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.

- [x] 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
- [x] Bound with other material/ Relié avec d'autres documents
- [x] 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.
- [ ] Coloured pages/ Pages de couleur
- [ ] Pages damaged/ Pages endommagées
- [ ] Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached/ Pages détachées
- [x] Showthrough/ Transparence
- [ ] Quality of print varies/ Qualité inégale de l'impression
- [x] 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
- [ ] Additional comments:/ Commentaires supplémentaires:

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

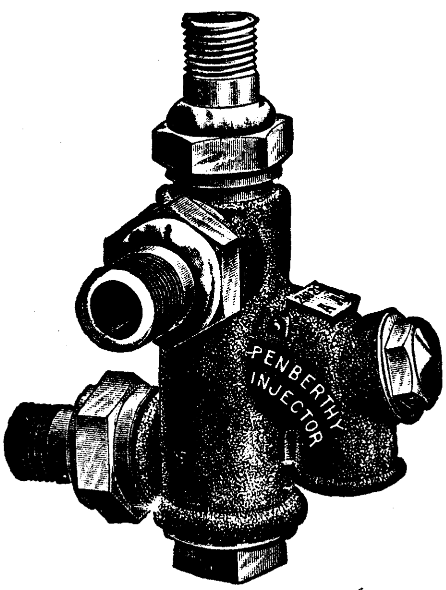
10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
										✓	

The Canadian Mining Review

Established 1882

Vol. XIV.—No. 9 | 1895—OTTAWA, SEPTEMBER—1895. | Vol. XIV.—No. 9.

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

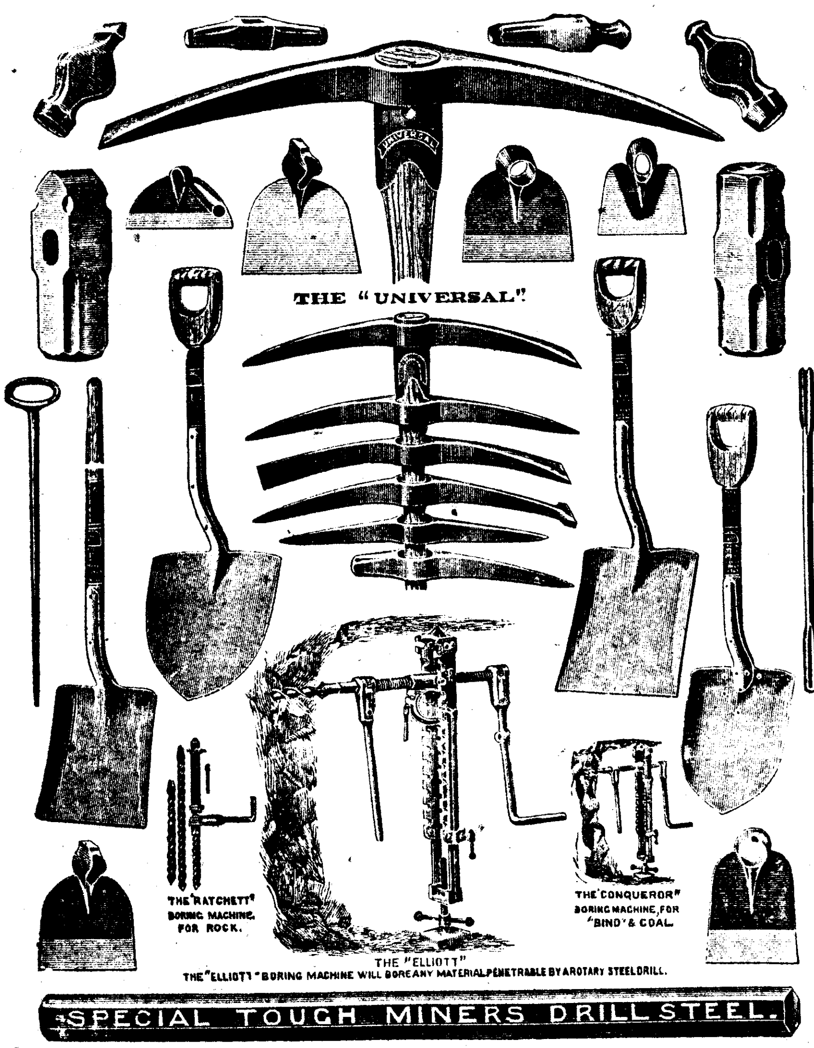
THOROUGHLY TESTED

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 HARDY PATENT PICK CO. Limited

SHEFFIELD, ENGLAND.

THE CASSEL GOLD EXTRACTING CO., LTD.

OF GLASGOW.

THE MACARTHUR-FORREST PROCESS (CYANIDE)

MINE OWNERS and others, having Gold Ores and Tailings hitherto untreatable at a profit, should send samples, prepaid, for experimental purposes, to the Company's Agent, W. PELLEW-HARVEY, F.C.S., when Cost of Treatment, Amount Extracted, and other particulars will be sent.

We want to contract for the purchase of Tailings, in parcels of 10,000 tons and upwards, or will treat on commission.

ADDRESS: **EXPERIMENTAL WORKS,**

Pender Street, Vancouver, B.C.

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

. . THE WEBSTER . .

VACUUM FEED WATER HEATER & 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.

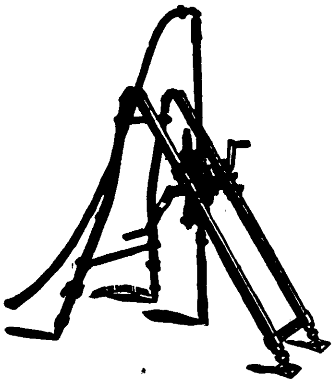
SEND FOR ILLUSTRATED CATALOGUE.

WEBSTER OIL EXTRACTOR AND LIVE STEAM SEPARATOR

MANUFACTURED BY

DARLING BROTHERS

"RELIANCE WORKS," MONTREAL.



"M" Drill—Hand Power.

Capacity—300 ft. depth.

Removes $1\frac{5}{16}$ 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,

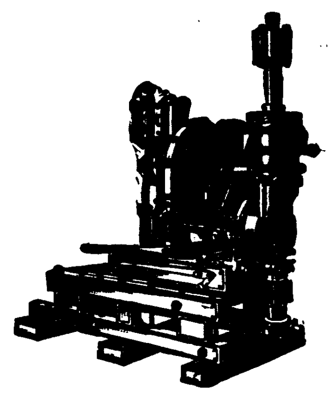
Successors to DIAMOND PROSPECTING CO., **54 & 60 N. Clinton St., CHICAGO, ILL., U.S.A.**

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 $1\frac{1}{4}$ 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. Leading and Connecting Wires.

Manufactured only by **JAMES MACBETH & CO.,**

128 MAIDEN LANE, NEW YORK CITY.

HAMILTON POWDER CO.

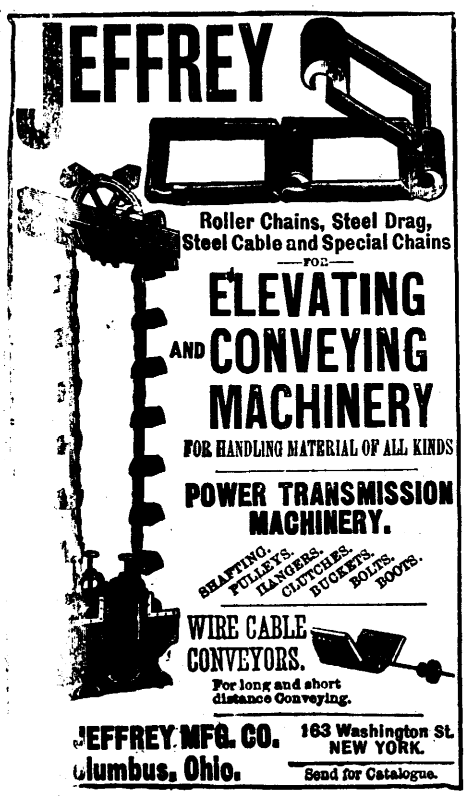
Manufacturers of Sporting, Military and Blasting

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.



REDDAWAY'S PATENT

"CAMEL" BRAND BELTING

REGISTERED TRADE MARK

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.

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.

CARRIER, LAINÉ & CO.,

FOUNDERS, MACHINISTS AND BOILER MAKERS,

LEVIS, QUE.

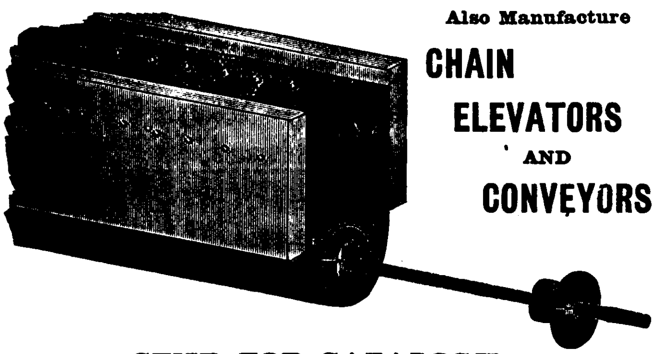
Engines, Boilers, Steam Pumps, Hoisting Gear and all Machinery for Miners, Contractors and Quarrymen. Also Builders' Castings, Stoves, Stove Fittings, Hollowware, Flour and Saw Mill Machinery, Marine Engines and Boilers, etc., etc.

WRITE FOR OUR PRICES.

JEFFREY STEEL CABLE CONVEYORS, SIMPLE IN CONSTRUCTION

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

Also Manufacture



CHAIN ELEVATORS AND CONVEYORS

SEND FOR CATALOGUE

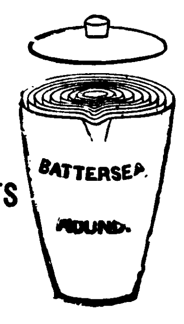
The JEFFREY MFG. COMPANY, Columbus, O.

Also, 163 WASHINGTON STREET, NEW YORK.

Chemical AND Assay Apparatus

AGENTS FOR THE DOMINION FOR THE

MORGAN CRUCIBLE CO. BATTERSEA, ENG.

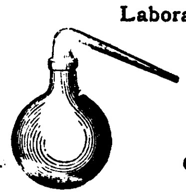


AND FOR THE

ANALYTIC L 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, Foil, Crucibles and Dishes, Swedish and Rhenish Filter Paper.



LYMAN, SONS & COMPANY,

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

CANADIAN GEMS, PRECIOUS STONES, ORES & MINERALS.

THE ATTENTION of Students and Collectors is directed to the REVIEW'S Cabinets of Canadian Gems, Precious Stones and Minerals.

No.	No. of Specimens.		
1	30	Canadian Minerals in Box	$ 1 00
2	30	Canadian Minerals in Box, larger	2 50
3	30	Apatite and Associated Minerals in Box	1 00
4	30	Apatite and Associated Minerals in Box, larger	2 50
5	30	Canadian Minerals in Box	2 50
6	60	do do do	3 00
7	60	do do do larger	5 50
8	100	Canadian Minerals in Box	7 00
9	100	do do do larger	12 00
10	100	Canadian Minerals in Cabinet	25 00
11	120	do do do do larger	50 00
12	210	Canadian Minerals, including Foreign Minerals, in Cabinet	100 00
13	30	Ores (Canadian) in Box	1 50
14	60	Ores (Canadian) and Foreign) in Box	5 00
15	60	Economic Minerals (Canadian) in Box	4 00
16	100	Economic Minerals (Canad'n and Foreign) in Box	10 00
17	30	Precious and Ornamental Stones (Canadian) do	3 50
18	60	Precious and Ornamental Stones (Foreign and Canadian) in Box	10 00
19	30	Cut Precious and Ornamental Stones (Canadian) in Box, $10 to	50 00
20	60	Cut Precious and Ornamental Stones (Canadian & Foreign) in Cabinet, $30 to	100 00

In addition to the above, we will make up sets of Minerals to conform with "Dana's Manual," or the work of any other author.

CABINET AND MUSEUM MINERALS.

We can supply single specimens of a great number of Canadian and Foreign Minerals. If you want something especially good let us know, and if we have not got it we will book your order.

CANADIAN MINING REVIEW

OTTAWA, ONTARIO.

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.

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.

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.

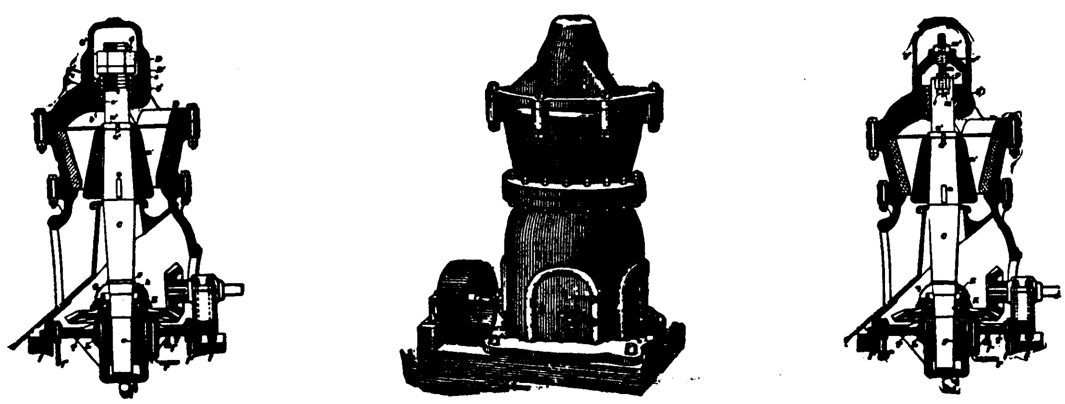
THE CANADA JUTE COMPANY (Ltd.)

17, 19 & 21 ST. MARTIN STREET,

MONTREAL.

The McCully

Rock and Ore Crusher....



Central Shaft with Crusher-Head supported from top instead of at lower end.

GUARANTEED to do more work with one-half less power than any other Crusher now known.

Received two awards at the World's Columbian Exposition at Chicago, Medal and Diplomas. The only awards given for this type of Crusher.

Also received an award and medal at the "Mid-Winter Fair," San Francisco, Cal.

Send for Catalogue or further information to

Patented in Canada and United States.

Waterous,

BRANTFORD, CANADA

Canadian Manufacturers of the McCully Rock Crusher

BLBACH 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 Consignment or Purchase.

Smelting and Refining Works:
Electrolytic Copper Works:
NEWARK, N. J.

Buena Fe Sampling Works:
Agency, SABINAS COAHULLA,

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

The Canadian Mining Review
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: Slater Building, Ottawa.

VOL. XIV., No. 9 SEPTEMBER, 1895. VOL. XIV., No. 9

British Columbia Mining.

This month the REVIEW sends to British Columbia a special correspondent to write up the important mineral developments now taking place in the Cariboo, Trail Creek, Slocan and other mining districts of that province. Our correspondent is an eminent English mining engineer, with a wide experience in the production of the precious metals and his contributions to these pages, copiously illustrated, will doubtless be of value to our readers interested in British Columbia mining investments.

Canadian Companies

Kootenay Consolidated Mining Co., Ltd., has been registered with an authorized capital of $500,000 to purchase and operate mines in the Province of British Columbia. The directors are:—George D. Scott, Vancouver; A. J. Scott, Vancouver, and W. J. McGuigan, Vancouver. Head office: Vancouver.

St. Elmo Gold Mining Co., Ltd., has been registered under the Foreign Companies Act, B.C., with headquarters at Spokane, Wash., and an authorized capital of $1,000,000.

Iron Horse Mining and Milling Co., Ltd.—Registered 10th August, 1895, with an authorized capital of $1,000,000, and headquarters at Spokane, Wash. To carry on mining in the Province of British Columbia.

Western Prospecting and Promoting Co., Ltd., has been incorporated at Victoria, B.C., with an authorized capital of $100,000 and headquarters at Vancouver, B.C. Directors: Richard E. Leonard, T. H. Tracey, George Geary, Alfred A. Smith, and Edward C. Taylor.

The Nanaimo Alberni Gold Mining Co., Ltd., has been incorporated under the laws of British Columbia, to acquire certain mineral claims held by William Leslie Jones and Alfred R. Hyland, respectively, situated at China Creek, in the district of Alberni, and to pay for the same either in cash or fully paid up stock of the company. The authorized capital is $300,000. Directors: Andrew Haslam, *President*; W. E. Morris, *Secretary*, and Wm. K. Leigton, *Treasurer*. Head office at Nanaimo, B.C.

Kootenai Mining and Milling Co., Ltd.—Registered 10th August, 1895, with headquarters at Spokane, Wash., and an authorized capital of $1,000,000. To carry on mining and milling in British Columbia.

Spokane Ore Co., Ltd., has been registered under the Foreign Companies Act, with an authorized capital of $5,000,000, and head office at Spokane, Wash., to carry on mining and milling in British Columbia.

Columbia Hydraulic Mining Co., Ltd.—Registered at Victoria, B.C., 19th July. Authorized capital, $100,000. Head office: Chicago, Ill.

British American Mining Co., Ltd.—Registered 1st August. Authorized capital, $500,000. Head office: Butte, Montana.

Phœnix Gold Mining Co., Ltd.—Incorporated in the United States, 12th August, 1895. Registered at Victoria, B.C., 3rd September, 1895. Authorized capital, $500,000. Incorporators: J. W. Wetherop, David Herman, J. F. Reddy, Jas. Cronan, J. H. Bench, J. K. Riordan, D. C. Newman. Head office: Spokane, Wash.

High Ore Gold Mining and Smelting Co.—Incorporated at Spokane, 14th June, 1895; registered, B.C., 3rd September, 1885. Authorized capital, $500,000. Directors: Cyrus Happy, *President*; D. M. McLeod, *Secretary*; Robert Russell, J. H. Griffith, H. L. Rogers, W. G. Estess, J. H. Kitcham, George H. Hughes, J. D. Findlay, A. B. Railton. Head office: Spokane, Wash.

