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The Canadian Mining Review

Established 1882

Vol. XIV.—No 6 1895—OTTAWA, JUNE—1895 Vol. XIV.—No. 6.

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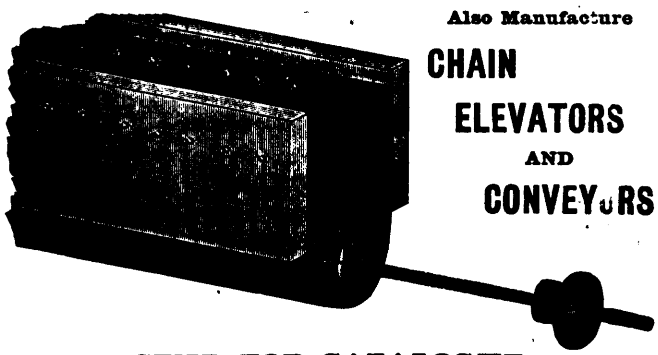

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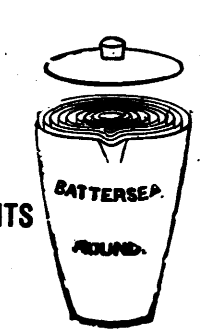

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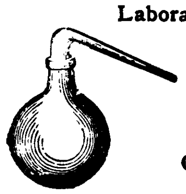

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CANADIAN MINING REVIEW

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.

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: Sclater Building, Ottawa.

VOL. XIV., No. 6 JUNE, 1895. VOL. XIV., No. 6

The Kingston Blast Furnace and Steel Works.

The proposal to erect a furnace of 125 tons capacity, and steel works comprising furnace and rolling mill of 40 tons daily capacity, has been before the Kingston people and excited more than local interest. The advantages of the site and the vicinity of abundant iron ores of various qualities, have fostered an impression that Kingston, more than any other place in Eastern Ontario, is wonderfully well situated for such an enterprise. It is only the scepticism which ignorance engenders that entertains any doubt of the feasibility of obtaining charcoal supplies on the lines of the Kingston and Pembroke, Canadian Pacific, and Ottawa and Parry Sound railways, for a length of time beyond the average duration of the charcoal furnace. A project that would put in circulation for labor $6.50 for the fuel required for the manufacture of each ton of pig iron, should have some consideration from merchants and railway carriers.

Nevertheless, neither the scheme submitted by H. G. Hamilton and others has materialised, nor has any counter proposition been made by the Kingston people to invite the erection of a plant, which, as outlined by the Youngstown promoter, seem to be very suitable for the requirements of Ontario industry. The proposition submitted to the city plausibly offered in return for a grant of the site and a loan of $250,000, a mortgage of the works and of the Government bounty per ton of iron and steel until the loan should be fully repaid with interest. There seemed every probability that beyond the expense of the site the city would receive its entire outlay.

The negotiations do not appear to have been conducted with skill on either side. The Youngston proposal apparently involved the disposal of more or less of an existing plant. The examination of this part of the proposition should at once have been committed to a competent engineer. It is more than likely that there are many plants in the United States which would profitably bear removal to Canada. There are also others which are best suffered to remain on their sites as monuments of the folly of the mad speculation which founded them. It was not seemly on the part of the Kingston people to arrive at any premature conclusion as to the Youngstown proposition without at least the opinion of some one competent to pronounce upon the value of the plant proposed to be erected.

Before obtaining any evidence on this point the promoters were called upon to furnish evidence of the capital available for the enterprise. Here, the proposition received its quietus. There was plainly on the part of the city a demand that at least half a million of dollars should be in view before they would submit a by-law for the loan of about $300,000. It is doubtful if any proposition will ever be presented to any Canadian municipality where such a condition would be satisfied. A little care on the part of those engaged in promoting this enterprise might have led to the modification of the proposition for the loan and the city would thus have encouraged the erection of works, the want of which is a hindrance to the progress of the Province of Ontario.

The Youngstown proposal to Kingstonians was for a coke furnace. But we do not see why, having a meridianal railway worthless without traffic in forest products or minerals, the promoters were not invited to submit a proposal for a charcoal furnace. Probably it was thought the Youngstown gentlemen knew their own business. The Kingston people ought to keep in mind that in the townships in their rear there would soon be a different state of affairs if the charcoal burner were invited to ply his calling instead of that fire fiend, the free-grant settler. Charcoal at 5 cents a bushel makes the ordinary forest worth to the laborer one hundred dollars an acre, and to the railway carrier an average of twenty dollars an acre. Such figures ought to arouse the sleeping beauty, whose mausoleum is the Limestone City, from her slumbers. It is to be feared the effort will be in vain to arouse her. Fearing a renewal of Mr. Hamilton's proposition, one of the city papers came out with the request, all too pleasant in Kingstonian ears: "Give us a rest."

Aid to the Phosphate Industry.

