontario Mining Institute.

The next ordinary meeting of the Ontario Mining Institute will be held in

CARRUTHERS' HALL, SCHOOL OF MINING, KINGSTON, ONT.

ON

THURSDAY AND FRIDAY,

3RD AND 4TH JANUARY, 1896.

By arrangement with the Grand Trunk and Canadian Pacific Railways, members and their friends will be enabled to travel to and from the place of meeting at reduced fares, on obtaining Convention Certificates from their ticket agent.

On Friday evening 4th January, arrangements have been made by the citizens of Kingston, to entertain the members to a Public Dinner.

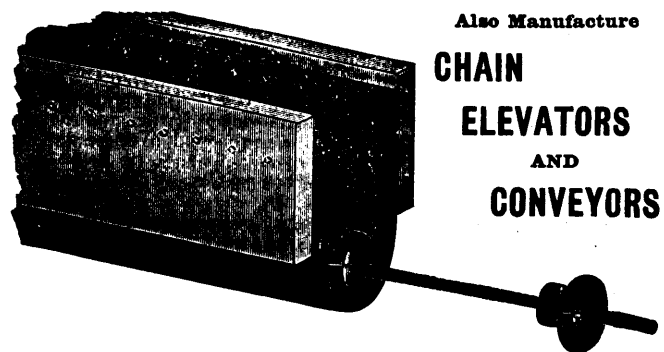
For programme of proceedings and other particulars, application should be made to

JAS. CONMEE,
President, Port Arthur.

B. T. A. BELL,
Secretary, Ottawa.

JEFFREY STEEL CABLE CONVEYORS, SIMPLE IN CONSTRUCTION

For Handling Coal, Ores, Chemicals, Refuse, Etc.



Also Manufacture

**CHAIN
ELEVATORS
AND
CONVEYORS**

SEND FOR CATALOGUE

The JEFFREY MFG. COMPANY, Columbus, O.

Also, 163 WASHINGTON STREET, NEW YORK.



CONDITIONS

OF

Obtaining Government Drill to Explore Mines or Mineral Lands.

Owners or lessees of mines or mineral lands in Ontario may procure the use of a Government Diamond Drill, subject to the provisions of the Rules and Regulations relating thereto, upon giving a bond for payment to the Treasurer of the Province, of costs and charges for (1) freight to location, (2) working expenses of drill, including labor, fuel and water, (3) loss or breakage of bits, core lifters and core shells, (4) wear or loss of diamonds, (5) other repairs of breakages and wear and tear of machinery at a rate per month to be estimated, and (6) an additional charge of \$50 per month after the mine or land has been shown, through use of the drill, to be a valuable mineral property.

Of the aggregate of costs and charges above enumerated, excepting the sixth item, forty per cent. will be borne by the Bureau of Mines in 1894, thirty-five per cent. in 1895, thirty per cent. in 1896, and twenty-five per cent. in each year thereafter until the end of 1900. All accounts payable monthly.

For Rules and Regulations *in extenso* governing the use by companies and mine owners of Diamond Drills, or other information referring to their employment, application may be made to ARCHIBALD BLUE, Director of the Bureau of Mines, Toronto.

A. S. HARDY,
Commissioner of Crown Lands.

Toronto, October 17, 1894.

W. PELLEW-HARVEY, F.C.S.

Mining, Analytical & Assay Work undertaken

Information concerning the Mining Industry
and Mines of British Columbia given.

ASSAY AND MINING OFFICES: VANCOUVER, B.C.

COPPER ORE!!!

Wanted at Good Shipping Points

Write with copy of analysis and state what quantities you can deliver this season.

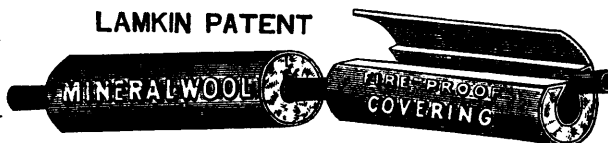
ALFRED BOYD,
1 WELLINGTON ST. EAST, TORONTO.