Van Winkle Consolidated Hydraulic Mining Co.—A meeting of the shareholders is to be held at the company's office, Vancouver, B.C., this month, to authorize the company to dispose of the whole of their assets to another company for the purpose of working their mining claims conjointly with others.

Centre Star Mining and Smelting Co., Ltd.,—Registered 16th July, 1895, at Victoria, B.C., under the Foreign Companies Act, to carry on mining in the Trail Creek division, West Kootenay mining district, and to develop the Centre Star mineral claims, etc. Authorized capital, $500,000. Head office: Butte, Montana.

Horsefly Hydraulic Mining Co., Ltd.—Advices up to 23rd ulto. report that everything is going on satisfactorily and there is nothing of importance to mention.

Cariboo Hydraulic Mining Co., Ltd.—Recent advices state that the supply ditch was completed on 19th ulto., and the supply of water from Polley and Bootjack lakes made available for the company's purposes. The ditch was found to work satisfactorily, while the quantity of water it will deliver will be ample for the company's requirements. Unless some unforeseen accident should occur, there should be nothing to prevent the company from running continuously to the close of the season. With average weather active hydraulic operations should be possible until the middle of October, and, perhaps, even for a week or two beyond that date.

War Eagle Gold Mining Co.—Last report from this claim says:—The mine has resumed shipments after a suspension of several days, chiefly caused by the fact that the power for the two drills at work in the mine being obtained from the Le Roi compressor plant, the alterations being made in the machinery at the latter mine prevented power being given to the War Eagle. This work, however, being now completed, operations at the War Eagle are resumed. Connection has now been made between the upper tunnel and the west shaft and stoping has again been started. As soon as the 20-drill air compressor plant, which is now on the way to the mine, is on the ground, the new tunnel will be started and pushed forward and the immense body of ore between the first and second levels opened up and mined.

Hall Mines, Limited.—This company has let a contract to the well known firm of Fraser & Chalmers, of Chicago, for a smelting plant of the capacity of 100 tons of ore per day. The contract provides that the smelter is to be completed by December 15th next. The company is pushing on with the aerial tramway between the Silver King mine and Nelson, and such progress has already been made on this that it will very shortly be ready for operation. Large ore bins are being constructed at Nelson, and the company will soon have every facility for economically and expeditiously getting its ore down to the shipping point or smelter.

Horsefly Gold Mining Co., Ltd.—This company is making preparations for extensive hydraulicing on its property next season. The litigation which has hampered its operations for the last three years has been brought to a conclusion and there appears no reason to anticipate further delays in the profitable development of the rich ground which the company has in its leases of what is known as the old "Harper claim." It expects to be able to handle 2,000 yards a day with the machinery which it intends to put in.

Lillooet, Fraser River and Cariboo Gold Fields, Ltd.—A special meeting was held in London, England, on the 18th instant, when resolutions were proposed increasing the capital from £50,000 to £300,000; raising the board of directors from five to nine members, and appointing as additional directors the Hon. Forbes George Vernon, M. Henri Rosenheim, Baron de Machiels, and Dr. Jules Goldschmidt, the last three being resident in Paris; and appointing Mr. F. S. Barnard, M.P., as managing director. In reference to this meeting and the proposals to be submitted, the directors have issued a circular to the shareholders from which we take the following:

The directors having, in pursuance of the powers vested in them for carrying out the objects of the company, secured throughout the Province of British Columbia many mines, mining rights and claims, and having selected from them six properties as the most promising, which have, by extensive works, shafts, tunnels, etc., and repeated and elaborate assays, been proved to contain gold in large quantities and to be of great value, they are of opinion that the time has arrived for the company to alter its operations from those of a Prospecting and Exploration Syndicate to those of a large Development Company.

For the purpose of doing this it will be necessary to largely increase the capital and strengthen the executive of the Company.

With a view to securing expeditiously a portion, viz., £200,000, of the additional capital which it is proposed to create, the Company's brokers in London and Paris have organized a syndicate, in which they themselves and the directors have taken a considerable share, and which will be managed by the Company's Paris brokers (the senior member of whose firm is proposed as one of the additional directors), to guarantee the subscription of half the new issue, viz., £100,000, if it should not be subscribed forthwith by the present shareholders or warrant-holders, on condition of the syndicate having the option for one year to take at par the remainder of the new issue.

You will observe that it is not proposed to issue at present £50,000 of the new capital. This the directors deem it wise to retain in the Company's treasury, for the purpose, if necessary, of issuing the same as fully-paid shares in payment of any further properties it may be thought advisable to acquire."

The Canadian Exploration Syndicate, Ltd., was registered in London, Eng., on the 20th ulto., with a capital of £2,000, to explore mines and lands in Canada and elsewhere.

Byron N. White Co., Ltd.—Of this company the *Northwest Mining Review*, Spokane, Wash., says: "It is always made public when a dividend is paid by a company whose stock is on the market and it is a matter greatly to be regretted that all dividends paid by any incorporated mining company is not made public to those who are constitutional bears on mining may have their eyes opened. Large dividends are frequently paid by so-called private mining corporations of which nothing is heard, and this has been the case with the famous Slocan Star mine in the Slocan country. The mine is in an advanced stage of development, having no less than four levels run to tap the vein, drifts extended both ways at right angles to the tunnels and upraises made are all in ore. Estimates made by disinterested parties vary as to the amount of ore in sight, but the lowest estimate made by such parties is that there are over $3,000,000 worth of ore in sight. The owners make no estimate themselves, but are quite well satisfied with the showing, as they should be. The mine has paid for itself, and all development, a large sinking fund is set aside for machinery, and on August 1st a 10 per cent. or $50,000 dividend was declared. A contract has been let to the Porter Brothers for a flume and tramway, and Mr. B. N. White has gone east to open bids for a 100-ton concentrating plant to be built this fall. The K. & S. Railroad has built as near to the workings of the mine as possible and the ore will be trammed to ore-bins alongside the track. Nor will they be at the mercy of one road, as the N. & S. Railroad will also have entered the field by the time the concentrator is completed. The dividends will be both large and frequent as soon as the concentrator is running, for then, for the first time, will the mine be operated at full capacity. The clean or shipping ore will also be taken out and shipped.

CORRESPONDENCE

Gold Mining in New Brunswick.

The Editor:

At a point in Northumberland County, New Brunswick, not far from the junction of the three counties, Restigouche, Victoria and Northumberland, a crew of men are busily engaged in prospecting for gold, under, it is thought, promising auspices. The Northern New Brunswick Mining Company is the name of the concern which has the working of this mine and its officers are:— Directors, Sol. Perley; John Graham; S. T. Baker; D. W. Johnson; F. H. J. Dibblee: Sol. Perley, President; F. H. J. Dibblee, Vice President; J. C. Hartley, Secretary; John Graham, Treasurer.

The mining lands are situated on the banks of the Serpentine stream, a branch of the Tobique river. The Tobique empties into the St. John river about fifty miles above Woodstock, and near Andover, the Capital of Victoria County. Along the banks of the Tobique are very fine farming lands, scarcely yet begun to be developed. Between fifty and sixty miles up the Tobque the river branches off into four directions and the appropriate name of "The Forks" is given to this point of separation. One of these branches which runs into Northumberland County is the Serpentine, and on this stream six miles from its mouth is the mining limit. Last autumn the Company bought a stamp mill from Fraser and Chalmers, Chicago, at a cost of $1,000. It has a crushing capacity of over three tons a day and is equal to five horse power. It was taken up the "Forks" and there remained all winter. On the 27th day of May a party of men, under the direction of Mr. Sol. Perley, left Woodstock for the mining lands. The journey up to the forks from the mouth of the Tobique had to be made by waggon, there being a railway (so-called) but useless for practical purposes. Moving the heavy stamp mill was no child's play. It was first loaded on a flat boat 44x9. For part of the way along the river this worked very well, but the time soon came when the boat struck the bottom of the narrow stream. The only chance left was to unload the mill and carry it up the stream by sections. It was a very happy day for the miners when they found themselves safe and sound with the stamp mill, on the banks of the Serpentine.

The mill was started on the 4th of July and works to perfection.

The bit of land which the Company controls is about ten miles square. It is described as being covered with a mossy growth. The mining party have erected fine buildings, the mill house being 14 x 36. Water to run the mill with is brought in by pipes about forty rods from the foot of the immense hill on the opposite side of the stream. Ten veins have been tested and the result is said to be satisfactory. These veins lie within a distance of seventy-five feet and are along the bank of the river. It s not claimed by the Company that the gold is of a very high order, but as it lies on the surface and is easily mined, they are confident it can be mined on a paying basis. The President has just been in Woodstock after a two months stay at the mine. He is at the time of writing, in St. John on a business trip.

Much interest is taken in the mine here, and there is a general hope and expectation that something may come of it. The miners themselves are so confident that they have already named the town and set it out in "lots."

T. C. L. K.

ST. JOHN, N.B., 1ST AUGUST, 1895.

Novel use of Mica.—The uses of mica are manifold. One of its latest developments is distinctly novel. An ingenious Australian has invented and introduced a mica cartridge for sporting and military guns. The filling inside the cartridge is visible and a further advantage is that instead of the usual wad of felt a mica wad is used. This substance, being a non-conductor unaffected by acids or fumes, acts as a lubricant. Where smokeless powders, such as cordite or other nitro-glycerine compounds are used, mica has a distinct advantage over every other material used in cartridge manufacture. Being transparent, any chemical change in the explosive can be at once detected. The peculiar property it has of withstanding intense heat is here utilized, the breech and barrel being kept constantly cool. The fouling of the rifle is also avoided, the wad actually cleaning the barrel.

NOVA SCOTIA NOTES.

Our windy Halifax contemporary, the *Colliery Guardian, Critic, &c., &c.*, comes out with the startling intelligence that the South Kensington School of Mines, so far as coal mining is concerned, is a gigantic humbug. Whether the School of Mines will survive this blow or not remains to be seen, but we would like to enlighten the *Critic* on a few points. In the first place there is no such institution as the South Kensington School of Mines, the title, until quite recently, being the Royal School of Mines, and it has now assumed the new-fangled title of the Royal College of Science, with which is associated the Royal School of Mines. The very fact that the controlling board have attempted to introduce the Royal College of Science by the prestege of the Royal School of Mines, is sufficient compliment to that old-time institution which has turned out some of the best men of the day in both coal and metalliferous mining. Secondly, that it was and is possible to obtain the Associateship of the school in either geology, metallurgy or mining, consequently a man who takes his associateship in metallurgy or geology, may, through force of circumstances, turn his attention to mining and is naturally not as sound as a man who has taken his associateship in mining.

Thirdly, during the four months' summer vacation the students are supposed to put in a considerable part of the time in either some mine or metallurgical establishment, or in field work; some of them do not always avail themselves of the introductions they can obtain from the professor for this purpose and are naturally not so good as those who do.

A school of mines at the best can only give a sound foundation for after work and it must rest with the student whether he makes proper use of this in after life. It is manifestly unfair because a few duffers can be found who have graduated from a school or university to condemn the whole institution.

An attempt is being made to open the Foord pit, Pictou Co. A 15 inch brick wall is being built to shut off the part supposed to be smouldering, and sand will be poured down behind to protect it. The air in the pit is reported to contain little or no gas.

A new find of gold has been made on and near the Dufferin mine, east of the present workings. T. R. Gue and others have taken up 374 areas.

Several very good returns of gold have been made at the Mines Office for the month of August. Fifteen Mile Stream heads the list with 409 oz., this increased return, we are informed, is due purely to a change in the management, the quartz gives about the same average amount of gold and the same number of men have been employed as heretofore.

A new find of gold has been made on the Dartmouth and Cow Bay road and 149 areas have been taken up.

Mr. George Stuart called on us recently. He is well satisfied with the progress made on the Plough-head property. He is also prospecting on his property in Wine Harbor with a view to cutting the Romkey, Twin and Eureka leads. He reports the surface as being very heavy.

The Golden Lode continues its splendid record. Mr. A. A. Hayward was in town with a 209 oz. brick and a 5% dividend has been declared for the month.

Mr. J. C. McDonald has resigned the management of the Woodstock mine at Forrest Hill, and Mr. W. J. McIntosh, Mr. J. E. Hardman's late foreman, assumes control. The property is looking well and we expect to hear good accounts of it.

Mr. J. A. Fraser's new plant, erected on the old Chicago property, is in full operation. Mr. Fraser is well pleased with the results of his development work.

Mr. Fraser has taken an option (with the right to develop) of the Mason-Hudson property, adjoining the Woodstock and Forest Hill properties. Mr. Fraser has a high opinion of both the richness and extent of this locality.

Messrs. B M. Davidson *et al.* have just completed the erection of a modern 10-stamp mill on their property in Wine Harbor. They report their Romkey and Twin leads at depths of from 25 to 120 feet, looking exceedingly well.

The Arthur-Partridge mine, known as the Springhill mine, Goldenville, is reported to have produced 200 oz. last month. This is a very handsome return for the small outlay which has been made on this property.

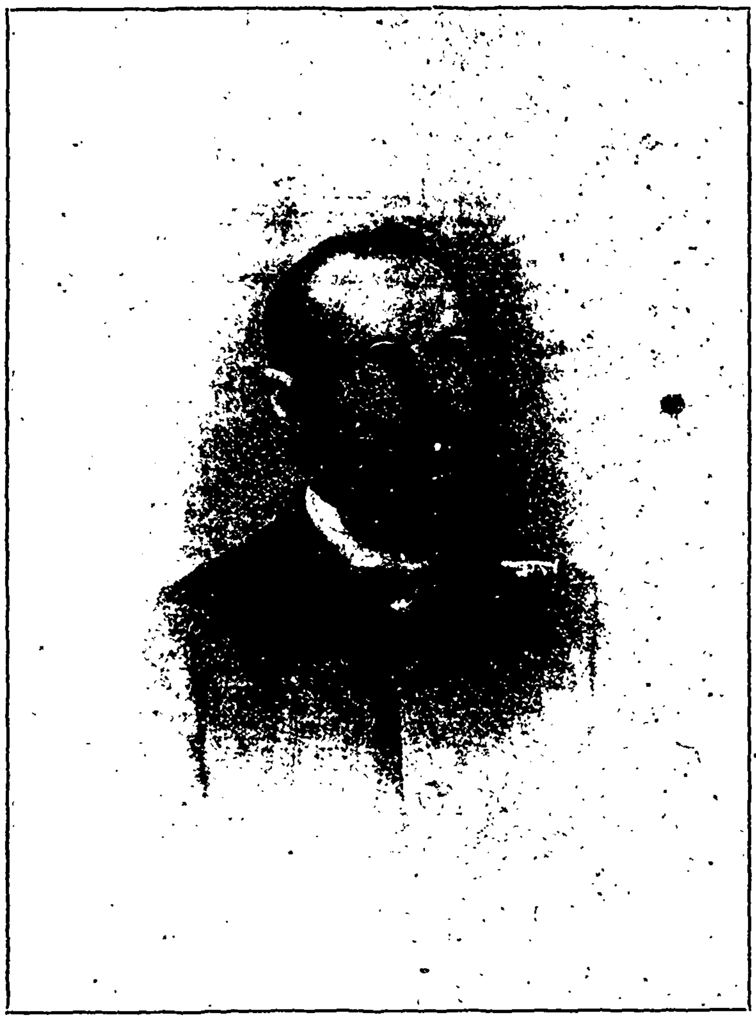
It is a particularly pleasing feature in the returns to see that sterling district of Goldenville once more on the producing list. Goldenville has been the best district in Nova Scotia, and we think there is every reason to believe it will be again before very long.

Mr. Whitney and several of the directors of the Dominion Coal Co. have paid a visit to their mines in Cape Breton, and are well pleased with their property and the progress made on it.

Mr. Miers, of New York, is making a thorough test of the Collins pulverizer, amalgamator and concentrator. Should his report be satisfactory, it is likely that the New York people for whom he is making the tests, will put up a custom plant with a bromination works attached.

Manager Hargreaves is taking a vacation trip to his old home in England. He is now there, and is expected to be away a month longer. Assistant Manager Matthews relieves him. Mr. Robert Archibald, formerly of Joggins, spent the last four months at Springhill and contemplates going to Scotland about October first.

At Joggins, work is fairly brisk, with an output of 350 tons daily. Most of this comes from No. 3 slope—only one level of No. 2 slope is now being worked. A strike which lasted a fortnight, took place in August, ended rather unfortunately for the men. After resisting for two weeks they accepted the terms originally offered them by the Company.



F. HILL, Mining Engineer, Port Arthur, Ont.

The coal trade of Cumberland County, during the summer months is confined to the Springhill and Joggins collieries. The demand has been about as usual, for these months when there is little coal burning weather. The barges built by the Springhill Company a couple of year sago, have been kept busy between Parrsboro and Bay of Fundy and New England ports. Transportation has been cheapened and the owners of barges have benefited in consequence or been enabled to push their sales into new territory in the face of keen competition.

St. John is the principal market for Cumberland coal. Competition, there, has been keener than ever owing to the determined effort made by the Dominion Coal Co. to obtain a foothold for Cape Breton coal in that market. Prices have been falling ever since the beginning of the season, and the war is still carried on with great vigor. Meanwhile St. John manufacturers, and others are enjoying the fun, and endeavoring to make long term contracts to provide against a possible agreement among the coal companies.

At Springhill very little new work is being carried on, with the exception of the rebuilding of No. 3 slope pithead buildings, destroyed by fire in February. Thus far only the trestle work in the immediate vicinity of the slope has been erected, and it is reported that the Company has abandoned the trestle connecting the two slopes. The engines at No. 3 slope which were badly damaged by the fire, have been thoroughly overhauled and repaired by Roob, of Amherst. A substantial foundation has also been put in, so that this slope should be in readiness for work within a couple of months if required. Nothing has yet been done towards rebuilding at No. 2 slope. Meanwhile only No. 1 slope is operated. The output is about 1600 to 1700 tons for a shift and a half. The pit works all day, and a half shift at night, which gives the men three-quarter time steadily. The outlook for the winter, with the return of better coal-burning weather and a stronger demand for domestic coal, is considered fairly good.