One of the prominent features of the United Meeting of Canadian Mining Engineers, to be held at Quebec on 27th and 28th June, will be the consideration of a number of papers on the phosphate and fertiliser industries. The desirability of some direct assistance by the Governments—provincial and federal—to these industries is recognized by every one cognizant of our great phosphate resources in Quebec and Ontario, the depressed condition of that once flourishing industry and the possibility of its revival by the extension of the use of superphosphates by the Canadian farmer. Canada is a great wheat growing country, but as yet it uses only a few hundred tons of fertilizers per annum The cereals and grass crops extract from the soil (Annual Report of the Minister of Agriculture) 235 million pounds of phosphoric acid, equal to 117,972 short tons. Supposing one-half only to be returned to the soil in the stable manure, there is still a deficit of 50,000 tons of phosphoric acid. Taking 33 per cent. as a fair average of the phosphoric acid in Canadian apatite, the quantity of phosphoric acid to be restored to the soil would represent about 177,000 tons of apatite. The worn out cotton lands of Georgia, by the use of artificial manures were raised in twenty years from a value of $3 per acre to $30 per acre. The same transformation might take place in Quebec and the older provinces of the Dominion, could knowledge and enterprise be combined to apply the remedy. Every ton of phosphate that can be produced in Canada is needed in her own soil and should be sold for use here instead of being exported to Europe and often sacrificed in competition with inferior foreign phosphates or through losses by those tricks of trade that are so notable a feature of modern commerce. How shall this home market be extended? Primarily by the education of our farmers through the Departments of Agriculture, our experimental farms and our agricultural colleges of the value of superphosphates as a fertilizing agency. If the Governments will devote an appropriation to the spread of this knowledge and to the mining and manufacturing of phosphates, it would be of greater benefit to Canada than the same amount applied to any other industrial development, be what it may. In our next issue we will publish verbatim reports of the various papers and discussions on this subject to be presented at the June meeting of the Quebec and other mining associations.

EN PASSANT.

Notwithstanding rumors to the contrary, there is no material improvement in the phosphate market, Canadian being quoted in London at 8d. for 80 %. The mines are still shut down.

A London correspondent writes:—"It is hard to get any one here to believe that any money is being made in mining in British Columbia. The present financial condition of the Provincial treasury militates immensely against private enterprise—especially as Mr. Turner is over here trying to raise another loan—which looks bad—and *Truth* has been running down the Provincial credit almost every week. A great deal may be said about business smartness here, but I fail to grasp what the financial condition of British Columbia has to do with the chances of success in gold mining. Investments here seem to be made on vague reports and mere generalities—such as 'Lots of money being made in the Transvaal: *ergo*, such and such a mining company is bound to be all right!'—and the ordinary public follow one or two men like a flock of sheep. A company for any part of West Australia or South Africa could be capitalized in one day. Everybody says the same thing."

The gold yield of the Province of British Columbia for the year 1894 is reported by the Hon. the Minister of Mines to have been $456,066, as compared with $379,535 in 1893 and $399,526 in 1892. Of this amount $380,055 was exported by the British Columbia banks, and $76,011 is estimated to have been carried away in private hands. The indications are that this season the output will be still further materially increased.

Perhaps no other manager is more widely known among the mining men of Canada than the subject of our portrait this month, Mr. George R. Smith, of the Bell's Asbestos Co., Ltd. Mr. Smith was, we believe, born in Newark, N.J., and had experience in slate quarrying and other professional work in the United States before coming to Canada in 1887 for the American Diamond Rock Boring Co., in charge of certain prospecting work with their diamond drills on the property of the Frontenac Lead Mining and Smelting Co., near Kingston, Ontario. In 1883 he visited Canada again, representing the Revenssler Falding Co., on a contract to open up the North Star phosphate mine on the Lievre River, Que. Here he remained only for some six months, being engaged by the Chapleau-Senecal syndicate to open up its phosphate properties on the opposite side of the river. On Senecal's death the company was dissolved, and Mr. Smith assumed the management for a number of years of the Little Rapids phosphate mine, where, in 1886, we have a lively recollection of his hospitality and a record run down the mine tramway. After severing his connection with the Little Rapids, Mr. Smith became associated with the Ingersoll Rock Drill Company of Canada, the Macgregor Lake Phosphate Company, and other enterprises, ultimately succeeding to his present position with the Bell's Asbestos Co. on the death of Captain Tom Sheridan in 1892. Mr. Smith is an officer of the Quebec Mining Association and the Asbestos Club, in whose affairs he has taken a prominent and active interest since their organization.

There is a rumour afloat to the effect that Col. Baker, Minister of Mines for British Columbia, has offered the appointment of Government Mining Engineer to Mr. W. A. Carlyle, Mining Engineer, for the past year or two Lecturer in Mining, at McGill College, Montreal. It is not known whether Mr. Carlyle has accepted the appointment. Mr. Carlyle is a capable engineer of some practical experience in silver-lead mining and milling in the Western States, and we heartily wish him every success in his new sphere of labor The appointment has been offered, we understand, very largely on the recommendation of Dr. George Dawson, C.M.G., Director of the Geological Survey.

The *Financial News*, London, advises the British public to look to West Kootenay, and to invest there instead of in South America and elsewhere in foreign lands, where investments so made have to be shadowed by one of H. M. gunboats. This shows that British Columbia has only to be heard of to be appreciated, and the best policy for all British Columbians to adopt is to see what means would the sooner bring about the object. It is to be hoped that the Government will join with those who are striving to make known abroad the mineral resources of the Province in the same way that the governments of other colonies have done, and there can be no question that the results that will accrue will yield an ample return for the little expenditure requisite for the purpose.