The CANADIAN MINERAL WOOL CO. Ltd.

122 BAY STREET, TORONTO

LAMKIN PATENT

Pipe and Boiler
COVERINGS.



STEAM
PACKINGS.

ASBESTOS GOODS OF EVERY DESCRIPTION.



MINING LAWS OF ONTARIO.

ANY person may explore Crown Lands for minerals. Mining lands may be taken up as surveyed locations or staked claims.

Locations range from 40 to 320 acres. Claims range from 10 to 20 acres on vein or lode. Locations may be acquired in fee or under leasehold.

Price of locations north of French River, \$2 to \$3 per acre, and south of it, \$2 to \$1.50, according to distance from railway.

Rent of locations first year 60c. to \$1 per acre, and subsequent years 15c. to 25c. per acre.

Rent of claims, \$1 per acre each year.

Claims must be worked continuously.

Royalty on ores specified in the Act, 2 per cent. of value at pit's mouth less cost of labor and explosives.

Royalty not charged until seven years from date of patent or lease, nor (as provided in s. 4 (3) of the Mines Act, 1892), until fifteen years in the case of an original discovery of ore or mineral.

Original discoverer of ore or mineral on claim entitled to stake out a second claim.

Crown Lands sold under provisions of mining laws in force prior to 4th May, 1891, exempt from royalty.

Copies of the Mines Act, 1892, Amendment Act, 1894, may be had on application to

ARCHIBALD BLUE,
Director Bureau of Mines.

TORONTO, May 25th, 1894.

HOW IS THIS?

Something unique even in these days' of mammoth premium offers, is the latest effort of Stafford's Magazine, a New York monthly of home and general reading.

The proposition is to send the Magazine one year for one dollar, the regular subscription price, and in addition to send each subscriber fifty-two complete novels during the twelve months; one each week.

Think of it. You receive a new and complete novel, by mail, post paid, every week for fifty-two weeks, and in addition you get the magazine once a month for twelve months, all for one dollar. It is an offer which the publishers can only afford to make in the confident expectation of getting a hundred thousand new subscribers. Among the authors in the coming series are, Wilkie Collins, Walter Besant, Mrs. Oliphant, Mary Cecil Hay, Florence Marryat, Anthony Trollope, A. Conan Doyle, Miss Bradon, Captain Marryatt, Miss Thackeray and Jules Verne. If you wish to take advantage of this unusual opportunity, send one dollar for Stafford's Magazine, one year. Your first copy of the magazine, and your first number of the fifty-two novels (one each week) which you are to receive during the year will be sent you by return mail. Remit by P. O. Order, registered letter or express.

Address:

STAFFORD PUBLISHING CO.

Publishers of

STAFFORD'S MAGAZINE,

P. O. Box 2264.

New York, N.Y.

Please mention this paper.

THE WEBSTER VACUUM FEED WATER HEATER AND PURIFIER

Aggregate Sales 400,000 HORSE POWER Guaranteed

We guarantee this Heater to give better results than any heater in the market, and will furnish the same subject to 30 days' trial.

IN STOCK—Heaters from 10 h.p. to 400 h.p. inclusive, in stock for prompt shipment.

SEND FOR ILLUSTRATED CATALOGUE.

WEBSTER OIL EXTRACTOR AND LIVE STEAM SEPARATOR

— MANUFACTURED BY —

DARLING BROTHERS, "RELIANCE WORKS,"
MONTREAL.

CHEMICAL AND ASSAY APPARATUS

AGENTS FOR THE DOMINION FOR THE

MORGAN CRUCIBLE CO., BATTERSEA, ENG.