Mr. Henry McArthur has filled the position of Acting Manager since the resignation of Mr. Archibald in May.

The River Hebert Mine, the property of the Seaman estate, worked under lease by Mr. Wm. Hall, has resumed operations on a large scale. Mr. Hall has a contract for five thousand tons for the I. C. R. During the summer the slope was sunk 300 ft., level driven a considerable distance east and west, opening up a new part of the area where the coal is of better quality. The capacity of the mine has thus been increased to about fifty tons a day.

The smaller mines about Maccan and Chignecto, which have been idle since April, are again showing signs of life and activity. Their sales are confined to the immediate neighborhood of the pits. One of the pits formerly worked by Messrs. Wetherby and Ripley, is said to be lost through careless mining, followed by spontaneous combustion. Mr. James Baird, who understands the nature of that coal-field, and is a sound practical operator, has had greater success. The Smith pit at Maccan station is doing little or no work, and the coal seam continues unsatisfactory. Occasionally this mine is visited by some Americans who appear to have a scheme of some kind concealed about their person, which fails to materialize. Mr. Frank Burrows has charge of the property.

The examination for granting managers certificates, came off on the 25th, 26th and 27th, of this month, at Springhill.

Gold Mining in Nova Scotia.

By F. H. Mason, Halifax.*

Twenty-five years ago Prof. Henry Youle Hind read a paper before the Society of Arts on "Gold Mining in Nova Scotia," and the writer proposes to draw some comparisons between the costs and methods of mining then and at the present day. The writer cannot give a better description of the lodes than Prof. Hind, who has made a life-long study of them, who wrote as follows:—

The lodes of Nova Scotia may be grouped as follows:

I. Bedded Lodes—Consisting of beds of quartz interstratified with slates and quartzites of contemporaneous age with them, these are the most abundant, and from them a considerable proportion of the gold is obtained.

II. Intercalated Lodes—These almost always, as far as known, occur in slates, and are numerous in broad bands of slate from 10 to 70 feet in width. Where these lodes abound it would be profitable to crush both the slate and the quartz, for gold is not infrequently found in the slate. The best illustrations of the intercalated lodes occur in Sherbrook and Wine Harbour.

III. Gash Lodes, occurring where the strata has been locally squeezed out of place. Instances are known in various districts, the most important being at Renfrew.

IV. True Lodes or Veins, cutting the strata. Some of these are very rich, but those which have been worked proved very narrow. The irregularity of true lodes is well known, and the fact that hitherto this class has yielded comparatively inconsiderable results should not discourage operations, for true lodes frequently thin out to a mere film of quartz and increase to a thickness of several feet within a vertical distance of a few fathoms.

These lodes occur in the lower silurian formations.

Prof. Hind describes the Sherbrook gold district as follows:—

If a slightly undulating line be drawn on the course of S. 83 degs. W. (true) or N. 75 degs. W. magnetic north, from area 775, on the east side of the St. Mary's river, it will represent part of the axis of the Sherbrook anticlinal. On the north side of the axis the lode dips to the north at an angle of about 45 degs., except on approaching the axis, when they commence to curve. On the south side the dip varies from 80 degs. to vertical, except when making the curve. Proceeding south from the axis, the lodes become more persistently vertical, until they acquire a slight northerly dip, thus showing that the form of the anticlinal is that of a slight overturn to the south, as represented in the sections. On making the curve some of the lodes sweep gradually round, with a dip varying from 80 degs. south to 60 degs. south-west, 35 degs. south-west by west 26 degs. W., then gradually increasing until they acquire the normal dip on the north side of the anticlinal of 45 degs. north. The strata and contemporaneous lodes at Sherbrook may be described as beds of slate and quartzite with thin sheets of auriferous quartz folded in an overturn anticlinal form, and subsequently tilted to the east by a cross anticlinal. The denuded crest of the intersections of the anticlinals has exposed the sheets of quartz in the form of long semi-ellipses, whose bases rest upon Cambrian gneiss, from which the silurian quartzites and slates have been removed by denudation. Numerous dislocations, having generally a north and south course occur in Sherbrook. These appear to have taken place during the north and south folding. Some of them are represented in the plans and in the sections.

Having given a description of a typical gold district, and one from which over 2,000,000 dollars worth of gold has been extracted, the writer will now turn to the methods of mining.

During the 25 years which has elapsed since Prof. Hind read his paper, the mining of gold in Nova Scotia has not progressed by the leaps and bounds which he had hoped to see. The principal improvements have been in the stamp-battery, the fast drop (90 to 100 per minute), taking the place of the slow drop of about 40 per minute, heavier stamps have been introduced and the construction of the mortar improved. Silver-plated copper plates are taking the place of copper plates, and the length of them considerably increased, and mercury traps have been generally introduced. Some few mines have put in concentrating machinery, but in the majority of cases the concentrates are allowed to flow away with the tailings, and enormous quantities of gold are being lost yearly through this neglect. This neglect is the more astonishing because in the majority of cases, the owners and managers know the value of the tailings which are being lost. The writer has in several instances made assays of concentrates which have run over 10 ozs. of gold per ton of concentrates, while the concentrates vary from 1½ to 10 per cent. of the total amount of ore treated. It is unusual for the writer to receive samples of concentrates which run under ½ ounce, although in some few cases they will run only 3 or 4 dwts. per ton. He has proved by experiments in his laboratory that the concentrates are capable of being economically treated by roasting and chlorination or bromination, and in the majority of cases by cyanide of potassium.

The concentrates from most of the mines are mainly composed of arsenical iron pyrites, those from the Montague and Uniacke mines are rich in copper pyrites, and also contain galena and blende in considerable proportions.

No scientific attempt has ever been made to treat these concentrates. A chlorination works was started at Waverley, the writer's experience being that the concentrates at Waverley are the poorest of any district in the province. The writer has been unable to obtain any reliable record, but has been told that large quantities of salt were used in the roasting, and the gold was lost in that process. Anyhow, it resulted in failure and was abandoned. An attempt to treat the tailings by cyanide of potassium was tried at Brookfield by people without experience of the process, and also resulted in failure. At the present time a chlorination works is being erected near Chester, a district where the concentrates are rich, and the writer hopes that the attempt may prove successful.

Professor Hind states:—"From careful assays of numerous parcels of tailings as they came from the mill and selected indiscriminately, the average quantity of gold contained was found to exceed 4 dwts. per ton." The writer's experience of samples of tailings sent to his laboratory gives an average in excess of that amount; but such an average would be unfair, because it contains several assays considerably in excess, and in some cases containing considerable quantities of auriferous mercury; it also includes assays of tailings, the ore of which never contained any appreciable amount of gold. These two factors make it extremely difficult to strike a fair average.

Prof. Hind gives as an instance of the way mines were worked 20 years ago the workings on the Tudor lode at Waverley. "The number of shafts by different companies on these lodes within a mean distance of 2,000 feet is 54, having a mean depth of 200 feet. This is equivalent to a shaft to every superficial area of 47 feet." Mr. John E. Hardman is now working this property for the Tudor Gold-Mining Company, by a series of levels and cross-cuts from a main shaft, and the writer is indebted to him for the following particulars of working expenses:—"The property has been worked for three consecutive years; the yearly average yield has been from 4 to 5½ dwts. per ton; the average width of the quartz vein has been and is 12 inches. The cost of mining the quartz per ton has varied from $1.25 upwards. The average cost per ton for mining, milling, and incidental expenses for last year was $3.20; this is from a depth exceeding 225 feet, and as deep as 400 feet. The costs include pumping, hoisting and all milling work. The milling cost and incidentals include salaries and office expenses, but excluding development and exploitation."

Many mines in Nova Scotia to-day are unfortunately not worked with the same degree of economy, and the writer regrets that the Tudor mine is an exceptional case, but it shows what can be done with a proper scientific knowledge of methods of mining.

The gold-miners of Nova Scotia have latterly been turning their attention to the large intercalated belts of lower-grade ore, and in this lies the future of gold-mining in this province.

As an instance the writer may quote the Richardson mine in the Stormont district, the lode has a minimum width of 6 feet, and a maximum width of 17 feet, with an average width of about 11 feet. Its yield runs from 4 to 8 dwts., with an average yield in excess of 5 dwts. of free-milling gold, the concentrates are totally disregarded, as at many other mines. This lode has been milled and mined for $2.27 per ton, including cost of pumping, management and office expenses, no allowance being made for wear and tear of machinery.

The majority of paying mines to-day are old workings which the old miners (most of whom were brought up as "tinkers, tailors, soldiers, sailors, apothecaries, or ploughboys") through lack of knowledge considered exhausted.

A typical instance may be quoted in the Hardman and Taylor property at Oldham. An English company sank £16,000 in this property without returning any dividends. Twelve years ago Mr. Hardman assumed the management, and has taken from it, without expending any large amount of capital, over $500,000 worth of gold, while in some years the profits exceeded $40,000. Through Mr. Hardman's kindness the writer is able to give the following particulars:—

The Dunbrack vein has been the chief producing vein during the past ten years, over $400,000 having been obtained during that time from 7,600 tons of quartz. Several phenomenal yields have been recorded from this vein, such as in August, 1885, when 125 ozs. were returned from 2·40 tons, and in 1890 when 37 tons yielded 1,037 ozs., and in the same year 12 tons yielded 530 ozs. In 1891, 48 tons yielded 757½ ozs., and in the same year 88½ tons gave 1,084 ozs. In August, of 1893, 2 tons gave 250 ozs., or at the rate of 125 ozs. per ton. This year was the largest in the history of the district, the gross yield being 62,000 dollars. The Dunbrack vein has been opened by five shafts or inclines, varying from 157 to 483 feet in depth, and by levels at 150, 250, 300 and 450 feet; from the 450 level a winze was sunk 124 feet, making the greatest depth on the incline 574 feet, equivalent to about 407 feet vertical depth.

The workings are intersected by several small slides or faults, from a few inches to 6 or 7 feet in width, and are cut by two main dislocations, one of about 112 feet, which has been cut through in each level. The other large fault is supposed to be about 125 feet in extent, but no workings have as yet been carried beyond that fault.

The concentrates from this mine have been collected, and average from 65 to 70 dollars per ton.

Other instances of old mines being successfully reopened may be cited, such as the

*Paper read before the Fed. Inst. of Mining Engineers.

Antigonish Company's mine at Country Harbour, the Pictou Development Company's property at Renfrew, and the Golden Lode Mining Company's mine at Uniacke Mr A. A. Hayward has given the writer the following of the latter mine :—

During the last three years 200,000 dollars worth of gold has been extracted, the average yield being over 10 ozs. per ton, the vein is eight inches wide, and dips 32 degs. The maximum depth we have reached is a little over 500 feet, on the incline where the quartz is as good as ever. The capital of the company is 30,000 dollars, and dividends are being paid at the rate of 5 per cent. per month or 60 per cent. per year.

Amongst other improvements in the methods of mining is the use of machine drills, worked at pressures of from 60 to 100 pounds per square inch. A low grade dynamite (about 40 per cent. of nitro-glycerine) has almost universally superseded blasting-powder; no attempts have been made to use the higher grades of dynamite gelatine-dynamite or blasting-gelatine. Dynamite has been considerably handicapped, as there is a heavy provincial import duty on it, and miners are unable to get it from the upper provinces, where it is manufactured, on account of the Government prohibiting its transit over the Intercolonial railway. However, through an agitation last year amongst mine-owners the local manufacturers have considerably reduced their prices, and a 40 per cent. dynamite can now be obtained at 16 cents per pound.

Perhaps one of the most notable features in the gold-mines of Nova Scotia is the lack of tramways from the pit-heads to the stamp-mill, the ore in many cases being hauled long distances by carts; this is due to the want of sufficient initial capital. Indeed, the want of capital is seen right through the gold-fields ; it prevents the proper exploiting and development of the mines, and consequently when a difficulty is met with, such as a fault cutting off the vein, a good mine is often closed. The mines are not opened sufficiently, nearly all the profits going to dividend account, instead of some being reserved for development.

In attempting to interest capital in Nova Scotian gold mines, one is often met with the statement, " The veins in Nova Scotia are narrow, and the quartz is expensive to extract. " The writer wishes to distinctly place on record that the first part of this statement is only partly true, and that the latter part is wholly untrue. Anyone starting mining operations in Nova Scotia may have the choice of narrow rich veins, varying from ½ inch to 18 inches in thickness, and carrying sometimes over 100 ounces per ton, or they may content themselves by working the big low-grade belts, from 10 to 70 feet wide, carrying from 2 to 8 dwts. of free-milling gold, and often as much as 5 dwts. in arsenical iron pyrites besides. Such belts occur in the Goldenville and Wine Harbour districts, and offer legitimate investment for capital. The second part of the statement is best refuted by Mr. Hardman's experience in working a 12 inches vein for 1 25 dollars per ton at the Waverley mine.

Labor in Nova Scotia is cheap, good miners commanding from 1·25 dollars to 1·75 dollars per day, laborers from 1 dollar to 1·25 dollars, and skilled mechanics from 1·75 dollars to 2·50 dollars per day. Coal may be obtained from 2·50 dollars to 3 dollars per ton at the pit-head, and wood can generally be had for 2 dollars per cord at the mine, stores explosives etc. etc., are also moderate. Nearly all classes of mining and milling machinery are made in the province, and are equal to anything that can be imported, and mining machinery not made in the province may be imported free of duty. Most of the gold mines are within 12 days from London and four days from New York, while many may be reached in two days less. Many of the mines have valuable water privileges. The winters, though long and severe, never interfere with mining operations, other than surface prospecting. The climate is healthy, and sport with both gun and rod is good.

The writer is satisfied that the gold mines of Nova Scotia offer a legitimate source of investment for capital, and with proper and economical management, remunerative returns may be looked for. Prof. Hind gave nine reasons why failure and collapse in place of continued prosperity have characterized some mining properties in Nova Scotia, and they are as true to-day as they were twenty-five years ago ; they were :—

1. The absorption of all returns to pay large dividends.
2. The small size of some of the properties.
3. Insufficient working capital at the outset.
4. A uniform neglect in preserving records and plans in detail of work.
5. Inadequate machinery and appliances to save gold.
6. The want of labor-saving machinery.
7. Ignorance respecting mining operations, the gold streak, or " chimneys," or " pipes," or zone of auriferous quartz.
8. General neglect of the contract and tribute work.
9. And as a necessary result of the foregoing the frequent incompetency of some so-called managers.

As a typical instance of the way some mines are mismanaged, on a visit to one mine, which has since collapsed, the writer found six pumps in one shaft and the mine full of water, while a neighboring mine was being kept free with one pump.

The following table gives the returns from the different gold-mining districts for the year ending September 30th, 1894 :—

District.	No. of Mines.	Day's Labor.	No. of Mills.	Tons Crushed.	Yield of Gold per Ton.		Total Yield of Gold.		
					Dwts.	grs.	Ozs.	dwts.	grs.
Tangiers and Mooseland ...	2	5,118	2	1,469	7	6	464	7	0
Caribou and Moose River...	4	21,657	3	9,727	5	17	2,779	16	17
Renfrew........... ..	1	5,020	1	757	15	14	590	0	0
Sherbrook	3	8,414	2	708	17	0	552	16	12
Fifteen-Mile Stream........	1	8,354	1	1,171	9	9	552	0	0
Uniacke............. .	3	10,797	2	1,544	18	1	1,394	8	1
Waverley................	1	19,397	1	9,310	3	23	1,860	1	0
Whiteburn................	1	4,846	1	555	12	3	336	8	0
Malaga...................	2	3,649	2	1,688	12	13	1,060	11	0
Lake Catcha....	2	12,522	3	2,387	14	8	1,715	6	0
Stormont	5	16,768	6	6,628	5	23	1,980	4	18
Salmon River.	1	5,496	1	1,467	3	16	271	5	0
Oldham	2	3,623	2	981	11	3	546	17	16
Unproclaimed districts.....	5	13,479	6	939	18	15	876	5	12

It would be impossible to close a paper on the gold-mining of Nova Scotia without a reference to the Government Department of Mines. More than half the revenue of the country is derived from its mines, and yet there is much the country might do for the miner which it leaves undone. (1) There are no plans kept of the workings, consequently when a mine is shut down the plans are often lost, and if at any time anyone desires to reopen it, the task is rendered difficult and dangerous, all the information obtainable often being what can be obtained from the miners. (2) In what is known locally as the Blue Book (which is a yearly record of the mining industry) there is a vast amount of room for improvement. The Blue Book of 1894 is infinitely inferior to that of 1870; it contains many inaccuracies, and instead of being a means of interesting capitalists in the mines of the country, it is calculated to have exactly the reverse effect. (3) Proper surveys and maps should be at once made of all the mining districts, distinctly marking existing and old workings ; these would meet with a ready sale amongst mine owners and mining engineers.

The Government has lately given a grant to the Mining Society of Nova Scotia, which institution is doing much to promote the mining industry.

As a rule, if anything is properly laid before the Government, they are willing to move in the matter, and many of these omissions are blameable to the mine-owners themselves for not bringing the matter properly to the notice of the Government.

NEW BRUNSWICK NOTES.

Since writing you last, no very decided change in regard to mineral matters in this province has taken place. Here and there you hear of some anticipated sale or development of a mining property, but nothing really tangible has as yet been shown. What the next few weeks may bring forth in this respect is hard to say.