A western contemporary pithily remarks: The absolute indifference of Canadians generally and eastern Canadians in particular to the mining developments of their own great country is enough to make a citizen of West Kootenay weary and tired. If the capital in Montreal, Toronto, Ottawa and other eastern cities that is used annually for gambling on Wall Street, New York, or on the wheat exchange, Chicago, Ill., or on the mining exchange, Denver, Col., were put into development work throughout the great mineral zone in British Columbia, which is as great or greater than any mineral bearing area in the United States, not only would we see more rapid development of the conntry, but we would see immense fortunes made by our own countrymen. We would also see some point in the east become one of the world's great trading centers for the refined product of Canadian mines. Canada would become a great exporter of the precious metals and Canadian commerce in every branch would feel the stimulus. But no, our precious metals now being mined in bulk, must filter through the markets of the United States into the commerce of the world, bringing prosperity it is true, to the loyal Canadians of West Kootenay, but in their ultimate and most far-reaching effects, doing no more for Canada than if the 49th parallel lay north instead of south of West Kootenay. Trail Creek is now producing $4,000 a day in solid gold. During 1895 it will export $2,000,000 worth of the precious metal, or 5 per cent. of the whole output of the United States. Who in Canada knows or cares anything about so comparatively uninteresting a fact, and what enterprising Canadian capitalist is reaching out a hand for a share in the golden shower? Trail Creek is now greater than Cariboo in its palmiest days and more permanent, but British Columbian ears are so stuffed with the traditions of Cariboo that the noise of a present day movement disturbs them no more than it would the lotus eaters of Alfred Tennyson."

CORRESPONDENCE.

The Geological Survey.

SIR,—To investigate and report upon the mineral resources of the Dominion is a statutory duty of the Geological Survey. That this work should be of like practical value with reports supplied by the Geological Surveys of the States of the American Union is not a disputable proposition. There is no reason assignable for conducting this portion of the business of the survey on any other line than according to the best standards. What have we to show for the hundreds of thousands of dollars our Geological Survey has cost us that can for one moment compare with the report of the Winchells on the Iron Ores of Minnesota,—a work which has had no small influence in promoting the development of the great iron mines of that State? It is not because the gentlemen connected with the Canadian Survey are less scholarly or professionally unqualified that the work of the Survey for the development of our mineral interests cannot for a moment vie with the work of American geologists, but because an unwise policy has guided their aims. May we hope that in future the Survey shall rest upon its laurels in the departments of Archæology, Indian linguistics and Palæontology, and devote attention to particular districts of definite mineral resources, the opening up of which will contribute to the prosperity of the country as well as to the reputation of the Survey for scientific investigations of practical value.

Yours, &c., KINGSTONIAN.

KINGSTON, 18th June, '95.

Mr. GEORGE R. SMITH, Superintendent,

Bell's Asbestos Co. Ltd., Thetford Mines, Que.

PERSONAL NOTES.

Mr. E. D. Ingall, M.E., A.R.S.M., chief of the Division of Mines and Mineral Statistics, is on leave of absence. A brief rest and change of air, it is hoped, will prove beneficial to his health, which, for some time past has been far from good.

Mr. Robert Archibald, C. & M. E., has severed his connection as mine superintendent of the Canada Coals and Railway Co., and is now in Scotland.

Mr. Harry Williams, for a number of years mine superintendent with the Beaver Asbestos Co., Ltd., has been appointed to a position with the Danville Slate and Asbestos Co., Ltd.

Mr. R. G. Leckie, M.E., late general manager of the Londonderry Iron Co., has gone to Fredericton, N.B., to operate his coal and iron properties at Grand Lake, N.B.

Capt. Robert C. Adams, Montreal, has gone to Midway, B.C., for the summer, to look after his various mineral interests in the Boundary Creek district.

Mr. H. P. H. Brummell, of the Geological Survey of Canada, having been appointed manager of the North American Graphite Co. Ltd., has left the Survey. The Dixon property in the Township of Buckingham, Que., is to be operated.

Mr. W. F. Sergeant, Tacoma, Wash., secretary of the Slough Creek Mining Co., has been in Montreal lately interesting capital in the Cariboo District, B.C.

Mr. J. Obalski, Inspector of Mines for Quebec, passed through Ottawa on 12th inst. on his annual inspection of the Ottawa County mines.

Mr. C. A. Meissner, an experienced operator from New Birmingham, Ala., has been appointed manager to the Londonderry Iron Co., in succession to Mr. R. G. Leckie.

CANADIAN COMPANIES

Dominion Coal Company, Ltd.

The report of the Directors and accounts for the fourteen months ended 28th February last, submitted at the annual meeting on 6th June, are as follows:—In submitting this report the attention of shareholders is called to the fact that to the time of making the report for 1893 the operations of this company were carried on for about ten months, but in consequence of the change in the fiscal year, which now begins March 1st, this present report covers a period of fourteen months.

January and February are months when the mines are practically closed and no revenue is received. The accounts for these two months are shown separately. Had this statement included but twelve months from January 1, 1894, the net surplus would stand increased by the sum of $64,597.65, or $92,211.56 instead of $27,613.91.

The quantity of coal mined was 1,020,537 tons, being an increase of 187,518 tons over the business of 1893.

In addition to this business much progress has been made in opening new pits, one on a seam of coal believed to be of superior quality, and in providing modern apparatus and machinery for mining and handling coal. This work is so far complete that no further expenditures are contemplated. As the coal seams of Cape Breton resemble those of the United States, it is believed that the same cheapening of cost will follow these improvements in the one case as in the other.

This cheaper cost of production and cheaper transportation will enable the company to market its coal in places which would otherwise be inaccessible, thus making a larger output possible, increasing the length of time when mining operations can be carried on, increasing the revenue of the Company and giving more employment and for a longer time to its employees.

The railroad to Louisburg is substantially completed as well as its piers at Sydney and Louisburg, and it is expected that the railroad will be open for freight and passenger business over the whole route on the first of July. The opening of the road to Louisburg will afford for the first time an opportunity for winter shipments of coal, and will consequently cheapen the cost of sea transportation to the lower Maritime Provinces, and to New England ports. The road is now forty-two miles in length, with grades exceedingly favorable. It is laid with 80-lb. rails and is in every respect first-class, and has connection by branches to all the company's collieries but one. That one is located at some distance from the main line and is equipped with a short piece of railroad and independent pier. During the past year a large amount of equipment, principally coal cars (of which four hundred are of a capacity of sixteen tons each) and three locomotives have been added. The local freight and passenger traffic has proved satisfactory.