AND FOR THE

**ANALYTICAL and ASSAY BALANCES and WEIGHTS of
BECKERS SONS, ROTTERDAM.**



Baker & Adamson's C. P. Acids and Chemicals, Brown's Portable Assay Furnace, Hoskin's Gasoline Blowpipes and Furnaces, Dangler Laboratory Lamp, Microscopes of E. Leitz, Wetzlar, Kavalier's Bohemian Glassware; Royal Berlin and Meissen Porcelain
Platinum wire, Fork Crucibles and Dishes,
Swedish and Rhenish Filter Paper.



LYMAN, SONS & CO.

380, 382, 384, and 386 St. Paul Street, MONTREAL

IN PREPARATION.

TO BE ISSUED IN JANUARY, 1895.

... 5th ANNUAL NUMBER ...

FIFTH YEAR.



FOR 1895.

Mining, Engineering .

Iron and Steel Trades

Companies Manual . .

EDITED AND PUBLISHED BY

B. T. A. BELL, Editor of the Canadian Mining Review,

Secretary General Mining Association of the Province of Quebec, Honorary Secretary the Mining Society of Nova Scotia,
Secretary Ontario Mining Institute.

This, the Fifth Edition of the Manual, will contain a careful digest of information, compiled up to date, respecting the history, organization and operations of all Canadian Mining and Quarrying Companies, Blast Furnaces, Rolling Mills, Iron and Steel Works, also of all the Rod Mills, Wire Mills, Cut Nail and Horse Nail Works, Car Axle Works, Car Wheel Works, Car Builders, Locomotive Works, Cast and Wrot Iron Pipe Works and Bridge Engineering Establishments.

In one Volume—600 Pages; Cloth; Royal Octavo.

PRICE: FOUR DOLLARS PER COPY.



PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

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

GOLD AND SILVER.

Under the provisions of chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at \$2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor is not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay

Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19 an ounce, and on smelted gold valued at \$18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

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

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX. NOVA SCOTIA.

School of Practical Science,

TORONTO, CANADA.

THE DEPARTMENTS OF INSTRUCTION ARE . . .



- 1 Civil Engineering (including Sanitary Engineering).
- 2 Mining Engineering
- 3 Mechanical and Electrical engineering.
- 4 Architecture
- 5 Analytical and Applied Chemistry.

The regular course for the Diploma of the School, in each of the above departments, is three years in duration. A Post-Graduate Course has been established, consisting almost entirely of laboratory work, which leads to the degree of B.A. Sc. in Toronto—Special Students are received in all Departments.
The Session continues from October 1st to May 1st.

SUMMER SCHOOLS FOR PROSPECTORS AND MINERS

And others interested in Mining, have been established at Sudbury and Rat Portage, and a Winter School of a similar character, but covering a more extended course, will commence in the SCHOOL OF PRACTICAL SCIENCE, TORONTO, on JANUARY 8th.

Properly equipped **ASSAYING, ENGINEERING AND CHEMICAL LABORATORIES** are provided for the use of students of the various departments, and the museum contains collections illustrating **MINERALOGY, LITHOLOGY, METALLURGY AND PALEONTOLOGY.**

For further information regarding the regular Courses and the Prospectus of the Winter School for Prospectors,

APPLY TO THE SECRETARY,

L. B. STEWART, D.L.S.
SCHOOL OF PRACTICAL SCIENCE, TORONTO.

DRUMMOND, McCALL & COMPANY.

IRON, STEEL & GENERAL METAL MERCHANTS.

OFFICE: New York Life Building, - MONTREAL, QUE.

CANADA IRON FURNACE COMPANY, Limited,

— MANUFACTURERS OF —

CHARCOAL PIG IRON

(From the Famous Ores of the Three Rivers District.)

Offices: NEW YORK LIFE BUILDING, MONTREAL, QUE.

GEORGE E. DRUMMOND, - Managing Director.

Plants at RADNOR FORGES, QUE., GRANDES PILES, QUÉ., LAC-A-LA-TORTUE, QUE., THREE RIVERS, QUE., LA PECHE, QUE.