Within the past few months some areas have been worked on in Albert Co., near the Goose Creek locality. A syndicate of Moncton gentlemen, and a Mr. Robt. Dryden, reported to be a practical Californian miner, have been opening up some quartz leads, assays of which, it is said, have shown tests of gold, silver and copper. There is some doubt as to its being a genuine gold-bearing and yielding lead, but the indications and appearances of copper are very good. In the meantime the promoters have taken out letters patent for incorporation with a fairly large capital and headquarters at Moncton, N.B. The unfortunate experiences of some of the Monctonites in the Memramcook Gold Mine is not calculated to cause any very great rush for stock in this venture, I predict.

Work of what might be called an initiative or inquiring character has been quietly prosecuted with a view to placing the salt works near Sussex in a first-class state of production, with suitable plant and machinery of most approved character. It is to be hoped the efforts may be finally successfully.

The promoters of the Gold Prospecting Company of Woodstock have been pushing forward their operations quietly yet energetically. The exact location of the company's property is in Northumberland County, near the borders of Victoria, on what is known as the Serpentine. With much hard work and at considerable cost they placed their 5-stamp mill at the point named, and have since been crushing and testing the rock from various leads on their areas. Some of these have been very satisfactory and show such good evidences of the yield of gold that the owners and promoters have been greatly encouraged. The company covers and controls mining interests in this locality embracing something like 10 miles in extent. There are about five buildings on the claims, including test mill, 14 x 16 ft. While every person in the province will be glad to know of the pluck and energy of these gentlemen and should be willing to give them all possible credit, and should not object to the Government treating them generously as to mining rights, etc., will it not seem a little too much of a good thing and somewhat after the dog-in-the-manger policy, to know they have absolute control over 10 square miles or = 6,400 acres of territory? Where is the inducement for other prospectors and capitalists if the impression gets abroad that these gentlemen have it all?

It was reported in July that immediate work of boring or prospecting for coal would take place on the Shives property at Dunsinane on the I. C. Ry. between Moncton and Sussex, but as yet no decided move in this direction has been made.

The gypsum property reported sold to New York capitalists some months ago still remains on the owners' or promoters' hands. A Mr. Sellock, who poses as the representative of New York capitalists, has been back and forth several times, but as yet no signs of his capitalists being ready to pay over their money. Whether it is that they doubt the genuine qualities of the properties they have made overtures on, or simply are playing a waiting game, hoping to eventually buy them cheaper, is a conundrum to be solved At any rate the faith in the great New York capitalists who were reported in Moncton and vicinity has been seriously shaken of late.

The sale of a block of coal land in the Grand Lake coal fields recently is reported. The area was formerly owned and worked by Walter MacFarlane, of or near Fredericton. The property was sold through efforts of Dr. J. E. March, of St. John, and F. W. Wedderburn, Esq., of Hampton, to New York capitalists, through a Mr. Wallbridge and Mr. Mulholland, both of whom are bright, shrewd business men and had personally visited the property this summer. It is said plans will be arranged to work the areas on a liberal scale.

Reports of prospecting for iron in the vicinity of Lepreaux, and coal on the Oromoncto, and several other ventures in different parts of the province, are prevalent, but nothing definite is known. When it is more fully known, steps will be taken to advise you of the facts.

The Richest Mines in the Empire.

BRITISH CAPITAL WANTED FOR BRITISH COLUMBIA'S MINERAL DEVELOPMENT.

Attention has often been called in our columns to the fact that the rich mines of British Columbia are, many of them, becoming the property of enterprising United States capitalists. Mr. Clive Phillipps-Wolley now writes from Vancouver to the *Times* deploring this fact, and urging British financiers to send experts to the province to see its wonderful richness. He says in the course of his letter :

The minds of all English mining men appear to be so engrossed in South African ventures at present that they will pay no attention to anything else. One of the most deplorable results of this is that they are allowing the first-fruits of perhaps one of the richest mining fields in the empire to be reaped by aliens ; nay, more, they are allowing a province of Canada to become American in men, manners, money and sentiment.

As long as British Columbia was only known as a silver field this was comprehensible, although our silver deposits have now proved themselves rich enough to pay, with silver even lower than it is at present. But since last year a gold-bearing belt of ore has been discovered and opened up, which, added to our gold-bearing gravels, seems likely to give British Columbia a prominent place among the gold-producing areas of the world.

British Columbia only became accessible to the world in June, 1886, when the Canadian Pacific Railway reached Vancouver. The province, which is of vast extent, is by no means sufficiently opened up by railroads, roads, and trails to-day. In spite of this, consider what has been don• in British Columbia since 1890, without foreign capital (except American), by the energy of poor men and the intrinsic value of the mines. In 1890 there were no railways into West Kootenay. To-day there are three competing for her ores. In 1893 there were no shipping mines in the country. During the past twelve months, in spite of the silver panic and such difficulties of transportation as still exist, our silver-lead mines alone have shipped 24,500 tons of ore. An idea of the value of this ore may be obtained from considering a return now lying before me. A shipment of 2,114 tons, sent from seven different mines to the Omaha and Grant smelter, netted to the owners $107 per ton. This shipment is not selected for its exceptional value, but at hazard, as the first absolutely reliable statement of fact which comes to my hand. Last year a smelter, representing an investment of $750,000, was opened at Pilot Bay, close to Nelson, and not only is this to be enlarged, but within the last few weeks representatives of four of the greatest American smelting companies have been hovering about the district, their apparent aim being to make a.rangements for the establishment of a great custom smelter at or near Nelson.

What has been written so far concerns our West Kootenay galena fields and the one great bornite deposit at Nelson only, but since the autumn of 1894 another belt of mineral of an entirely different character to the mineral of Slocan has been opened up. We know now that from the Kettle River to the Salmon River (a tributary of the Pend d'Oreille), at least, there is a belt of pyrrhotite, with some chalcopyrite, carrying gold in very considerable quantities, some silver, and a percentage of copper. In September, 1894, there were only four houses at Rossland, the principal camp, so far, on this belt. To-day Rossland is a town of from 1,400 to 2,000 people, growing with truly American rapidity, from which in June four of her young mines shipped to Helena and Tacoma 2,930¼ tons, of the value of $135,386. New machinery is on its way to Rossland, and this monthly output will shortly be doubled. One mine alone is under contract to the Montana Ore Purchasing Company to supply 75,000 tons during the next four years, and another, the War Eagle, has, since its purchase in December last, paid dividends amounting to between $80,000 and $90,000, thereby covering its original cost and all subsequent expenses. For this mine I am credibly informed that $900,000 is now offered, and half a million for an adjoining property. Unless readers bear in mind the time in which these things have been done, the limited population we have to draw upon, and the abnormal scarcity of cash in this country, these developments may not seem great, and yet there must be some great intrinsic value in our mineral belts. If it were not so, our mountains would not be alive with prospectors from the Cœur d'Alene, our camps with middlemen representing the greatest American mining capitalists and ore-handlers, neither should we have in such a young country so many shipping mines. In the new belt we have already the War Eagle, Le Roi, Josie, Nickel Plate, Cliff and Northern Star, whilst scores of prospects are being rapidly developed. In the silver-lead district the mines which have shipped are too numerous to mention, but the chief are the Slocan Star, Noble Five, Idaho, Dardanelles, Rueccau, Ruth, Blue Bell, and Alpha. Of these, the Slocan Star bids fair, in the opinion of the most trustworthy authority whose opinion I have heard, to rival the famous Broken Hill Mine. Scattered throughout the country are free milling properties, one at M'Kinney, on which they have sunk 150 feet, another, near Nelson, has paid for itself over and over again, and there are others at Fairview and elsewhere. Throughout the country, companies like the Parrot Mining and Smelting Company, of Butte, Montana, and mining men, are buying greedily, but every day fresh strikes are being made, prospects can be bought or bonded for a mere song, and camps like Boundary Falls, with huge deposits of comparatively low-grade ore, are neglected, because they are still sixty-five miles from a railway.

It would be unfair to the province to conclude without some mention of our gold gravels, especially as local and eastern Canadian capital is being largely employed in their development. The story of Cariboo's gold returns to the poor men who worked with pan and shovel in the sixties has been told too often to need repetition. Since 1859 British Columbia has contributed $50,000,000 to the world's store of gold, of which by far the greater part came from Cariboo. This total does not include gold taken out by Chinamen, of which it seems difficult, if not impossible, to obtain an accurate estimate. To-day machinery can be taken into the gravels of the Fraser, the Similkameen, and the Tulameen, and over a million dollars has already been expended in hydraulic works on these three rivers, whilst it seems likely that another field will be opened up this winter on China Creek, in Vancouver Island. The two great mines so far are the Cariboo and the Horsefly. Of these the Cariboo has just cleaned up $14,000, after a run of 172 hours. The clean up of another small property on which $20,000 has been expended has just come to hand. The Nelson Hydraulicing Company has cleaned up between $4,000 and $5,000 in 120 hours' run. In considering the results it is only fair to remember that none of the mines are yet in fair working order, or, at any rate, not in such a state as to make a thoroughly representative showing of what they can do when fully under way. The Cariboo mines I have not personally visited, but upon the Semilkameen the results of panning in all sorts of places, likely and unlikely, form the river bed to the grass roots, and in shafts 60 feet deep, was an average of 27 cents to the cubic yard. A large amount of platinum is also found in the gravels of the Similkameen and Tulameen, which has been sold hitherto in the local stores at $4 an ounce.

I have travelled this country now for a great many years as a mere sportsman who has gradually grown interested in its development, but I cannot help echoing the cry of every camp in our mountains. Is it not worth the while of some English capitalist to send a party of reliable experts through British Columbia to ascertain whether what is good enough for alien investors is not good en ugh for some of those who talk so much about the necessity of uniting the different atoms of the English Empire? At the present moment American capital is buying, Americn energy is conquering, and American people populating British Columbia, simply because she is utterly neglected by those of her own kin; and, as usual, the American is making a fortune out of the operation. Perhaps it is worth while adding that the mining fields spoken of are so situated as to enjoy the advantages of water comunication afforded by the Arrow Lakes, Kootenay River and Lake, and the Columbia River, have all the lumber they require, and deposits of coal near the Crow's Nest Pass and elsewhere which can be tapped by railways at a very small expense.

It may be stated that the great bornite mine which is mentioned above is the Silver King, which is being developed by British capital. Mr. Wolley thinks much will be heard of that mine in the near future, and Mr. P. A. Peterson, chief engineer of the Canadian Pacific Railway, who has just visited it, is also of the same opinion. He says:

The English capitalist company that owns this mine is working away with a great deal of energy, and is getting out a very large quantity of ore. It is also building what is known as a wire tramway from the mines down to Nelson, some four and a half miles, the last named place being the Kootenay River terminus of the branch of the Canadian Pacific Railway, which runs from Robinson. The Silver King Company has likewise given Messrs. Fraser and Chalmers, of Chicago, a contract to build a smelter for them at Nelson, and when this is completed it will be able to do its own smelting instead of sending ores to England and the United States.

The Silver King has already got out six or seven thousand tons which average somewhere near 5 per cent. of copper and gives fifty ounces of silver, while picked samples run as high as 15 per cent. of copper and 150 ounces of silver. This concern has, of course, done a great deal of development in the way of sinking shafts and digging tunnels, and, I believe, there are no less than 100,000 tons of ore in sight. The Slocan Star has also shipped from 6,000 to 7,000 tons of ore, and the owners are at present engaged building a concentrator half way down the mountain side, where the silver and lead will be separated from the rock. There is one of these concentrators already built at Three Forks, that serves the Idaho group of mines, which produce about 100 tons of ore per day, or equal to 100 ounces of silver, the rest being lead. There are a number of other mines in the Slocan district such as the Mountain Chief and the Noble Five, etc., all of which are producing and will continue to produce a large amount of precious metal during the present year. Capital is all that is required to render the Trail Creek, the Slocan, and the Nelson districts produce gold and silver in wonderfully paying quantities. All who have invested capital there have received large returns.

CHEMICAL AND METALLURGICAL NOTES.

New Element from Bauxite, by R. S. Bayer.—The residues after fusing or boiling bauxite from Var with caustic or carbonate alkalies, and the precipitation of the alumina by carbonic anhydride, contain a new element in addition to iron molybdenum, vanadium and other rare metals.

The new element appears to be carried down with the sulphides of molybdenum and vanadium by passing sulphuretted hydrogen through an acid solution, although it is not so precipitated when isolated from these elements.

The new element appears to form with oxygen two oxides, in the higher state of oxidation it forms a well marked acid, while in the lower state of oxidation it is decidedly basic.

The chlorides are volatile and give a well defined spectra with characteristic lines in the green, blue and violet. With alkaline sulphides the acid forms an intensely red solution, probably due to a thio-acid, as a sparingly soluble rust-coloured sulphide is precipitated by acids.

We have received an interesting little book on the McArthur-Forrest process of gold and silver extraction by J. S. McArthur. It gives a good account of the cyanide process, but of course showing it in the best possible light, while remarks on other processes, namely, roasting before amalgamation and on the chlorination process we cannot wholly agree with. For instance, in describing the chlorination process, the author confines himself to a description of the Plattner process, which is rapidly giving way to chlorination in barrels. We also take exception to the following, referring to the amalgamation of highly sulphuretted ores: "Sometimes the amount of loss may be lessened by roasting the concentrates before amalgamation, but this is by no means a perfect remedy, as the roasting removes only the volatile constituents of the concentrates, principally sulphur, while the base metals, lead, zinc, etc., are left in the form of oxide *to oxidize and waste their equivalent of mercury.*

There is one paragraph which we consider is rather a confession:—

"Under favorable circumstances the gold and the useful metals may be recovered by smelting, but these favourable circumstances, which are proximity of the gold mine to coal, clay, limestone and other fluxes, are quite exceptional, as auriferous reefs are generally found in primary formations. As before implied, chlorination is frequently inapplicable—no attempt is ever made to chlorinate gold ores containing an appreciable quantity of lead—and where applicable is always troublesome and never cheap. When this question presented itself to Dr. Forrest and myself, we tried to find some solvent which, unlike chlorine and mercury, would have a stronger affinity for gold than for sulphides. *Acting on this principle we drew out a list of all probable and possible solvents fulfilling this condition. The list included cyanides, and we found that these salts solved the problem.*"

This was the foundation of the present *patented* process.

The cost of "cyanidation" as given by statisticists in this book, appears to range from $1 to $3.75, while the recovery of gold is from 90% to 94% of the assay value.

The lowest cost of chlorination that we know of has been made by W. A. Thies, who, in 1893, practised the Mears process at the Bunkerhill mine, in California, at a cost of $3.02 per ton.

In 1894 the cost rose to $3.31, owing to the fact that there was a smaller quantity of concentrates to be treated, this cost is made up as follows:—

Labour	$2·31
Fuel	0·55
Sulphuric acid	0·24
Chloride of lime	0·21
Total	$3·31

The percentage of gold extracted is not given, but usually chlorination will clean concentrates more completely than the cyanide process.

Each process has its advantages, and one will often work economically where the other will not. Where "cyanidation" will extract 94% of the gold we should nearly always use it, but we know in many cases it will not extract nearly that amount. In cases where the concentrates contain mercury, and they often do, although we are prepared to admit they should not, the mercury coats some of the particles of gold and prevents the cyanide from attacking them. There are also certain ores which decompose the cyanide before it attacks the gold.

With chlorination, appreciable quantities of galena prevent its success, as do appreciable quantities of limestone, a mineral which luckily does not often occur with gold. Everything depends on a successful roasting of the ore.

The last issue of the Chemical Society journal is the most interesting we have seen for a long time. Foremost amongst the papers from a metallurgist's point of view, is one by Dr. Thomas Kirk Rose, of the Royal Mint, London, on "The Dissociation of Gold Chloride." As the author points out, it has often been affirmed and denied that trichloride of gold volatalizes readily, and the statements of various metallurgists as to the temperature at which the chlorides of gold are decomposed, are anything but concordant.

Dr. Rose has carried out a most elaborate series of experiments on the action of chlorine on fine gold at various temperatures. The fine gold was placed in a tube and dry chlorine gas passed over it, the tube containing the gold was placed in an oil bath and kept at the temperature of 180° C., the chlorine was absorbed by the gold and the resulting chloride was in the form of dark red shining plates and needle-shaped crystals.

The following table shows the percentage of gold volatalized in an atmosphere of chlorine, at various temperatures:—

Temperature in Degrees Centigrade.	Percentage Volatalized in 30 minutes.
180	0·007
230	0·35
300	2·32
390	1·82
480	0·88
580	0·60
590	0·58
805	0·50
965	1·63
1100	1·93

When gold chloride is heated in air no gold is volatalized below 1058°, and only about 0·02% in 30 minutes at a temperature of 1100°. "The amounts of gold volatalized vary according to two factors: (1) The vapour pressure of gold trichloride which of course increases continuously as the temperature rises; and (2) the pressure of dissociation of trichloride of gold, which also rises continuously with the temperature, but not at the same rate as the vapour pressure.

"The rise of the vapour pressure tends to rise, and that of the pressure of dissociation to reduce, the amount of gold volatalized as chloride. The vapour pressure increases more rapidly than the pressure of dissociation at temperatures below 300°, and also above 900°, but less rapidly at intermediate temperatures."

Dr. Rose's next experiments consisted of heating a mixture of mono and trichlorides of gold at various temperatures in air and in chlorine, the mixed chlorides were made by passing chlorine gas over fine gold at 210°-220°. When no more chlorine was absorbed the tube containing the chlorides was sealed, heated to 300° and the melted chlorides shaken up, allowed to cool and sampled. An analysis of the mixed chlorides gave

Metallic gold	Nil.
Au Cl	18·81
Au Cl_3	81·19

The following table shows the rates of decomposition of gold chloride in chlorine gas and in air respectively:—

Temperature.	Time of Treatment.	Analysis of Product, Percentages.			Percentage of Au Cl_3 decomposed per hour.
		Metallic Gold.	Gold as Au Cl.	Gold as Au Cl_3.	
In atmosphere of chlorine.					
165°	4 hours	....	20 11	79·89	0·40
188°	18 hours	....	21·86	78·14	0·21
190°	8 hours	....	27·06	72·94	1·27
190°	24 hours	....	37·30	62·70	0 95
In air.					
100°	7 days	....	24·33	75·77	0·04
165°	4 hours	....	28·60	71·40	3·015
168°	18 hours	....	59·59	41·41	2·72
190°	10 hours	0.12	99·88	....	....
190°	24 hours	57·88	42·12	....	....
175-180°	6 days	100·00	....	....	....
155-163°	7 days	52 23	47·77	....	....