All the construction work in contemplation at the time of organization is now completed. All of the bonds held for this expenditure ($1,500,000) have been sold at a satisfactory price. The proceeds (in part received) place the company in a satisfactory financial position.

The net revenue since organization has been sufficient to provide for all interest, sinking fund and dividend requirements on preferred stock and to pay a considerable sum toward depreciation and expenses for change in the fiscal year. When the savings by the new methods begin to be realized, it is believed that the net results will show a gratifying increase which can be used for dividends on the common stock.

The sinking fund provision for the bonds requires the payment to the trustees, the New England Trust Company, of two cents per ton on all coal mined the first year (1893), three cents the second year, four cents the third year, and five cents thereafter, and after the sum of $125,000 has been received by the trustees (which shall be held in cash or in securities) the bonds will be called for payment and cancellation. Even on the present basis of output a small amount will be required to be called in April, 1897, and thereafter an amount equal to five cents per ton on the output. The amount now in the sinking fund has been invested in United States bonds.

Report of the Treasurer, January 1, 1894, to February 28, 1895.

Net proceeds $1,020,537 tons coal, less cost mining, transportation, royalty, etc		$184,075 01
Profit on Steamships, railway, barges, etc		196,873 43
		$380,948 44
From which has been paid—		
Balance sinking fund (1893)	$320 43	
Interest	176,864 31	
Dividends, preferred stock	120,000 00	
General expense	47,857 69	
		345,042 43
Balance		$35,906 01
Add—		
Surplus from 1893	$51,977 48	
4 months' interest allowed in 1893 statement afterwards paid in above interest account	30,000 00	
		81,977 48
Total		$117,883 49
For which provision must be made for—		
Dividend preferred Stock, 2 months, January and February, 1895	$20,000 00	
Sundry accounts payable	3,343 45	
Sinking fund	28,055 05	
		51,398 50
		$66,484 99
Add subsidy received for railway construction		64,000 00
Gross surplus		$130,484 99
Written off as follows—		
Subsidy to suspense account for future depreciation railway and equipment	$64,000 00	
To profit and loss, depreciation in property	21,054 98	
" " provision doubtful accounts	5,638 42	
" " sundry items properly chargeable to 1893 business	12,177 68	
		102,871 08
Net surplus carried over		$27,613 91

NOTE—This surplus remains after deducting expenses of two unproductive months, costing as follows:—

Maintenance of mines, offices, etc	$29,597 65
Interest on bonds	15,000 00
Dividend, preferred stock	20,000 00
Total	$64,597 65

Balances, February 28, 1895.

Assets—		
Property	$19,194,123 54	
New supplies warehouses and stores	107,315 09	
Agents' balances	188,085 10	
Bills receivable	3,000 00	
New England Trust Co. sinking fund	15,460 28	
" " interest account	63,465 00	
" " special account	106 00	
American Loan & Trust Co., dividend account	1,892 00	
Cash	54,041 76	
		$19,627,497 77
Liabilities—		
Common stock	$15,000,000 00	
Preferred stock	1,500,000 00	
First mortgage bonds	2,100,000 00	
Bills payable	719,147 64	
Unpaid coupons	63,465 00	
" dividends	1,892 00	
Coal, balance payable	29,026 91	
Accounts payable	3,343 45	
Royalty, 5 months	32,082 73	
Accrued dividend, 2 months	20,000 00	
Sinking fund	28,055 05	
Railway subsidy, suspense account	64,000 00	
To profit and loss	38,871 08	
" surplus 1895	27,613 91	
		$19,627,497 77

J. S. McLENNAN,
Treasurer.

Boston, June 6, 1895.

New Vancouver Coal Mining and Land Co., Ltd.—At the meeting of shareholders held in London, Eng., last month, a balance dividend of 2 per cent. was declared, making 4 per cent. for the year 1894, carrying forward nearly £18,000 to credit of profit and loss. The net output in the half year ended December 31st was 169,183 tons, making a total for the year of 345,283 tons, while the sales in the half-year were 171,973 tons, making the total for the year 347,573 tons.

Paris Belle Gold Mining Co., Ltd., has been incorporated under the B. C. (foreign) Companies Act, with an authorized capital of $800, and headquarters at Spokane, Wash., to carry on mining operations in the Province of British Columbia.

Good Hope Mining and Milling Co., Ltd., has been incorporated in Spokane, Wash., with an authorized capital of $500,000, in shares of $100, to carry on mining in the Province of British Columbia. The incorporators are Frank Guse, Spokane, Wash., President; E. L. Hooper, G. Mackie, Peter Steep, Wm. Townsend and James Maxwell.

The Granite Creek Mining Co., Ltd.—This company has applied for incorporation under the Dominion Statutes. The objects are to purchase, take over or otherwise acquire, in whole or in part, the mineral lands, mines, estate, both real and personal, properties, rights, credits, privileges, business, good-will, and assets of the Stevenson Gold and Platinum Hydraulic Mining Co. (Limited Liability), and to assume, undertake and pay all liens, charges and incumbrances affecting the same or any one or more of them, or any part thereof respectively, and also to assume, undertake and pay all the liabilities of the said The Stevenson Gold and Platinum Mining Co. (Limited Liability) and to purchase and sell gold, silver, copper, nickel, iron and other metals in the Dominion of Canada and elsewhere. Directors: Robert Stevenson, Chilliwack; Wm. Lovitt Hogg, Inspector of the Western Loan and Trust Co., Ltd.; W. Barclay Stephens, Manager of the Western Loan and Trust Co., Ltd.; Clarence Gillard, physician, and James Naismith Greenshields, advocate, all of the city of Montreal, in the Province of Quebec, and Andrew Walker Fleck, Esq., and Wm. Dale Harris, civil engineer, both of the city of Ottawa, in the Province of Ontario. Authorized capital stock, $150,000, in 15,000 shares of a value of $10.00 each.