MONTREAL CAR WHEEL COMPANY

..... MANUFACTURERS OF

RAILROAD CAR WHEELS

STREET CAR & LUMBER TRUCK WHEELS A SPECIALTY

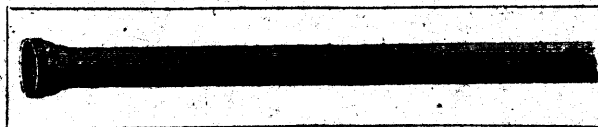
Works: LACHINE, QUE. Offices: NEW YORK LIFE BUILDING, MONTREAL.

THOMAS J. DRUMMOND, - - GENERAL MANAGER.

DRUMMOND, McCALL PIPE FOUNDRY CO. Ltd.

..... MANUFACTURERS OF

Cast Iron Pipes



Special Castings, &c.

WORKS: LACHINE QUEBEC.

OFFICES: NEW YORK LIFE BUILDING MONTREAL.

LUDLOW HYDRANTS, VALVES. &c., ALWAYS ON HAND.

THE DOMINION WIRE ROPE COMPANY, LTD.

MONTREAL

Manufacturers of LANG'S PATENT WIRE ROPE

FOR

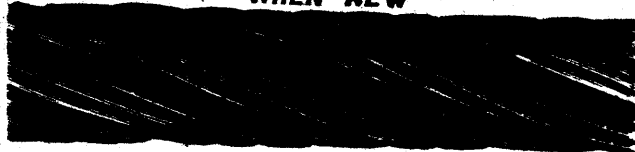
TRANSMISSION AND COLLIERY PURPOSES.

SOLE CANADIAN AGENTS for the

WHEN NEW

SOLE CANADIAN AGENTS for the

CELEBRATED



CELEBRATED:

MILLER & HARRIS-MILLER

WHEN WORN

"BLEICHERT"

CABLEWAYS.



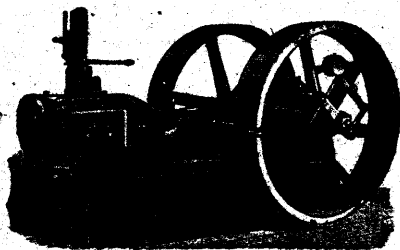
TRAMWAYS.

Also Ropes for Hoisting, Mining, Elevators, Ship's Rigging and Guys, Etc., Etc.

Send for Catalogue and Estimates to P.O. Box 1947

ROBB-ARMSTRONG ENGINES

SIMPLE and COMPOUND. AUTOMATIC or THROTTLING GOVERNOR.



BUILT ON THE AMERICAN INTERCHANGEABLE SYSTEM.

THE MONARCH ECONOMIC BOILER

—COMBINES ALL THE—

ADVANTAGES

—OF—

Light Portable Forms

—WITH THE—



HIGHEST POSSIBLE ECONOMY.

MANUFACTURED BY

ROBB ENGINEERING COMPANY, LTD. *

AMHERST, NOVA SCOTIA.

Dominion Coal Company, Limited.

Owners of the Victoria, International, Caledonia Reserve, Gowrie, Little Glace Bay, Bridgeport and Gardner Collieries.

OFFERS FOR SALE

STEAM, GAS and DOMESTIC COALS of HIGHEST QUALITY

Carefully prepared for Market by improved appliances, either F.O.B. or Delivered.

It is also prepared to enter into Contracts with Consumers covering a term of years. Its facilities for supplying Bunker Coals with promptness is unequalled.

APPLICATION FOR PRICES, ETC., TO BE MADE TO

J. S. McLENNAN, Treasurer, 95 Milk St., BOSTON, MASS.

DAVID McKEEN, Resident Manager,

Glace Bay, Cape Breton.

M. R. MORROW,

50 Bedford Row, Halifax.

KINGMAN BROWN & CO., Custom House Square, Montreal.

HARVEY & OUTERBRIDGE, Produce Exchange Building, New York, Sole Agents for New York and for Export.