Trichloride of gold is completely decomposed in air in 36 hours at a temperature of 200°, and at the melting point 288° in less than one minute. These experiments of Dr. Rose's bear directly upon two well-known metallurgical processes, namely, the roasting of auriferous sulphurets, and the Millar process for the purification of gold bullion. This latter process, as is well known, consists of passing a current of chlorine through molten bullion, the silver and base metals are converted into chlorides and either float on the surface of the gold or are volatalized and pass away as vapour.

Now, according to Dr. Rose's experiments the gold volatalized as chloride would be somewhere about 3·86 per cent. per hour. Of course the process does not last for this length of time, but surely an appreciable amount of gold must be lost by it.

In the roasting of sulphurets without salt the amount of gold lost would be almost nil, provided always there is no telluride of gold present. But in the case of roasting with salt it is evidently different. It would appear from Rose's experiments that the proper time to add the salt would be at a temperature of from 600° to 800°.

Paul Jaunasch gives the following method of decomposing silicates:—Lead carbonate is prepared by precipitating a hot solution of lead acetate by ammonium carbonate, the precipitates is washed with water and dried in a porcelain dish. The silicate is mixed with from 10 to 12 times its weight of lead carbonate and placed in a platinum crucible, it is heated at first gently until most of the carbonic anhydride is driven off, then at a red heat. The hot crucible and contents are thrown into cold water, treated with nitric acid, and the solution evaporated to dryness. The product is dissolved in nitric acid and water, separated from the insoluble silica, and the greater portion of the lead precipitated, by the addition of concentrated hydrochloric acid. The salts are then converted into chlorides by evaporation with hydrochloric acid, and the remainder of the lead precipitated by hydrogen sulphide. The filtrate is freed from hydrogen sulphide and then subjected to the ordinary methods for the separation of the metals.

There is an exceptionally good series of lectures being reproduced in the *Society of Arts Journal* on "Recent American methods and appliances employed in the Metallurgy of Copper, Lead, Gold and Silver," and we propose giving an extensive review of them in our next issue.

Mr. Amos P. Brown, in the *Chemical News*, gives the results of the investigations he has made on the two forms of bi-sulphide of iron found in nature, namely, pyrites and marcasite. The former resists the action of air, and when decomposed in the earth gives rise to limonite, frequently in pseudomorphs, whereas the latter oxidizes readily into a sulphate, and only occasionally yielding limonite; pyrites is obtained when ferrous sulphide is deprived of iron by ferric salts or carbonic acid, marcasite when ferrous sulphate is reduced by organic matter. From an elaborate series of experiments (each of which was repeated ten times), which consisted of shaking the finely divided minerals with aqueous solutions of permanganate of potash of different strengths and at different temperatures and then determining the sulphuric acid formed and also determining the proportion of pyrites oxidized by electricity. Mr. Brown concludes that the composition of pyrites is $4\ Fe^{IV} S_2\ Fe^{II} S_2$ while marcasite has the more simple composition $Fe^{II} S_2$, or a polymeride of it.

The Necessity of Competent Geological Surveys of Gold Mines.

Mr. Nicol Brown, F.G.S., in a recent paper before the Geologists' Association of London, enunciated that geology in competent hands is the first science for gold mining, and that no sure foundation is laid for other sciences to base their work unless the preliminary work of the geologist be well done. Whether a man goes to seek fossil shells or golden sands, the same qualities are required for success, the same intimate knowledge of nature and nature's laws, without which her thrilling secrets cannot be discovered. From the want of this knowledge, the ordinary uninstructed gold-seeker always defeats the end he has in view. He works hastily, and by imperfect methods, and never stops to mark the finger-posts or compass-points, which might guide him to the object of his search. The finding of gold must no longer be left to chance, but should be the result of well-designed and well-organized efforts, and the basis of that industry, which is now being built up, rests on geological surveys made by qualified men. These are now demanded, and must be obtained, and the gold miners can well afford to pay for them, and at a different rate from what has hitherto been paid.

Directors of gold mining companies have considerable difficulties to encounter in selecting employees who understand the various departments of the work. To the uninitiated these latter appear complicated; but in reality they are simple to those who take the trouble to spend the time and labor to learn about them. Directors of gold mining companies should, however, themselves learn how to appoint their staff, and to control them by allocating to them their work in such a way as to get the best results. Instead of this, their aim has been to get what they call an "all-around" man, and thus try to shift the responsibility off their shoulders. Owing to the confusion existing in the minds of such unskilled persons as to the proper administration of gold mines, the work of the different departments has often become hopelessly mixed. By these persons the manager is expected to be a geologist, a miner, a mechanic, a chemist and a business administrator, all rolled into one; but evidently this leads to failure. Pseudo-geologists, or prospectors without adequate knowledge, have been often employed to survey and report on the properties.

Incapable persons also have been entrusted to do the industrial part of the work of mining, milling, and saving the gold. All this blundering results in heavy loss. So largely has this been the case from the earliest times, that those who have taken the trouble to enquire into the facts, taking good and bad mines alike, have often made the statement that gold costs more to produce than it is worth. Proper geological surveys, not only of the gold-bearing veins or beds, but of the enclosing rocks, must now take the place of the old prospector's empirical work in order to prepare the field for the tools of the workers of the mines, who cannot otherwise proceed intelligently with their operations. The costs of preliminary and concurrent surveys by competent geologists should always be provided for in any gold mining scheme. The expense of such surveys will be infinitesimal, compared with the money thrown away in times past on many expensive, abortive, El Dorado-like schemes.

The mining operations should be under the control of an educated and experienced mining superintendent. He must be a practical miner, and should have had experience in mining various ores in different parts of the world. It is a great disadvantage to employ a miner whose prejudices have been developed by long experience in one particular series of rocks or of the physical structure of one country. Such a man, however capable otherwise, has no resources when he comes to deal with new geological conditions. Unfortunately, many good mines have been condemned by such men. The various methods of gold mining naturally depend on the formation of the gold bearing rocks. The operations often reveal sections of the earth's crust, which when noted by the thoughtful geologist, lead to further following up of the payable deposits; if, however, these sections are left unnoticed and unrecorded, rich opportunities are thrown away.

Having "torn up the mountains by the roots," as mining was described in the book of Job, and brought the ore "to grass," the next operation is to mechanically crush it, in order to free the gold from the gangue; there is no evidence of this operation having been attempted by the ancients. The stone-breakers, mechanical hammers and various crushing appliances of all kinds do on an artificial scale what the earth's movements, the sea, ice, frost and rivers have always done with the rocks on a natural scale. The Californian stamp mill for crushing the ore is an improvement in detail and adaptability on the old Cornish mill used in tin stamping, which has been in vogue since the seventeenth century. By the stamp mills, which are at present the chief means of crushing, the ore is reduced to a fine state of sub-division, and the battery is flushed with water to act as a carrier of the finely divided ore or pulp from under the hammers. This pulp is carried over plates coated with mercury, which catches a certain amount of gold, and so saves it in the form of an amalgam of gold and mercury. The general result of this treatment is great loss in float gold, and loss of gold in slimes. A newer method, which is now attracting much attention, but may not be applicable to all kinds of ore., is to crush the ore dry, and this makes the product easier to deal with, when a percolation chemical process is used for dissolving the gold out of the ore, instead of taking it out by amalgamation with mercury.

It has been the aim of this paper to show that the chance of men finding much gold in massive nuggets, and becoming suddenly rich, has for ever vanished. To continue the necessary supply of gold, to carry on the ever-extending commerce of the world, a vast industry of the first importance, aided by many sciences, is needed to gather out the infinitely small scattered portions of gold as they exist in nature. The product in gold of the industry which has recently sprung up will afford relief to the straitened currency of the world; and as it can now be procured with the industrial and scientific certainty predicted by Jevons, the result to the world will in the near future be very great. The governor and directors of the Bank of England may hold the key of the bank's gold, but the geologists hold the golden key of knowledge to the earth's store-houses of the kingly metal, and although it cannot be counted up like gold in the bank, they, and they only, can be relied on to survey the new gold-fields which may yet be found. If this be done, the still potent survivals of mediæval or Oriental superstitions, ever ready to delude again and again a too gullable public, will definitely die out. Men cannot nowadays keep slaves to work their gold mines as of old ; but, always provided that they work upon the basis of proper geological surveys, the mining, mechanical, the electrical engineers, and the metallurgical chemists, with all the far-reaching fingers of their various sciences, can gather out the countless small particles of gold from the rock matrices, and pile them into the bank storehouses. Industry must be set off against industry ; our future gold, got by well-directed industry, will represent the result of honest men's toil. Gold so obtained will reach a steady value ; it will neither become greatly "appreciated" nor "depreciated," as the supply will constantly keep pace with the requirements of commerce ; it will help to keep the countless mills of many different industries in continuous motion, without intermittent periods of fluctuating trade, and thus bring benefits to many people in all parts of the earth.

Mine Sampling.

The readers of the prospectuses of mining companies, of which there are at present no lack, are familiar with the phrase that "samples taken from the mine have been assayed by Messrs. So-and-So, and have yielded" so many ounces or pennyweights to the ton, as the case may be. Now, the name of the assayer is a guarantee that the samples submitted to him contained no more and no less than the amount certified. It is, however, in no sense a guarantee that the samples so tested represent the actual average value of the lode. This latter depends for its accuracy not only upon the sampler, the conditions under which the samples were taken, but also upon the quantity of the sample, and whether it was taken from a heap of ore already mined and accessible outside the mine, or from the lode itself as standing and exposed in the workings. Now the sampling of a heap of ore is of itself a difficult process, but with care and the exercise of patient skill, judgment and supervision on behalf of the sampler, and the absence of interested parties, a tolerably correct idea of its average mineral contents can be arrived at, and is, indeed, a common occurrence amongst mineral merchants, who keep men and appliances especially for this work. In the mining and smelting districts of America mills are erected solely for this purpose, and the whole process is automatic and mechanical. The ore is crushed in bulk—that is, in quantities of from 50 tons upwards—and as in the process of sampling its quantity is reduced, great care is taken to prevent any tampering with its quality, until, at last, a finely-crushed sample of a few pounds in weight is obtained, which accurately represents, by its mineral contents, that of the total amount operated upon. In short, it is a recognized rule that, unless the ore is thus treated in a sampling mill erected for the purpose at great expense, a correct idea of its value cannot possibly be obtained. In spite of all this, we are brought face to face with presumably competent men, who, in the course of an hour's ramble through a mine, knock off a stone here and there, and so pretend that they have procured an average sample of a mass of ore, amounting to many thousands of tons. The idea that such an haphazard way of doing business can afford any reliable data is, to us, so prepostorous that we have long ago ceased to place any confidence whatever in the results so obtained. They are, in short, as likely to show on the one hand that the mine is too poor to work, as they are, on the other, to prove that it is a perfect Eldorado. Only by a most improbable concurrence of circumstances can they possibly give an accurate estimate of the value of the lode. Apart from the treatment of a bulk sample of several tons in a sampling mill, there is only one reliable method of ascertaining the commercial value of the ore—and that is, by milling a large quantity of it. If there is no mill on the spot, it is far wiser, and in the end cheaper, to go to the expense of conveying the ore to a neighboring mill than to risk the expenditure of public money on results obtained by crude, imperfect, and unreliable methods. In the case of a mine with a mill already at work, the duty is simplified ; as, if it is not advisable to accept the results obtained by past operations, it is a comparatively easy matter to clean out the mill, and put through a hundred tons or so obtained from various parts of the workings. In the case of gold ores where Government returns of the bullion obtained in the past are usually available, is it not impossible to confirm the number of tons said to have been crushed in order to obtain that amount by measurements of the stopes, levels, and shafts from which the ore was abstracted, and so obtain the average yield per ton upon which it would be fair to base an estimate for the future. If these returns are available, and can be utilized for the purpose, it would be manifestly absurd to neglect or ignore them ; and yet we have known of an expert under such conditions ignoring the past, and the milling returns actually obtained for several consecutive years up to the very date of his examination, and basing his opinion, to a large extent, upon a sample of a hundredweight or so of the ore obtained during a hurried examination, with the curious result that while his sample showed that there was no gold in the ore being treated, the actual milling returns for the same time yielded considerably over half-an-ounce to the ton.

In every well-managed mine the process of sampling is practically a continuous one, for in order to arrive at the difference between the amount of gold actually contained in the ore and that extracted from it by the milling operations, in order to ascertain the amount of loss, a careful and systematic sampling of the crushed ore, and also of the tailings, is a part of the routine of the day's work. This process is very clearly described in a paper read on April 21st last by Mr. A. C. Claudet, before the Institute of Mining Engineers. When dealing with the sampling of the ores and tailings at the Mesquital del Oro Gold Mine (State of Zacatecas, Mexico), he said that "as a general rule it is found that the gold extracted, added to that left in the tailings, approximates pretty closely to the assay of the ore before entering the batteries ;" in fact, as we understand, there is rarely a difference of 5 p. c. between the two. This proves that the method of sampling is nearly perfect, even though it is not an automatic one, but is effected by taking a couple of shovelfuls of the crushed ore every two hours, just previous to its entering the feed hoppers. An iron bin is fixed between each head of five stamps and the sample is put into this, making four shovelfuls for each 10 head of stamps per two hours. At the end of each shift of 12 hours the bin is emptied, its contents well mixed and quartered down, the final sample from each 10 heads weighing about 20 lb. The whole of the battery samples are mixed together in the assay office, crushed down to the size of peas, well mixed and again quartered down until reduced to an amount of about 2 lb, which is the representative battery sample for the shift. A portion of this is assayed, and a portion kept to be mixed with all the other samples taken during a month's run so as to form the sample of the mineral crushed in the month. In like manner, a cupful of tailings from each battery is taken every two hours, and when dried forms the tailings sample, from which, again, a portion is taken to make the monthly sample. It is very evident that, if it requires a careful and long continued process like the above to arrive at the average value of the ore, it is practically impossible for the cleverest expert to obtain even approximate results by any less carefully conducted operation ; while to expect to do so by merely dipping a shovel into an ore-bin is a farce, and is as likely to yield as valuable an idea of the contents thereof as the dipping of one's hand into a lucky-bag at a bazaar. Enough has been said to prove that, wherever possible, bulk samples only should be dealt with, and can alone give fairly accurate results. It will, however, sometimes happen, that there are no means of handling the quantity necessary, and for many reasons it may be necessary to arrive at approximate results by simpler means, such as by sampling an ore heap and assaying the sample. The process seems simple, but it necessitates the cutting of a trench straight through the ore heap, the reducing by hand to the size of macadam, or under, and the quartering of the large sample so obtained. The reduced sample must now be crushed down still finer well mixed and quartered down again until the amount is reduced to 20lb or so of ore. This may be still further reduced, but great precautions must be taken to prevent its being tampered with, as the insertion of a few grains of gold by any of the well-known dodges would vitiate the results.

The sampling of a mine itself is a long process, and will entail the cutting across of the face of the lode at regular and frequent intervals, the careful collection of the whole of the mineral so obtained, and the reduction of its bulk afterwards by the same system of crushing and quartering-down as before. If the ore occurs in rich shoots, then the samples from them should be kept separate from those of the poor ones, so that the extent and value of each may be known. Some experts say in their reports that "after picking out all pieces of visible gold the sample assayed," &c., but if the sample has been fairly taken it seems just as absurd to us to pick out the gold because it is visible, as it would be to take out the sterile pieces of quartz. In both cases the result would be unreliable as indications of the value of the ore. The sampling of a mine is by no means to be lightly undertaken ; it is a most serious matter, and will require patient care and occupy many days ; but seeing that the expenditure of large sums of money depends upon the results, we would enforce an opinion that the work should be entrusted only to well qualified men, and that they should be prepared to go minutely into the whole question, and spend whatever time on the spot which may be necessary to obtain reliable results.—*Mining Journal* (London).

The Spontaneous Combustion of Coal Cargoes.