Nanaimo Rossland Mining Co., Ltd.—Gives notice of application for charter under B. C. statutes. Authorized capital, $500,000. Directors: C. U. Westwood, Nanaimo, B.C.; Jas. McGregor, A. Jenkins, W. K. Leighton, and Thos. Kitchin, all of Nanaimo. Head office: Nanaimo, B.C.

Mineral Creek Gold Mining Co., Ltd., has been formed in British Columbia to acquire mineral claims on Vancouver Island, and particularly "The Alberni," "The Warspite," "The Victoria," "The Halifax," and "The American Boy," as well as placer claims known as "The Spike Horn," "Mint," "Hidden Bank," "Enterprise," "Golden Star," and "Black Hawk," all of which are situated on mineral Creek, in Alberni district, B.C. Authorized capital, $500,000. Head office: Nanaimo, B.C. Directors: George Bevilockway, W. J. Curry, and Percy Lorne Simpson, of Nanaimo, and Walter Jones, of Wellington, B.C.

Horsefly Hydraulic Mining Co., Ltd.—Advices received up to the 25th of May state that there is abundance of water. The result of the big blast (which was mentioned in our last issue) has been most satisfactory, the gravel being thoroughly shaken up and the amount of gravel operated on effectively is much greater in consequence. The first clean-up for this season is expected to be made between the beginning and middle of July next.

Cariboo Hydraulic Mining Co., Ltd.—Reports from Quesnelle Forks, up to May 24th, state that the company was running 8 hours a day with about 2,000 miner's inches of water. Since then heavy rain has fallen, and there is now an abundant supply of water, so that work can be carried on without intermission on the three-shift plan. Before the supply of water from the present available sources is exhausted, the ditch will be completed from Hazleton Creek to Polley's Lake, when there will be at all times an ample supply of water. The company has now 400 men at work on the construction of the ditch, which is to be completed by the end of July. These extensive undertakings have infused new life into the district and the success of these hydraulic companies will have results—direct and indirect—on the future of Cariboo which can scarcely be overrated. The first clean-up will probably not be made till sometime in July.

West Le Roi and Josie Mining Co., with a capital stock of $500,000. The incorporators are George H. Casey, of Butte, Chas. G. Griffith, of Helena, John M. Burke, D. Holzman, Sam Silverman, John L. Wilson, J. B. Jones, C. S. Vorhees, and H. M. Stephens, all of Spokane, and Ross Thompson, of Rossland. The principal offices are to be in Spokane. The company is to erect all kinds of mining machinery, deal in real estate, etc.

The Robert E. Lee Mining Co. have incorporated for a period of 50 years, and will buy, sell, hold, lease and operate mines in the United States and British Columbia. The principal place of business will be in Spokane. The capital stock is $500,000, divided into 500,000 shares of $1 each. John M. Burke, W. Clayton Miller, J. L. Wilson, C. S. Vorhees, C. W. Ide, and A. P. Sawyer are directors.

The Eureka Concentrating and Mining Co. is another concern that has been incorporated for a period of 50 years, and will buy, sell, hold, lease and operate mines in the United States and British Columbia. Headquarters will be at Spokane. The capital stock is $500,000, divided into 500,000 shares at $1 each. John M. Burke, J. B. Jones, Ross Thompson, S. Rosenhaupt, H. L. Wilson, O. D. Garrison, and G. W. Dickenson will act as the board of directors.

Mountain Sprite Mining Co. of Tacoma.—Capital stock, $500,000, in 500,000 shares of $1 each. Incorporators, Nelson Bennett, M. V. B. Stacy, and Henry Blackwood; to operate mines and handle mining machinery in Washington and British Columbia.

The Lookout Mining and Milling Co., with headquarters at Spokane, has been incorporated with a capital of $250,000. G. E. Kumpe, E. W. Talbot, L. R. Lindsey and Geo. E. Pfunder are the trustees.

Consolidated Gold Lake Mining Co., Ltd.—Capital, $400,000. J. B. Neily, President; W. A. Temple, vice-president, and James Reeves, secretary-treasurer, with H. C. Walker and G. H. Mackinley as directors. The property consists of 305 areas at Gold Lake, N.S., and 400 acres of land.

The St. Elmo Mining Co. has been incorporated by Spokane parties to operate the St. Elmo claim on Red Mountain. The incorporators are Frank C. Loring, George W. Crane, F. E. Snodgrass, E. D. Olmstead, and R. E. Coe. The office of the company will be at Spokane. The St. Elmo is the highest claim on Red Mountain and was originally located by Samuel Creston. It lies between the Mountain View on the one side, which is being operated by W. H. Taylor, and the St. Elmo Consolidated on the other, on which J. R. Cook and J. B. McArthur have an option. At various times during the past four years Sam Creston has sold small interests to L. Mulholland; and on the 10th of May the whole claim was sold at a large figure to F. C. Loring and G. W. Crane of the Josie mine on thirty and sixty days' time.