The following excerpts are from a paper read before the Institution of German Engineers, by Mr. Hermann Pape, C.E. :—

The first part of the paper deals with the theory of the spontaneous combustion of coal in vessels, and in the second part the author propounds a method for the prevention of the danger. He arrives at the conclusion that the first and most important condition for an efficient protection of the coal cargo in ships is to prevent as far as possible the absorption of oxygen. This can be done either by shutting off the atmospheric air from the ship's hold, or by changing the surface of the coal so that during the voyage little or no oxygen is absorbed. Mr. Pape, after showing that it is practically impossible to prevent the absorption of oxygen by providing a neutral atmosphere in the vessel, proceeds to describe a new invention, which he claims to be suitable for removing in a most simple and safe manner all the difficulties which have as yet stood in the way of the effective protection of coal ships. This is the invention of Mr. Behnke, manager of a large chemical works in Germany. The process, upon which Mr. Behnke's proposals are based, is shown by the following experiment : If a glass vessel is partly filled with carbonic acid, and vapour of ammonia is brought into the vessel, the shell of the vessel or the surface of anything brought into the vessel is immediately coated with a thin white film. A closer investigation shows that this film consists of carbaminate of ammonium ($NH_2\ Co_2\ NH_4$). If then some moisture is made to act upon the white film, the latter does not change its appearance, but its chemical constitution is altered. It is transformed into carbonate of ammonium $[(CO_2)_2\ (NH_3)_3\ H_2O]$ or sal volatile. If afterwards fresh carbonic acid is allowed to act upon the transformed film—for instance, by making up enough carbonic acid to maintain the same percentage in the interior of the testing vessel—the white coating is still further changed, finally bicarbonate of ammonium ($CO_3\ (NH_4\ H)$ being formed by the additional carbonic acid. If now the vessel, the shell of which is covered with the thin coating of salt of ammonium, is heated, there will appear an evaporation of this salt at a temperature of about 158 degs. Fahr., the vapour of the salt escaping quickly out of the vessel into the air and causing an odor of ammonia. By the foregoing experiment, the principal idea of Mr. Behnke's invention is shown. His process consists in providing in the ship's hold an atmosphere containing carbonic acid, and then forming the salt just described by the introduction of vapour of ammonia. This salt precipitates upon the coal at first in the form of carbaminate of ammonium in very thin layers ; later on it takes up moisture from the atmosphere between the coal and is thereby transformed into carbonate of ammonium, while finally, by excess of carbonic acid in the atmosphere of the ship, this salt is transformed into bicarbonate of ammonium. In this form the thin coating remains until the voyage is finished, and the presence of this coating is said to entirely prevent the absorption of oxygen. If, says Mr. Pape, the putting into practice of the Behnke principle is entertained, the question will at once arise as to the best way in which an atmosphere containing sufficient carbonic acid can be produced in the ship. This is proposed to be done by introducing gases obtained by the combustion of coke. By burning good coke the fire gases will contain 14 to 16 per cent. of carbonic acid, 0·5 to 4 per cent., of oxygen, 0·5 to 2 per cent. of carbon oxide, and 79·5 to 81 per cent. of nitrogen, and the combustion of 240 lb. of coke will furnish sufficient gases for filling up the whole air space in a cargo of 1,000 tons of coal. To ensure having an atmosphere charged with enough carbonic acid, it would seem desirable to introduce double the theoretical quantity of coke gases ; hence every 1,000 tons of coal would require 480 lb. of coke. The ammonia necessary to form the salt already mentioned is introduced into the ship in the shape of liquid ammonia by means of the pipes used for the coke gases. The ammonia evaporates immediately after being released from the high pressure existing in the cylinder and spreads quickly through the coal. The quantity of ammonia required for the process will be, as is proved by trials made on a large scale, about 80 lb. for every 1,000 tons of coal. As to the combustion of coke, this can either be done in an auxiliary boiler or in a furnace built for the purpose. The introduction of the gases is effected by a fan. It is suggested either that ships should have on board a special coke furnace with fan, or that the application should be made while the vessel is still in the harbour by a tug boat provided with the necessary plant.

Machinery Foundations.

WALTER H. MUNGALL, B. SC.*

The importance of a sound and unyielding foundation for machinery or other erections has long been realized, and at an early stage in the work of opening and fitting a new colliery, the engineer has to turn his attention to this subject. The first engine that is to be used in sinking a shaft requires to have a foundation previously provided for it. Boilers and chimneys ; the permanent winding, pumping, and haulage engines ; head-gear and screening plant all require foundations. In the present

* Paper before the British Society of Mining Students.

article, the subject will be dealt with only so far as it lies within the province of the mining engineer, and it is not intended to enter into any discussion of the theory of foundations.

A foundation in its simplest form consists of an excavation in the ground of such form and dimensions as will give a firm base for the superstructure. Such a foundation is all that is required for comparatively light structures, not subject to sudden and severe strains. But for most structures about a colliery such a foundation is quite inadequate, and the excavation is partially or completely filled with some material which will form a firm and solid base. In many cases, as for example in the case of a pulley frame, the area of the base of the structure is small in comparison with the weight upon it, and the pressure per unit area is consequently great, greater often than simple earth foundations can resist. To reduce the pressure per unit area it is customary to form the excavation of sufficient size, and subsequently to fill it with some solid material as masonry, brickwork, or concrete, through which the pressure is distributed to any desired extent. Before proceeding with the construction of foundations, the first thing to be ascertained, after an acquaintance with the nature of the ground, is the approximate weight to be supported, and the foundations must be so designed that the pressure per unit area will be well within the limits of safety. The direction of the pressure must also be taken into account, and the base of the foundation should be formed as nearly as possible at right angles to the direction of pressure upon it. As a general rule also, the line of the resultant pressure on a foundation should pass through the centre of gravity of the foundation, or as near thereto as possible.

In some few cases a firm and sufficient foundation readily obtainable on rock, in which case all that is necessary to prepare it for the superstructure resting on it, is to cut away all loose or decayed parts, and to hew or dress the surface of the rock to suit the form and pressure of the structure to be erected. When the surface of the rock is irregular, it may be necessary to fill hollows in it with masonry or concrete. It is customary in engineering practice to allow for stone structures a factor of safety of not less than eight, and for foundations on rock the pressure should not exceed, at any point, one-eighth of the pressure required to crush the rock. Experiments on the crushing pressure of rocks have from time to time been made by various engineers of eminence, the average results of some of which are given in the subjoined table:—

TABLE OF THE STRENGTH OF ROCKS.

	Crushing Stress. Pounds per square inch.
Sandstone (strong)	5000 to 9000
do (weak)	2000
do (ordinary)	3000 to 5000
Limestone, compact (strong)	8000
do magnesian (strong)	7000
do do (weak)	3000
do granular	4000 to 4500
Chalk	300 to 400
Whinstone (basalt)	9000 to 17000
Granite	6000 to 11000

Where the rock surface is not accessible for forming the foundation, the base of the structure has to be rested on the earth above the rock, and the total pressure must be more or less distributed as the earth is softer or firmer. In firm earth, such as hard clay, clean sharp sand, or firm dry gravel, the greatest pressure in general engineering practice is from 2,500 to 3,500 pounds per square foot of bearing surface. For a superstructure that is in itself heavy, or that has to support a heavy load, or that is liable to severe strain, the foundation base must be made of such area that the pressure per square foot will not exceed the above limit. Usually the footings or lower courses of ordinary masonry or brickwork, as of an engine house, have an additional breadth or "spread" equal to one-and-a-half times the thickness of the body of the wall when built on compact gravel, or of twice that thickness when built on sand or stiff clay.

Before building on *soft* earth, additional precautions must be taken with regard to the foundations, and some other expedients must be adopted than those applicable to firm earth foundations. Of course there are degrees of softness, and no general rule can be laid down applicable to the variety of cases that may occur in practice. The simplest class of foundations on soft earth are those already referred to as applicable to firm earth, with this difference, that the base must be further increased to reduce the pressure per unit area. When softer earth, as peat moss, soft alluvial clay or silt, with, in some cases, a natural slope of one vertical to eight or ten horizontal, is met with, of considerable depth, other methods have to be adopted. These generally entail the use of timber or iron. Timber platforms are usually constructed by forming a grating of crossed beams of elm or oak which in turn is covered by planking on which the superstructure rests. The beams employed are usually from 10 to 12 inches square, and laid about 3 feet apart, the spaces between being filled with concrete.

The method usually adopted, however, for securing a good foundation in very soft ground is by piling. Piles are usually of square or round timber from 6 to 9 inches diameter for piles from 6 to 12 feet long, and larger in proportion to the length, the ratio of diameter to length being in general about one to twenty. In setting the piles they are placed as close together as practicable. When piles are driven to form a rectangular or circular foundation, the outer circuit of piles should always be driven first. The work being finished at the centre. The piles may be surmounted by a platform as above described, or simply by a layer of concrete. The most suitable timber for making piles is elm. In general practice the limits of pressure on pile foundations may be taken at 1,000 pounds per square inch of head area when the piles are driven till they reach firm ground, or 200 pounds per square inch of head area when the frictional resistance between the timber and the earth is the only support. In all cases where timber is thus employed in foundations, care should be taken to keep it entirely removed from the influence of the atmosphere, and to keep it wet, otherwise it will soon decay.

Engine foundations, as a rule, require to be raised sufficiently high above the surrounding ground to give clearance for the fly-wheel, drum, or gearing, or for other purpose, as also to form a sufficient weight to which to fix the engine. Engine foundations may be constructed of timber, brickwork, masonry or concrete. For permanent work timber foundations are not to be recommended, as they are liable to early decay, but for temporary winding or pumping engines at a sinking shaft they form a convenient, simple and cheap foundation. They are easily built and easily removed, and the material may subsequently be used for similar or other purposes.

One form of engine foundation, now almost obsolete, was built of ashlar masonry, the stones being of large size, each measuring about 10 cubic feet, the usual dimensions being 4 feet by 2 feet by 15 inches thick. Stones of larger size are more expensive, and were consequently seldom, if ever, used. Undoubtedly this makes a very good foundation, but it is costly, and it is now generally superseded by brickwork or concrete.

Brickwork built with Portland cement mortar is in very general favor, and forms an excellent foundation. The bricks should be tightly built, the joints not exceeding quarter of an inch in thickness, and the whole structure well bonded together so as to form, as nearly as possible, one solid block. The cost of this kind of engine foundation is considerably less than one of ashlar masonry.

For engine foundations, and, indeed, for all sorts of foundations about a colliery, there is much to recommend the use of concrete. It forms the best foundation, and is less costly than either ashlar masonry or brickwork. Concrete is essentially a species of rubble building, the stones of which are cemented together by a mortar, usually of Portland cement and sand or fine gravel. About a colliery where, as a rule, a plentiful supply of sandstone is readily obtainable, especially during sinking operations, it may with advantage be used in the manufacture of concrete. A quantity of stone is broken to about the size of ordinary road metal, or from 1½ to 2½ inches diameter. This is mixed with certain proportions of clean sand and of Portland cement, the proportions of the various ingredients varying with the purposes for which the concrete is to be employed. For ordinary foundations the proportions are generally about four parts by measure of broken stones, one part of sand, and one part of cement. These, after being thoroughly mixed, have sufficient water added to make the whole a plastic mass, which is forthwith transferred to the excavation or other receptacle previously provided for it. At the same time, a number of large stones may with advantage be thrown in, care being taken that they are thoroughly bedded in the concrete, which should also fill all interstices between them. When using sandstone for making concrete, it is not generally necessary to add sand, as in breaking the stone a quantity of sand is produced, unless the stone be very hard. By a little experience one can readily estimate whether there is a sufficient quantity of sand among the broken stones, and it becomes unnecessary to measure them out separately. Broken bricks, blast furnace slag, limestone and other materials are frequently used for making concrete. It should be noted that the concrete occupies only about two-thirds of the volume of the ingredients when unmixed.

When concrete foundations have to be raised above the level of the surface, a casing, usually formed of planks, has to to be erected, of the form and height of the monolith, into which casing the plastic concrete is placed. After it has sufficiently set to permit of the casing being taken away, this should be done.

In conclusion it may be useful to compare the cost of building engine foundations of the three classes referred to. For a set of coupled winding engines, each foundation will contain about 40 cubic yards, or say 80 cubic yards in the two, and the total cost will be approximately as under:—

80 cubic yards ashlar masonry	@ 55/- =	£220	0	0
80 " brickwork in cement	@ 16/- =	64	0	0
80 " concrete (5 to 1)	@ 9/- =	36	0	0

Water Power Applied by Electticity to Gold Dredging.*

BY ROBERT HAY, M. Inst., C.E.

In many mining districts there are deposits of gold which cannot be worked owing to the difficulties of transport and the dearth of fuel. The application of water power transmitted to a distance by electricity is, therefore, a subject which may well command attention in well-watered countries like New Zealand, where a plentiful supply of power is obtainable; for intervening hills and valleys form no obstacle to its transmission, there being few districts through which light wires and poles cannot be easily carried. The plant described in this paper is the first of its kind constructed in New Zealand. It was designed by the author for gold dredging on the River Shotover, at a point about thirty miles from its confluence with the Kawarau River and twenty-five miles from Queenstown, a small town situated on Lake Wakatipu, which lies about 1,000 ft. above sea-level. The Shotover runs through rugged and inhospitable country, generally in precipitous rocky gorges, and is only accessible by tracks cut down the leading spurs and gullies. Since the dredge commenced operations, however, a mountain road has been constructed at a considerable elevation above the river, and extends some twenty miles towards the upper Shotover dredging ground, opening up to some extent the interior of that part of the country. All the bucket, grab and suction dredges hitherto employed in New Zealand have been actuated by steam power, bituminous coal, lignite or firewood usually being fairly plentiful, and accordingly moderate in cost. In the case referred to, however, fuel could only be obtained at prohibitive prices, as it would have been necessary to transport it to the dredge for long distances over the mountain tracks on the backs of horses. Water power in a convenient form was found to be available at a branch creek, but for many reasons it could not be applied directly to dredging. It was therefore decided to transmit the water power by electricity to the dredge in whatever part of the river it might be working. The water was obtained from a creek one and a-half miles, and was brought, by a race cut in the side of the hill, or, through places where the ground was too precipitous or loose to carry the race, by a timber flume, to a pressure tank situated at a point 524 ft. above the generator house. The race is 2 ft. 6 in. deep, and 3 ft. wide at the bottom, and the sides are cut with slopes of 2 in 1. The flume is rectangular in cross-section, 2 ft. deep and 3 ft. wide, and in places where it could not be wholly set in, a cutting along the side of the hill, is carried, partly upon trestles standing about 6 ft. apart. The pressure tank is 20 ft. long and 12 ft. wide at the bottom, and has sides with slopes of 1 in 1 and 2 in 1. The water passes from the pressure tank through a bell-mouth covered by a wrought iron grid, and is carried in steel pipes to the generator house. The pipes are of rolled steel of 16 and 11 Birmingham wire-gauge, with double-riveted longitudinal seams and single-riveted circular seams with 1½ in. lap. The pipes are each 19 ft. 6 in. long over all, and are jointed with wrought iron flanges riveted to the pipes. The internal diameter of the main pipe is 14$\frac{3}{8}$ in. The quantity of water available in ordinary seasons is 240 cubic feet per minute; but in dry weather after a fine winter, when the snowfall has been light, the supply falls to about half that quantity. This, however, is sufficient to develop the necessary power. The generator-house is situated about midway between the ends of the portion of the river to be worked, which is about four miles long. The prime mover of the generator-house is a 4 ft. Pelton water wheel, on the buckets of which the water impinges from a 1½ in. nozzle at a pressure, in the pipes outside the station, of 228 lb. per square inch. The Pelton wheel drives by belts, two Brush-Victoria, series-wound dynamos, which, when working at their normal speed of 700 revolutions per minute, give each an electromotive force of 650 volts and a current of 40 amperes, or together a total electrical output of nearly 70 horse power. The two dynamos are coupled in series. A Buss-Sombart tachometer, driven from the armature shaft of one one of the dynamos, indicates their speed, while a Soames-Nalder ampere-meter and a Cardew voltmeter (the latter reading up to 1,400 volts) indicate the current and electromotive force respectively. The Pelton wheel has no automatic regular, as the work required of it is fairly constant. It was necessary, however, to provide against the possibility of an abnormal increase of current, due either to accidental short circuiting of the line wires

*A paper read before the Institution of Civil Engineers in conjunction with the paper on "Electrical Haulage at Earnock Colliery."

or to the sudden arrest of one of the motors, which might result in damage to the generator armatures; and to provide also against racing of the Pelton wheel and dynamo, which would take place if the circuit was broken or the load suddenly thrown off one of the motors by a belt leaving the pulley. This has been accomplished in the following manner. Two electro-magnetic switches are placed in circuit with the dynamos and motors, and are so adjusted that, in the event of the current increasing to 3 amperes above its normal amount, one of them, and in the event of it decreasing to 3 amperes below it the other one, disconnects the line and motors from the circuit and throws into it in their place a set of iron wire resistance coils, constituting an artificial load of the normal amount. If anything occurs to the line of motors to cause an abnormal increase or decrease of current, the dynamos are therefore automatically protected and continue to work as if nothing unusual had occurred. When either of the switches comes into action, an electric bell calls the attention of the attendant. The contrivance has been found to answer well in practice, and has on several occasions saved the dynamos from the risk of damage. The conductors between the station and the dredge form a completely metallic circuit, and consist of bare copper wire of No. 4 S.W.G. supported upon Johnson-Phillip fluid insulators. The supports are old 40 lb. rails, with a short hardwood cross-arm bolted to each about 2 ft. from the top; this arm carries the insulators for the conductors, while a third insulator, bolted to the top of the rail, carries a telephone wire connecting the generator-house with the dredge, the length of line being about two miles. Between the ends of the conductors on the bank and the motors in the dredge the two cables consist of seven No. 16 copper wires, and are heavily insulated with vulcanized indiarubber. The shore ends are clamped to the conductors near to one of the poles, a supplementary pole having to be used occasionally when the river bed is too wide to admit of a single span to the dredge. The other ends of the cable pass over insulated pulley-blocks and are coiled as the dredge moves towards or from the shore. The electric motors, of which there are two, are also arranged in series and are exact duplicates of the dynamos, the object being to make the various parts of the machinery interchangeable, and to avoid a multiplicity of spare apparatus. A spare armature and field magnet are provided which will fit any one of the machines. One motor drives directly, through a belt, a centrifugal pump; whilst the other, geared to an intermediate shaft, drives the buckets, winches and revolving cylinder of the dredge. As it is sometimes necessary to vary the speed or to stop the motor that works the buckets, a variable iron wire resistance is provided by which its field-magnet coils can be shunted. The motor that drives the pump acts as a current-regulator, for, when the bucket motor is switched off, or its speed varied, the pump motor absorbs the surplus electrical energy—revolving faster and causing the pump to throw more water, which, however, does not cause inconvenience. By this means great simplification in the working of the plant is attained—an important factor when electrical apparatus is placed in the charge of unskilled hands. The frames and plat- of the dredge, which is 80 ft. long and 20 ft. wide, are entirely of steel, and where possible, all the framing, ladders, buckets, etc., are constructed of the same material. The buckets, which have each a capacity of 3½ cubic feet, are filled and discharged at a rate of about twelve per minute. This gives a lifting capacity, while dredging to a depth of 20 ft., of more than 90 cubic yards per hour, which is as large a quantity as can be economically treated on the tables for gold-saving purposes. The winches have separate barrels for the quarter, head and hoisting lines, which are of steel wire, and each barrel is driven by a large worm wheel. A vertical shaft carrying a worm wheel is connected with bevel wheels below the deck, which are provided with friction clutches so arranged that the barrels can be thrown in or out of gear by moving the winch handle to one side or the other, all the winches being driven by a shaft below the deck. The dredgings, boulders and gravel are delivered into a revolving cylinder 10 ft. long, constructed of bars set ¼ in. apart. Through these bars the gold and finer sand pass on to the tablos, the stones and debris being retained and afterwards discharged direct into the river through the stone shoot. The tables are set at an inclination of 1 in 12 and are covered with baize upon which the gold is caught. The cloths are washed into tubs at intervals of eight hours and are then replaced on the tables. A 10¼ in. centrifugal pump, driven at a speed of 600 revolutions per minute and with a lift of 16 ft. from the water level, supplies about 2,000 gallons of water per minute to the revolving cylinder. The dredge is lighted by two 10-ampere Brush arc lamps included in the power circuit in multiple series with the motors. They are controlled from a small switchboard on the vessel. A resistance coil to take 20 amperes is arranged as a shunt on the lamps, while the remaining 20 amperes is divided equally between two circuits, in each of which an arc lamp is placed. The switches are arranged so that if one of the lamps is switched off an equivalent resistance is thrown into the circuit in its place, the current in the circuit of the other lamp remaining unaltered. When the lamp is switched off it is entirely disconnected from the power circuit, so that it may be touched without danger of unpleasant shock. A third switch disconnects the resistances and lamps from the power circuit during the day time, when the lamps are not required. The full available output of the plant is not utilized and a reserve of power is always maintained. The working duties of the plant as observed are:—

Pressure of water in the pipes	228 lb. per square inch.
" at the valve	195 lb. "
" at the nozzle	188 lb. "
Speed of the Pelton wheel	447 revs. per minute.
Water used per minute	108 cubic feet.
Power of the Pelton wheel	88 horse power.
Total electro-motive force of the dynamos	1,170 volts.
Total current of the dynamos	30 amperes.
Total electrical output	47 horse power.
Loss of power transmitted through two miles of line	5.2 horse power.

The cost of the entire installation was:—

Dredge	£2,600
Race and flume	500
Intake, pipes and valves	600
Electrical plant	2,500
Cartage of material to the site of the works	800
Total	£7,000

The cost of working the machinery with three shifts of eight hours each, as obtained from the results of three years' work, has been:—

	Per week.
Wages, including dredgemaster and electrician	£25
Renewals, maintenance, oils, brushes, etc	5
Management, office, rates and taxes	5
Total cost	£35

Notes on Modern Steel Works Machinery.*

By Mr. James Riley, Glasgow.

Amongst the many results of the introduction of mild steel into engineering work may be mentioned the development of the various mechanical appliances used in the process of manufacture of that metal into the finished forms of sectional bars, plates, &c. As engineers have become better acquainted with its many excellent qualities, and have realized the possibilities opened up by its use, their demands on manufacturers have steadily increased for plates and bars of greater area, strength and weight. Conversely, manufacturers have stimulated these demands by costly outlay on improved machinery, designed to deal with masses and weights which but a few years ago would have been looked upon as unattainable. This continuous emulation has resulted in the massive installations of machinery to be found in the most modern steel works.

Rolling-mill Engines.—The improvements or modifications which have been made of late in rolling-mill engines have been in the direction of largely increased strength and power, and of careful attention to the designing of details, these latter perhaps small in themselves, but in the aggregate having an important bearing on the economical working of the engines, and on the diminution of the cost of maintenance. In these days of keen competition, when rigid economy is essential in order to reduce costs to a minimum, it is important that the consumption of steam should be reduced to the lowest possible; hence for pull-over or non-reversing mills compound condensing engines have been introduced with automatic valve-gear, which are working with a consumption of not more than 3 lb. of fuel per indicated horse-power per hour, in place of the old wasteful engines which consumed from two to even four times that quantity. With reversing-mill engines also attention has been turned to the economizing of steam, and trials have been made with compound engines. Compound reversing engines have not proved economical, when applied to mills—such as cogging or roughing mills—where the pieces being rolled are of short length and necessitate frequent reversals; while their use has been accompanied with troubles and difficulties in other directions, which have more than counterbalanced the small economies possible. Where water is available in sufficient quantity, it has beee utilized in condensers, connected either with single engines or with several engines from which the exhaust steam is led to the condensers at a central station. The use of central condensing stations for a number of engines appears to have received more attention on the continent than in this country: it is stated that recently this plan has been adopted there in several instances, and with satisfactory results both in economy and otherwise. The only instance known to the author where the plan has been adopted on a large scale in this country is at the North-eastern Steelworks at Middlesbrough, where a central condensing and pumping station of considerable magnitude has been put up by Mr. Cooper; and, although no definite statement has yet been made as to results, they are believed to be not unsatisfactory. The consideration of rolling-mills will here be limited to those engaged in the production of plates; and cogging mills are naturally the first to be dealt with.

Cogging-mills.—In the earlier days steel slabs to be rolled into plates were made from ingots under the hammer. Labor difficulties and possible economies led the author early in 1884 to put down at Blochairn Works the first cogging-mill used for this purpose. Recent slab-cogging mills are in all essential features like that pioneer mill, but are much larger and stronger, and therefore are capable of dealing with heavier ingots, yielding much larger and heavier slabs. Modifications have also been made in the machinery for tilting up the ingots and slabs for alternate edge and flat rolling.

A good example of a slab-cogging-mill was made recently by Messrs. Lamberton & Co. for the Wishaw Steelworks. The rolls of that mill are 8 feet 6 inches long and 40 inches diameter, and at both ends have grooves in which slabs 54 inches wide can be rolled on edge. The housings for both rolls and pinions are massive, and well fitted for their work. The pinions of cast steel are 48 inches in diameter, and have helical teeth 36 inches long, with shrouds or flanges at the ends. The spindles are of steel: the upper has spherical ends, and is supported from the pinion housing at one end and from the top-roll chock at the other. The mill is fitted with screwing-down gear, driven through gearing by a pair of steam-engines; and an indicator is fitted to guide the screwer. Live rolls of steel are fitted back and front of the rolls, and are driven by a steam-engine with cylinders 9 inches diameter by 15 inches stroke through gearing in the ratio of three to one. In front of the mill is a set of tilting machinery. The turning levers are placed on movable carriages, which traverse to and fro across the front of the rolls as required, being actuated by hydraulic power. Thus the ingot or slab can not only be turned from flat to edge or *vice versa*, but can also be traversed from one end of the rolls to the other. The cradle for receiving the ingot and lowering it upon the feed rollers is of massive character, being designed to deal with ingots up to 10 tons in weight. It is controlled by hydraulic power acting through a ram, which carries a sliding block taking on to the pin of a crank fitted on the axle of the cradle. The mill is driven by a pair of massive engines having cylinders 46 inches diameter by 60 inches stroke, and gearing in the ratio of one and three-quarters to one.

A cogging of quite a different kind was designed in 1890 to meet some special requirements at the Blochairn Steelworks, and to embody some modifications suggested by the author's experience with the ordinary cogging-mill. Up to that time the widest slabs in cogging-mills did not exceed 36 inches. Slabs of much greater width were then required under special circumstances; and it was decided to adapt the mill to produce them up to 60 inches wide. It was also decided not to turn them up on edge, thus dispensing with the necessity for the powerful and somewhat cumbrous, as well as expensive, tilting gear which would have been required for such wide slabs. Furthermore, experience had shown that in the course of years the cost of maintenance of the live roller gearing was considerable; and it was decided to dispense with this, and to adopt other methods of moving the ingots and slabs to and from the mill. These considerations led to the mill being made of the universal kind, with one pair of horizontal rolls for work on the flat, and one pair of vertical rolls for work on the edge of the slabs. Every part of this mill is made of steel. The housings are massive and are true examples of the steelfounder's art. Besides the usual provisions connected with horizontal rolls, the housings have also provision for the footsteps and bearings of the vertical rolls, as well as for the strong horizontal shaft by which the latter are driven. Furthermore, one of the vertical rolls is made to move forwards and backwards across the mills, so as to put work on the edges of the slabs, and has a traversing motion through 28 inches, so that slabs can be made of any width from 60 inches down to 32 inches. With these arrangements it was contemplated that armorplates up to nearly 5 feet wide might be rolled in this mill, with their edges so well finished that comparatively little machine work would be required upon them. With a view to the transverse motion of the vertical roll, provision was made in the housings for the necessary screws and nuts by which it is effected, as well as for the slides and guides necessary for keeping the roll in the true vertical plane. Hence it will be seen that,

* Abstract of a paper read before the Institution of Mechanical Engineers, Glasgow, July 30, '95.

in order to meet these requirements, as well as some other details, the production of these housings was a work involving no little skill and anxiety.

Screwing-down gear for the horizontal rolls is placed in the usual way on the top of the housings. On the housing and side frame of the mill is arranged screwing gear for setting up the vertical roll transversely, and simultaneously for setting up the necessary guides for the slabs, these guides extending a considerable distance in front and at the back of the rolls. Both sets of gear are driven by a small pair of engines through gearing. They can be worked together; but the practice is not to work them simultaneously, but alternately as required, so that work can be put on the flat or edge of the slab at choice. To this end clutches are arranged on the shaft of the small driving engines.

The horizontal rolls are 28 inches diameter, and the vertical rolls about 21 inches. The latter are driven by bevel wheels on a horizontal shaft, which extends to the pinion housings and receives its motion through a pair of wheels, one on its extreme end, and which works into another keyed on the shaft of one of the mill pinions. This outer end of the driving shaft is carried in bearings formed in the pinion housings. As one of the vertical rolls has a traversing motion, the bevel wheel driving it must necessarily slide along the shaft. In order to keep it in gear with the crown wheel on the roll, a special form of yoke and thrust bearing was designed, which is carried on the projecting end of the vertical roll above the crown wheel. The driving wheel on the horizontal shaft has a long boss or sleeve, on which are formed collars; these fit into and run in the thrust bearing on the top end of the vertical roll. The spindles for driving the horizontal rolls are both supported in bearings, the upper one in a manner similar to that already described for the cogging mill at Wishaw.

At the front and back of the rolls are dead rollers, carried in brass bearings on side frames, and extending a considerable distance from the rolls. At each extremity are special carriages, similar though not identical in design, for bringing the ingot to the mill at one end, and removing the slab to the shears at the othe. These carriages were adopted in place of the long series of live rollers commonly used. They are actuated by hydraulic rams, whose stroke is multiplied by the intervention of chains and pulleys. The rams and cylinders are placed on the ground, a little away from the centre line of the mill. The carriage for bringing up the ingot was a necessity under the special circumstances, inasmuch as the crane carrying the ingot is fixed, and can deliver it only at a certain point some distance from the mill. At this point is placed the ingot cradle, now so commonly used, but first designed and used at these works.

At the front and back of the mill, and in line with the roll housing at one side of it, are special appliances for moving the ingots or slabs. These consist of long piston rods, having a piston at about the middle of their length, on which work long pushing cylinders, carrying arms that extend across the centre line of the mill. The arm in front of the mill is made to rotate in a vertical plane upon the pushing cylinder by means of a small hydraulic cylinder and ram, which can take hold of a small projection on the back of the arm, when by the longitudinal movement of the pushing cylinder it is moved out to a certain distance from the rolls. The piston rods are hollow from each side of the piston, and through apertures in them the water pressure is admitted by which the cylinders are moved. The action of the parts is as follows: The ingot carriage is moved up to the cradle, which has received the ingot from the crane. The cradle is turned down, and deposits the ingot on the carriage, which is then moved forward to the end of the mill, the pushing arm having been tilted up for allowing the ingot to pass under it. The arm is then lowered behind the ingot and water pressure is admitted into the pushing cylnder, which moves forward and pushes the ingot over the rollers up to the horizontal rolls of the mill; these seize upon it and pass it through. Then the corresponding pusher on the other side of the mill comes into action, and pushes the ingot back again into the rolls, and this alternate action is continued until the slab is finished to the required width and thickness. All these operations are controlled by one lad at the screwing gear, one man at the pushers and carriages, one man at the mill engines with his assistant to do the necessary oiling, etc., and the roller in charge of the mill. When the slab is finished, the back pusher slides forward, takes hold of the near end of the slab, and pushes it off the rollers and upon the carriage which conveys it to the shears. The carriage is long enough to accommodate long slabs; it is supported and travels on a frame-work of girders, one end of which is pivoted, and the other rests on a hydraulic ram of short stroke, which by raising the end of the girder frame and the carriage resting thereon enables the slab to pass forward through the shear blades without contact with the lower blade until the shearing actually begins.

Hydraulic Slab-shears.—In connection with the first cogging-mill the author adopted hydraulic power for cutting the slabs; and when the second mill just described was constructed shears of the same kind but much more powerful were erected. They were made by Messrs. Tannett Walker & Co., Leeds. On the four corners of a massive bed-plate are placed columns supporting the cast-steel entablature, in which are formed three cylinders, the centre one 31 inches diameter, and the two side ones each 22 inches diameter. Four strong steel bolts, passing through base-plate, columns and entablature, bind the whole together into a firm strong structure. The rams for the two side cylinders are made sufficiently long to extend for some distance into the base-plate; they thus act as guides to the bolster of the upper shear-blade. The bolster is a strong steel casting; its upper centre part forms the ram of the large centre cylinder, while the two side rams pass through and are attached to it by strong tap-bolts or screws. The lower bolster is fixed on the base-plate; for resisting the lateral pressure when shearing, it is supported by two strong steel castings, which are placed on the base-plate under the columns, the main binding bolts passing through them. These castings are also strengthened by a strong bolt fastened through them, transversely to the shears. Provision is made for holding down the after end of the slab during shearing, by a cylinder fixed on the entablature, in which works a ram acting through a cross-head upon two rods; the latter are attached to a second cross-head, which presses down on the slab. All the rams are designed to work against constant pressure from the accumulator, and thus the return stroke is obtained. The accumulator is loaded to give a pressure of 1 ton per square inch. The pipes or tubes are all led to a convenient position, where all the movements are controlled by one man at the valves. On two of the columns brackets are provided, which support sliding brackets carrying the table that receives the slab when sheared. This table has hydraulic cylinders and rams under it, by which it is raised or lowered to suit the stroke of the shears when cutting off the slab. By the action of another ram the table after receiving the sheared slab is made to slide outwards, away from the shear-blade, and into range of the hydraulic crane, which lifts the slab and loads it upon the carriage, where it is weighed and stamped, preparatory to being passed forward to the plate-mill. In shears of this kind, it is important that the cut should be made as rapidly as possible; otherwise the hot slab is so long in contact with the blades that they become softened, the edges fail and they are soon rendered useless. Hence the areas of all apertures leading to the hydraulic cylinders should be as large as possible.

Slab-cutting shears of great power were made by Messrs. Buckton & Co., to work in connection with the cogging-mill at Wishaw steel works. The machine will cut a hot slab up to 42 inches wide and 12 inches thick. It is driven by coupled engines, with cylinders 26 inches diameter and 30 inches stroke, through gearing with a multiplying power of thirty to one. The eccentric shaft is 20 inches diameter in the necks; the caps of the eccentric shafts are held down by four bolts of 10½ inches diameter, passing through the uprights from top to bottom. While a slab is being cut off, it is held down on the anvil of the machine by a self-acting hydraulic-pressure foot, giving a load of twenty tons; this prevents the slab from tilting upwards under the action of the cut. The remaining portion of the bloom rests on a roller cradle, which is supported by a hydraulic cylinder loaded to a constant pressure of 20 tons, so that the bloom is upheld and prevented from tilting downwards under the action of the cut. Thus both parts of bloom are compelled to remain approximately horizontal; in consequence the severed ends are cut square, and are not sensibly scarfed. The cradle of live rollers which supports the bloom becomes depressed under the pressure of the shear slide, and recovers its position when the slide goes up again. The cradle is arranged to feed the blooms into the machine, and the cut slabs are delivered over the anvil. The object of this arrangement is that the live rollers which feed the bloom in may be brought as close to the knives as possible. At the delivery side of the machine there is a hydraulic measuring stop, for gauging the cut slabs to measured lengths from 6 inches to 8 feet long. It has a pointer and graduated scale for measuring; and is made with a hydraulic tilting cylinder, to swing the top free above the travelling bloom. With this gauging stop, the bloom can be stopped while travelling on the live rollers, and can also be pushed back into exact position for cutting, and be regulated easily to a fraction of an inch.

Plate Mills.—In this country it is almost the universal practice for plates of, say, ¼-inch thickness and upwards to be rolled in reversing mills, especially if they are of considerable area and weight; the difficulty in handling heavy slabs and plates no doubt conduces to this practice. Whether it is the most economical method of manufacture, especially for what may be described as plates of medium thickness and weight, may, perhaps, be open to discussion; but for handling the heavy plates now produced it is undoubtedly the safest, and, perhaps, also the most economical. The plate mills supplied to the Wishaw works by Messrs. Lamberton & Co. are excellent illustrations of present practice. For general use in producing plates of medium width, the mill is provided with two stands of rolls, the fi 'ng pair being chilled, as is customary. The rolls are 8 feet long and 30 inches diameter. Both top rolls are supported on hydraulic balances, and have a lift of 18 inches. Mechanical screwing-gear is applied to the roughing rolls, and is driven by a pair of small horizontal engines geared to give the required speed. The chilled roll is screwed down by hand in this case; but there is no satisfactory reason why the screwing should not be done mechanically at both rolls. Arrangements exist which admit of accuracy of gauge being obtained with certainty when mechanical screwing is applied to the finishing as well as to the roughing rolls. One simple method which may be mentioned is the insertion of what may be termed a short screw-jack between the chock and screw in one of the housings; a slight alteration of this, made by the roller when necessary, will at once correct any small inaccuracy in the setting or position of the main screws. Live rollers are fitted in the front and at the back of the rolls, and are driven by a pair of vertical engines conveniently placed so that the driver can see the operations at the mill. The live rollers extend a considerable distance in front of the rolls, but only a short distance at the back; here they are supplemented by live rollers fitted into a table, which traverses the two sets of rolls, carrying the slab or plate across from the roughing to the finishing rolls. The table and rollers are actuated by a pair of vertical engines in the usual manner. The table travels in a pit; and its rollers being on a level with the mill floor, the finished plate is rapidly and readily delivered upon it. In a line with this mill is a stand of rolls for handling plates of the greatest weight and width. The rolls are 12 feet long and 40 inches diameter, the top one supported on hydraulic balances. The chocks are all of steel with heavy brasses.