Alexandra Mining and Dredging Co., Ltd., has been incorporated under British Columbia statutes, with an authorized capital of $3,000,000, to carry on mining in that province. Head office: Vancouver, B.C. Directors: Marshall H. Alworth, Charles Wilson, John B. Heinrick, George Turner, and J. B. Hanrahan.

Nova Scotia.

Caribou District.—Some little excitement has been caused by the finding of some rich quartz about two miles from this district on ground prospected some years ago by Mr. Touquoy. It is yet too soon to predict that this discovery means a new district, as the pocket found appears to be in a cross vein and not on a regular lode.

The Sanders (formerly "Lake Lode") property is reported to have uncovered some high grade quartz, and the property owned by Jack & Bell of Halifax is also in good ore.

Reports from the Caribou Gold Mining Co. area are not encouraging. The yield from the old Dixon mine is said to be decreasing, and the efforts of the company to open up high grade rock have not as yet been successful. Rumor has it that an effort will be made to place the property in either the New York or London market.

Moose River District.—Mr. Damas Touquoy continues to crush the surface gravel from some of his areas with success. He is enabled to make a small profit on this material at 60c. per ton. The output from his quartz mine is being increased and maintains its average yield.

Mr. MacGregor has resumed work on the large body of low grade rock in the Moose River Gold Mining Co's property. Recent crushings have been made at a profit, and the summer will see a considerable increase in the output.

Fifteen Mile Stream.—Some changes in the plant here were made during the spring and returns for April and May show large yields. This district is much hampered by its bad roads, but has abundance of good ground awaiting exploitation.

Oldham.—Nothing is doing here beyond tribute work.

Renfrew.—The Pictou Development Co. have not yet completed the sale of their property to New York parties—rumor says the deal is off. The McLeod lode continues to show rich quartz in pockets, and the Ophir lode is to be re-opened and tested. Returns from the district are good.

Montagu.—The recent decision affecting the validity of the Temple-Logan title to the old British-American areas is causing great comment and no little uneasiness in gold-mining circles. The burdens capital has to bear in opening up our mineral fields are heavy enough without the addition of an uncertain title. The difficulty appears to have arisen through loose and ambiguous wording of the statute, and is a commentary on the present loose system of amending the mining laws. The decision of the courts will undoubtedly occasion a change in the statute, but this process of reforming the language of the Provincial Acts will be found decidedly detrimental to the introduction of capital to develop the province's resources.

Waverley.—The Tudor Gold Mining Co., Ltd., continues to be the only producing concern in this district. Its Dominion Shaft now has a depth of about 500 ft. The cuts made by the railway in crossing the measures of this district have so far failed to discover any new veins or facts of value.

Cochran Hill.—The Supreme Court, in rendering a decision against the Cochran Hill Mining Co. in a suit for debt recently tried, took occasion to comment most forcibly and appropriately on the financial methods and ideas of the promoters and directors of this company, to all of which the REVIEW says *Amen*. The responsibility the English law imposes on directors of limited liability companies should obtain throughout Canada, and the sooner the better.

Some Boston and New York gentlemen some time ago acquired some passibly good coal areas in Inverness County, Cape Breton, and organized a company under the laws of Maine for the purpose of opening up and developing the same. Recently the same parties also acquired valuable rights on a block of fine coal property on the Pictou coal fields, and also a broad and liberal charter passed by the N. S. Government in 1894, with a view of consolidating the two interests. H. A. Ely and A. C. Jones, of Boston, recently visited Pictou and examined into the merits of the new coal area, and returned to Boston very much pleased with the prospects. They purpose putting the matter before capitalists who are willing to furnish the capital necessary to open and work the properties provided they are satisfied the statements made to them are correct. It was for this purpose Mr. Ely visited the ground personally and saw for himself. The negotiations for the acquirement of the Pictou areas and the N. S. charter were conducted through E. A. Charters, of Sussex, who is also the secretary of the Inverness Coal Mining Company. They possess a good property and there is no doubt the necessary capital to operate it on a large scale will be forthcoming. First-class chances of shipment, both by rail and water, exist on and near the property.

New Brunswick.

The mining news from this Province is not of a very positive nature, but it looks as if a boom was in store and a possibility of some developments being made that may be of importance.

The Local Government of New Brunswick has made arrangements to conduct a series of borings at Salt Springs, in Kings Co., near Upham. Salt brine from flowing springs was utilized some years ago in manufacture of salt, but the brine being low in percentage, cost of manufacture would not permit of its coming into competition with Upper Province and American Salt. The object now is to ascertain if, by boring, a stronger brine cannot be had and perhaps the salt rock itself. The salt made at this point formerly and at Hendricks Spring, a short distance above Sussex, is the finest on this side of the Atlantic for dairying purposes, and as a table salt also. A chance for investment of capital at the last point named can be had, and with improved plant there is no doubt a good return on a fairly moderate investment could be made.

The development of Grand Lake coal bids fair to be among the possibilities. R. G. Leckie and some American capitalists, it is said, will expend some money there to determine the value of same. Provided the smelting furnace is erected in St. John by Mr. Leckie and his associates, it is possible Grand Lake coal will furnish the fuel necessities. Should a cheap and expeditious system of mining the coal be devised, as a furnace fuel for factories, etc., it may be in good demand, but at present its coming into competition with Cape Breton or Nova Scotia coal for house use is doubtful.

Some New York people recently visited Albert County to examine the prospects of a deposit of Albertite coal, which outcrops there in fairly good quantity, and may prove to be of very much value. It would be a boon to Albert County to have this once important and highly remunerative industry again revived. The visitors who have control of the property in question it is said are very favorably impressed and will expend some money in development at an early day.

The promoters of the Baltimore Coal Mining Co., which is duly incorporated under the laws of the Province of New Brunswick, with a capital of $300,000, are engaged quietly in perfecting their operations for a development or sale of the same. Mr. John Harding, of St. John, a veteran organizer of companies, is interested in the project, and recently explained his views on the possibilities of this shale to parties in Montreal, according to the *Star*. The location of this property is in Albert County, and but a short distance from good shipment.

The sale of a gypsum property at or near Petitcodiac is reported, to New York parties, by gentlemen in Moncton, who have had control of the same. Just what may be done is not yet apparent. It is said the deposit is very large and near good railway facilities.

Some time ago a company was announced having a view to the prospecting and boring for coal at Dunnmore, about eight or ten miles above Sussex. Coal in small quantities and of a very good character has been taken from a vein near surface, and it is believed that boring would prove the existence of other and underlying seams of working value. As no move has yet been made it is not known what the intentions of the promoters are. Kilgar Sheves, Esq., of Campbellton, N.B., on whose property the coal lies, is principal promoter of the scheme.

Last fall exciting rumours of the discovery of visible gold in quartz were in vogue and said to be gotten from a vein in one of the branches of the Upsalgulch River, in the County of Restigouche. Fine quartz, well studded with gold, was freely exhibited, but as no move has been made to prove or develop it, the knowing ones smile and think a piece of Nova Scotia gold quartz drifted over here by accident, and the gold mining boom in Campbellton is quiet now.

I have heard of the probable discovery of asbestos in a certain locality in New Brunswick. Search has been persistently made for some time for same. What the actual facts are I cannot say, but if it proves to be authentic, I shall give you correct particulars at a later day.

Mineral springs are abundant in Nova Scotia and New Brunswick. The writer has assays of four or five, and any person interested in such matters can obtain information by inquiry at office of REVIEW where address will be furnished. In the meantime I shall try and be more regular in future in mining notes for your valuable journal.

A mining party belonging to Woodstock, N.B., have gone on to the Tobique to a point called Gold Brook, in search for gold. This syndicate have been prospecting in this locality for some time and at various times found first-class indications of gold. A small stamp-mill has been bought and is being taken in for practical tests. The gold is said to be in low grade ores and any quantity of material. Just what the yield is per ton is not known. It is to be hoped the attempt will meet with success, as should the existence of gold in paying quantities be proved it will very materially add to the chances for investment of capital in this province.

Quebec.

A good deal of activity is noticeable at the asbestos mines, and although prices are not what they ought to be, the output should be quite up to that of last year. The following companies are operating. Bell's Asbestos Co. Ltd., Johnson's Co. Ltd., King Bros., Danville Slate and Asbestos Co. Ltd., Anglo-Canadian Co. Ltd., American and United companies.

The Eustis and Nichols pyrites mines at Capelton, are reported to be working night and day shifts and producing large quantities of ore.

In the Ottawa County district Wallingford Bros., Lake Girard and Vavasour Mining Association are producing mica, and the Walker Mining Company's mill is running on plumbago. Only a small quantity of phosphate has gone forward.

British Columbia.

Vancouver Island.

The output of coal for the twelve months ended 31st December last was:—

	Tons.
New Vancouver Coal Mining and Land Co	304,624
R. Dunsmuir & Sons	376,956
Union Colliery Co	241,372
Total output, 1894	1,012,953
Add balance on hand 1st Jan., 1894	19,044
Total coal for disposal, 1894	1,031,997

The exports during the year amounted to 827,642 tons as follows:—

	Tons.
New Vancouver Coal Co	280,130
R. Dunsmuir & Sons	304,852
Union Colliery	233,660
Total exports	827,642
Home consumption	165,776
On hand 1st Jan., 1895	38,579
Total	1,031,998

Cariboo District.

During last season upwards of sixty applications, aside from those held by the ordinary record, were made to the Gold Commissioner for ground for hydraulic mining in various parts of this district, upon some of which very large expenditures are being made.

The output of gold for 1894 is estimated to have been:—

Barkerville Division	$66,300
Lightning Creek	34,700
Quesnelle Mouth	26,200
Keithley Creek and Quesnelle Forks	65,150
Estimated product 15th Nov. to 31st Dec	10,000
	$202,350

The first clear-up for the season of the Horsefly and Cariboo Company's claims was to have been made on 15th, and much interest is manifested in the returns, which are expected to be rich, both in British Columbia and in Toronto and Montreal, where a large portion of their stock is held.

On the lower part of Quesnelle River the Quesnelle River Hydraulic Mining Co. obtained a lease of ground last season and brought in pipes and monitor during the winter, constructed ditches and dams, and got pipes laid, but not in time to take advantage of the water supply. However, they managed to secure a few hours run, which gave satisfactory returns.

Cassear District.

The following has been estimated by the Gold Commissioner to be the yield of gold from this district in 1894:—

Dease Creek	$8,300
Thibert Creek	4,000
McDame Creek	9,550
Rosella Creek	200
Grand River Division	350
Stickeen River Division	300
	22,700

East Kootenay.

The yield of gold from the various creeks in 1894, is estimated as follows:—

Wild Horse Creek	$22,500
Perry Creek	300
Moyie River	1,800
Desultory mining, say	300
	$24,900

showing an increase of $5,200 over 1893.