This mill is fitted with mechanical screwing gear, driven by horizontal engines which are fixed on the top of one of the housings; and it is so arranged that either of the screws can be moved alone. Hence, the roller has full control, and can modify the screwing at pleasure, even to the extent of rolling plates of taper cross section if required. The arrangement is as follows:—On the crankshaft of the engine is keyed a pinion, which through a spur wheel drives the main shaft that extends over both housings; and on each of the main screws is a worm wheel, which is driven by a worm on the main shaft. These worms are loose on the shaft, and run in collar bearings in pillow blocks. They have three-pronged clutches on their outer ends, into which can engage corresponding clutches sliding on keys or feathers on the shaft; either or both of the clutches can be thrown in or out of gear, and either of the main screws can thereby be moved or stopped at pleasure by the screwer, who stands on a platform near at hand, and obeys the instructions of the roller. The pinions for driving both mills are placed between them. The spindles for driving the large rolls are of considerable length, so as to reduce the angle at which they drive. They, as well as their coupling boxes, are of steel. In front and at back of this mill are complete sets of live rollers, driven by a pair of vertical engines, which are conveniently placed for driving either these or the live rollers of the 8-feet roughing rolls, as may be required. A useful appliance is here provided for adjusting the position of the plate in front of the rolls so that it shall pass through them as nearly square as possible, and at equal distances from the housings. Such an appliance was first designed by Mr. Duff for the large plate-mill at Blochairn works, but has been modified for use here by Mr. Williamson. A long pusher-bar is connected to a hydraulic ram and cylinder fixed at one side of the live-roller frames; it is moved to and fro across the front of the rolls in grooves between the live rollers; holes are provided in it, into which pegs can be temporarily put, for moving the plate sideways or otherwise adjusting it. These mills are driven by a massive and powerful pair of reversing engines, constructed by Messrs. Duncan Stewart and Co., of Glasgow; they have cylinders 52 inches diameter by 60 inches stroke, and the gearing is in the ratio of two to one.

Three-high Plate Mills.—Although mills of this kind have not been adopted to any great extent in this country, it is known that they are largely employed in America; and in the author's opinion they are worthy of much more consideration than they appear to have received here. When well designed in all parts and details, the three-high mills used in the United States, which have two larger rolls and one smaller, are capable of doing more work in a given time, and probably at less cost, than the reversing mills so commonly used here. The grounds of this opinion are:—Firstly, that for driving three-high mills engines can be used which are highly economical in steam consumption, and if sufficient water can be obtained, they may be of triple-expansion with automatic valve gear; secondly, the mills can be driven at a higher speed; thirdly the loss of time due to reversing can be saved; fourthly, plates can therefore be finished more quickly, and thin plate of large area can be rolled and finished with greater accuracy of gauge and in better condition for testing; fifthly, a larger output is obtained in a given time. These are advantages of considerable importance. The disadvantages are:—Firstly, that the cost of the three-high mill and its tables, &c., is, perhaps, somewhat greater than that of the ordinary reversing mill; and, secondly that the cost of maintenance is slightly greater. But it may be repeated that, if the details were carefully designed, it is doubtful if these disadvantages would exist at all, or, if they did, whether they would be worth much consideration. It is a pleasure to see one of the three-high mills at work, when in good order; and the contrast with an ordinary reversing-mill is somewhat striking. With proper appliances few men are required, and there is little, if any, larger demand on their skill. The use of the three-high mills, however, should be limited to the production of plates of light or medium weight and of medium width.

Steam Plate-shears.—A set of plate-shears recently supplied to Messrs. Colville & Co., Motherwell, by Messrs. Lamberton & Co., which are considered to embody some improvements, are worthy of note. They were designed for cutting plates 2 inches thick at a gap of 37 inches. It was concluded that the ordinary form of cast-iron standard could not be relied upon to resist the strain on the material round the region of so wide a gap; hence the special design was adopted. The standards are formed of several pieces, which are bound firmly together by large steel bolts, 13 inches diameter, passing from top to bottom of the machine. In the act of shearing the whole strain is taken by these bolts, which are considered to be much more reliable than any mass of cast-iron in the form of standards could possibly be. The engines are coupled and reversing, and of sufficient power to start the cut from rest. Rams are also provided for holding the plate firmly down on the bolster during the shearing.

Hydraulic Plate-shears.—Recently doubts have arisen whether steam-driven shears are the most suitable for the heaviest class of work, and consideration has been given to the use of hydraulic power for this purpose. By one of those curious coincidences which not unfrequently occur, two or three minds appear to have conceived simultaneously the application of hydraulic power in almost identical form. In a set of hydraulic shears designed by Mr. Lamberton the same general construction of standard is used as in the steam shears just described. But motion is imparted to the cutting blade through toggle arms attached to a main crank-shaft, whereon are keyed two levers, which in turn are connected to the rams of two hydraulic cylinders. Pressure in a hydraulic cylinder counterbalances the weight of the apron, and ensures the return of the rams in the main cylinders when the valve is open to the exhaust. The special feature in this machine is that by a special arrangement the parallelism of the cutting blade is maintained throughout the whole length of a cut, which may be as long as 12 feet or 15 feet to meet modern requirements. Designs for a hydraulic shearing machine embodying the same principle and in almost identical form have also been recently submitted to the author by Mr. Wicksteed.

A powerful shearing machine which Messrs. Beardmore are having constructed appears also to be on the same lines, but with some novelties in construction which are of interest. It is of massive design, and is capable of shearing mild steel plates up to 2½ inches thick. The cheeks or standards each consist of two steel plates 14 feet by 9½ feet by 6 inches, which are separated by a cast-steel distance piece, so as to stand about 13½ feet apart from centre to centre. The gap is 37 inches wide from the edge of the bolster, and is quite open at both ends of the machine, so that a 2½ inch plate 6 feet broad and of any length can be split from end to end with ease. The motive power is supplied by two cast-steel hydraulic cylinders, 20½ inches internal diameter by 4½ feet stroke, firmly snugged and bolted to the back of the cheeks. The ram of each cylinder is in the form of a trunk piston, to which is secured a mild steel connecting rod. The water, under a pressure of 700 lbs. per square inch acts on an area of 330 square inches on the under side of each ram, while there is a constant back pressure of 700 lb. per square inch on an annular area of 47 square inches on the upper side of the ram, thereby enabling the blade to be lifted when the pressure on the lower side of the ram is relieved. The effective pressure on the lower side of each ram is thus 88½ tons. The hydraulic pressure is transmitted from each ram to the blade or apron through a lever having a mechanical advantage of three to one. Both levers are rigidly keyed to one common shaft, 18 inches diameter and 18 feet long, which passes from end to end of the machine, and is supported by cast-steel brass-lined bearings passing through the cheeks and bolted firmly to them. Any tendency to thrust the blade endwise will be resisted by the torsional rigidity of the main shaft. The total pressure therefore transmitted to the blade at any instant is upwards of 530 tons; and, as the cutting edge has an inclination of 1 in 9, the intensity of pressure per square inch on the section of, say, a 2 inch plate in the process of being sheared, will be approximately 30 tons, which allows an ample margin for friction in the working parts. While the plate is being sheared it is held steadily against the bolster by three small hydraulic cylinders, which together exert a pressure of 10 tons, and are bolted firmly to the front guide of the machine. Arrangements are under consideration whereby a mild-steel plate of any dimensions and of thickness up to 2 inches can be taken from the mill-house floor, sheared on all four edges, and deposited again on the floor, with the aid of only one man and a boy.

It is a question worthy of consideration whether plates of such great thickness should be subjected to shearing. Familiarity with the use of mild steel has removed the nervousness which led in its earlier days to the exercise of great care in its treatment. It is now the axiom that in good work steel plates should not be punched; or, if they be, then rimering must follow to remove the injured portions around the hole. Shearing is detrimental to the edges of plates, especially when the shearing blades are in bad order; and the injury is greater with such thick plates as those under consideration, and should be removed by subsequent planing. These considerations induced the author to hesitate in adopting the shearing process for thick plates, and rather to prefer ripping machines for the purpose, thus avoiding the injury, although at a slightly increased cost.

Hydraulic Forging-press Cylinder.—Hammers, which since the introduction of cogging mills have fallen into desuetude for making steel slabs to be rolled into plates, are also being gradually displaced for other work by the increasing use of hydraulic forging presses; and in connection with the construction of a most powerful press, Messrs. Beardmore have taken a step which it may be of interest to mention. The cylinder is of nickel steel, and is probably the heaviest piece yet cast of this material, certainly in the form of a difficult casting. The weight of the casting with head is 64 tons, and the finished weight of the cylinder will be 42 tons. A test of the actual casting has not yet been made; but a portion of the charge was run into an ingot 23 inches by 18 inches, then cogged down to a billet 5 inches by 7 inches, and from this the following test results were obtained: Tensile strength, 40·1 tons per square inch; elongation in 8 inches length, 20 per cent.; elastic limit, 55·8 per cent. of tensile strength; contraction of area, 43·4 per cent.; and Lloyd's bending test was stood without fracture. This product of Messrs. Beardmore's skill and enterprise is peculiarly interesting to the author, seeing that it confirms his expectation of the service which nickel steel may render to engineering work.

Le Roi Mining and Smelting Co. has declared a dividend of 5 cents per share on the 18th inst. This company has now thoroughly developed the property and it may safely be assumed that dividends will be of frequent occurrence. The Le Roi, as said before, has been thoroughly developed, the company has put in expensive machinery, hoists, air compressors, etc., which are all paid for, and now as the product is nearly 100 tons daily the stockholders are bound to be benefitted. A Sullivan diamond drill to be worked by electricity was recently ordered. This will be used to further prospect the properties owned by the company.

MISCELLANEA

Pumice Stone.—Some interesting details respecting this useful mineral may be found in the report furnished by Mr. Norman Douglas to the Foreign Office. Pumice, as is well known, is of volcanic origin, being a trachytic lava which has been rendered light by the escape of gases when in a molten state. It is found on most of the shores of the Tyrrhenian Sea and elsewhere, but is at present almost exclusively obtained from the little island of Lipari. Most of the volcanoes of Lipari have ejected pumiceous rocks, but the best stone is all the product of one mountain, Monte Chirica, nearly two thousand feet in height, with its two accessory craters. The district in which the pumice is excavated covers an area of three square miles. It has been calculated that about one thousand hands are engaged in this industry, six hundred of whom are employed in extracting the mineaal. Pumice is brought to the surface in large blocks or in baskets, and is carried thus either to the neighboring villiage, or to the seashore, to be taken there in boats. The supply is said to be practically inexhaustible. Pumice is used not merely for scouring and cleansing purposes, but also for polishing in numerous trades, hence the fact that the powdered pumice exported exceeds in weight the block pumice. Between twenty and thirty merchants are engaged in the pumice trade in the island. Prices rose considerably about seven years ago, when a syndicate, with a capital of £20,000, rented the municipal pumice lands. The syndicate, however, failed through mismanagement, and, since then, though the ge l qualities always command a high figure, the general tendency of prices has been to fall.

Prevention of Mine Accidents.

At a meeting of the Federated Institute of Mining and Mechanical Engineers, held at Newcastle, England, a prize paper was read by Mr. Austin Kirkup on the means of preventing accidents in coal mines. Dealing first with explosions in mines, from fire-damp and coal dust, he said that, as far as now known, gas and coal dust were the only agents for producing explosions in mines; and to dilute the one with air and to destroy the other was the only method of rendering them harmless. The most explosive mixture of gas and air was in the proportion of one of gas to 9.4 of air, and the least explosive was one of gas to 15 of air. When more air was added, the mixture became unexplosive, and therefore harmless so far as the presence of lights was concerned. Hence the first requirement of every fiery mine was a sufficient ventilation to dilute and render harmless noxious gases to such an extent that the working places of the shafts, levels, stables, and workings of the mine should be in a fit state for working and passing therein. He laid stress on the necessity of good airways. Many mines were at a disadvantage in this respect. In some cases the shafts were too small, but more often it was the underground roads, more especially the return airways. These roads were not usually intended for haulage and travelling, and were allowed to get into a bad state. The sectional area was in many parts very small. Acute bends were frequent, and where faults were met with, the air in many cases was deflected from an horizontal to a vertical course. In order to ensure good results, the sectional area of the return airways should be equal to that of the intake airways, sharp bends should be avoided as much as possible, the abruptness of faults should be smoothed down, and the air should have as easy and straight a road as possible to the upcast. The accumulation of gas in old workings should be guarded against by a system of thorough inspection; where gas is being evolved in old workings which cannot be ventilated it should not be stopped off; the workings should be placed in connection with the return airways, so that the gas as it is generated may expand into them and be diluted by the current.

With reference to safety lamps, the writer thought that in addition to being examined, they should be tested in coal gas and air before being locked and sent into the mine. Fire-damp detectors he considered useful for ascertaining the proportion of gas present in the main return airways of a fiery mine, more especially when the ventilation is produced by a furnace-fed—as in the majority of cases—by the return air current. An ordinary safety lamp will only detect gas when the proportion of gas in the current is 2 per cent. or more, and when it is remembered that it is unsafe to fire shots in a dusty mine in air containing 2 per cent. of gas, it will be seen that the systematic use of a fire-damp detector in a fiery mine may in many instances reveal hidden dangers. It seems probable that, as fire-damp detectors become better known, they will no longer be regarded as scientific toys, seeing that they give such reliable indications of the state of the return air currents. The writer has already alluded to the property of coal dust, whereby an explosion may be extended far beyond the limits of the gas. It is also an undoubted fact that under certain conditions coal dust mixed with air alone will produce an explosion. These conditions are seldom attained except during the process of shot-firing, although instances are on record of dust taking fire on the screens on the surface. The fiery blast from a shot-hole in the presence of coal dust is increased by the combustion of the dust particles, and where sufficient dust is present to feed the flame a blast of explosive violence is formed which often extends for long distances. When small proportions of gas are present in such dust-laden air, the initiation and extension of an explosion is facilitated.

The commonest cause, almost the only cause of dust explosion, is the occurrence of a blown-out shot. This is generally due to the injudicious choice of a shot-hole, combined with the use of too great a weight of explosive and too short a length of stemming. Blown-out shots should be, as far as possible, prevented, and the sole way of doing so, that occurs to the writer, is to employ only such officials at this work as are thoroughly qualified by experience and intelligence to calculate the correct position of a shot-hole and the weight of explosive necessary to do the desired amount of work. The last point in relation to shot-firing is the use of blasting powder in dusty mines. In many mines its use has been abolished; in many more it should be abolished. It produces a heavy shower of sparks and flame, which are most favorable for the initiation of an explosion. Only such explosives should be used as will give a minimum of flame, and devices for the extinction of flame in shot holes should be more resorted to. There are many more proposals for the prevention of accidents in mines from explosions which the writer might have dealt with, such as the compulsory use of safety lamps in all mines, the abolition of all underground fires, boiler fires, furnace or otherwise, and the abolition of blasting in all mines. For the most part they will not bear criticism, for it goes without saying that before abolishing a useful agent we should find something equally good to put in its place.

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 be 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.

THE DOMINION WIRE ROPE COMPANY, LTD.

MONTREAL

Manufacturers of 'LANG'S PATENT WIRE ROPE.

FOR

TRANSMISSION AND COLLIERY PURPOSES.

SOLE CANADIAN AGENTS for the

JEFFREY

STEEL CABLE CONVEYORS

FOR

Handling Coal, Ores, Minerals, Refuse, Etc.

SOLE CANADIAN AGENTS for the

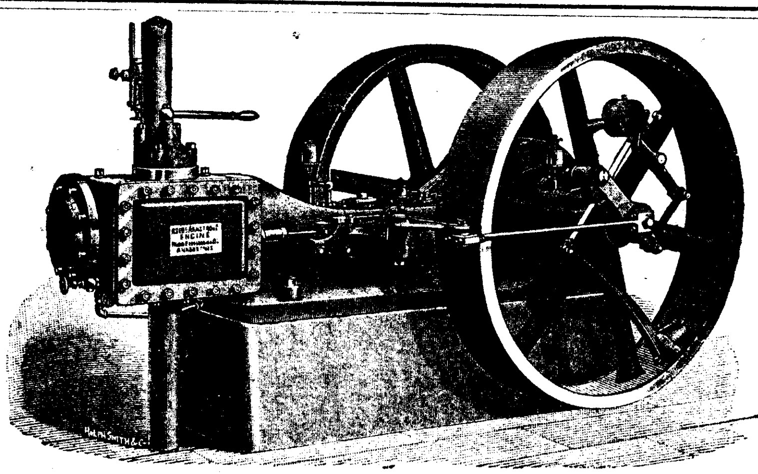
CELEBRATED

"BLEICHERT"

TRAMWAYS.

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

Send for Catalogue and Estimates to P.O. Box 2274



ROBB-ARMSTRONG

AUTOMATIC ENGINES

SIMPLE, TANDEM and CROSS-COMPOUND.

Combining the best features of the leading American High Speed Engines with several improvements.

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.