On Wild Horse Creek the hydraulic operations of the East Kootenay Exploration Syndicate have given very fair results, considering many unforeseen drawbacks which occurred to impede. Operations were commenced under the superintendence of Mr. Beatson, a Californian mining superintendent, early in May. Great delay took place, owing to land slides, which carried away large portions of the Victoria ditch. During the extremely high water of the past season the old dam at the head of the ditch was carried out, occasioning, altogether, delay of over six weeks at the most important part of the season. The pipe plant purchased some years back seems to have given much trouble, not proving sufficiently strong for the pressure of the head of water of 370 ft. The head had to be diminished to the extent of about 130 feet by introducing a pressure-box at a lower level, thus decreasing the efficiency of the giants. In August a new giant was received from Messrs. Hendry, of San Francisco, and piping was commenced towards the end of the month and continued to the end of October. The quantity of gravel put through the sluices for the season was 77,500 cubic yards, or 0.66 of a cubic yard of gravel for each 10 hours miner's inch of water used. It is estimated that this efficiency could be increased to 1 cubic yard per 10 hours miner's inch of water by the introduction of a proper pipe plant, using the full head of water; or by using electric light and working 24 hours, the quantity could be increased to 2½ cubic yards of gravel for each miner's inch of water. The operations showed that the company's ground on Wild Horse Creek can be worked at a handsome profit.

The Ridgway Company has, for a long time, been prospecting for placer on different portions of the Moyie River. During last summer they discovered some good pay ground in an old channel and have obtained a lease covering the ground desired. The work which they have done consists of a drift of about 80 feet long, run into the bank at an elevation of 5 feet above the river, at the end of which an incline was sunk to bed-rock, where some very good prospects were found, viz., $85 to the last two sets of timber. As water gave trouble, a drain was run, about 600 feet in length, from a point further down the river to reach the foot of the incline. The ground reached here proved not nearly as rich as indicated by the first prospects found. After drifting 300 feet further, however, another pay streak was found, stated to be about 40 feet wide and 5 feet high. A drift was run some distance in this, and breasted out some distance on each side. This ground was paying well when a serious accident occurred. The timbering at the face of the drift gave way, and nine sets in succession from the face fell in, one of the miners, John Ridgway, being buried; another man, working near him, succeeded in extricating himself. A rescuing party commenced work at once, additional men being sent out by the Mining Recorder at Fort Steele. Two shifts were worked continuously. After eight days' work, night and day, the front of the drift was reached. Ridgway's body was found, dreadfully crushed; death must have been instantaneous. The cause of the accident is attributed to the neglect to brace the sets longitudinally to one another. When the first set tipped back, the weight on the sagging brought each set down in succession in a similar way.

Lillooet District.

The total yield of gold (ascertained from reliable sources only) was, in 1894, $39,257, showing a decrease as compared with 1893, of $12,119, and very much below the average of the past ten years. The extreme high water in all auriferous streams in this district, in the early summer, put a full stop to mining for nearly two months, and this cause must largely account for the shrinkage in production.

Yale District.

The Thompson River Hydraulic Mining Co., at Tranquille, had the misfortune to lose their dam, which was carried away by the great pressure of water to which it was subjected. The structure was forty feet high, and the work required to build another so delayed operations that but two or three days' piping with an inadequate supply of water could be obtained. The results, however, proved very satisfactory, the gravel in the pay streak returning at the rate of fifty cents to the cubic yard. This company has expended a large amount of money and is fully deserving of success.

The Glen Iron Mining Co. at Cherry Creek, has shipped one thousand tons of ore to the Tacoma smelter, and have a contract for supplying one thousand tons more at a higher figure than that previously obtained. Ten men are at work, and the probability is that a much larger number will be employed next summer, as the excellent quality of the ore, which is comparatively free from impurities, is largely increasing its demand.

Mr. D. Gilman, of Seattle, who is the president of the Lake Shore and Eastern railway, has bonded the mine in the sum of $60,000 for a period of six months. Should the deal be effected the production will be greatly increased to supply the wants of extensive iron works which are to be erected at Seattle for the manufacture of railway cars.

The Adams Lake group of mines promises to become very valuable. The principal work has been accomplished in the Homestake and Troublesome mineral claims, owned by Messrs. Olsen and Flynn, who will shortly reap the benefit arising from their energy and perseverance. An average lot of twenty tons of ore shipped to the smelter at Everett, Wash., U.S., yielded $1,200. There are two distinct lodes running parallel to each other through these locations. The first has been cross-cut and found to be twenty feet thick. The tunnel is being carried forward to intersect the second vein, which has about two feet of very rich ore on the hanging wall averaging from 500 to 3,000 ounces per ton in silver. This portion of the ledge is broken up and difficult to trace on the surface, but it is expected will be found intact when depth is attained.

Osoyoos Division.

Foremost amongst the mineral claims in the district at the present time are the Cariboo and Amelia, owned by the Cariboo Mining and Milling Co., of Spokane, Wash. Early in the present year the company brought in a ten stamp mill to work their ore, and since the 1st day of May (when it started running) up to the 1st instant it had worked 163 days, milled 3,100 tons of ore, which produced gold to the value of $34,750 and about 60 tons of concentrates. The work, principally on the Cariboo, consists of 675 feet of tunneling, at a depth of from 60 to 80 feet, 370 feet of which was run this year. The area stoped out will amount to about 170 feet long, 50 feet deep, and 4 feet wide. About 30 men have been constantly employed in the mine and about the mill during the summer, and I believe it is the intention of the company to keep the mill running all winter, if not prevented by frost.

On the Eureka, owned by Mr. John Douglas, there is a shaft 159 feet deep, and a drift at the 80 foot lead of 112 feet. No work has been done on this claim this season.

On the Fontenoy, belonging to Mr. Hugh Cameron, an 83 foot shaft has been sunk, and the rock, which carries silver, lead and gold, has assayed as high as $400 per ton. The average is about $24 in silver and gold.

On the Alice and Emma there is a shaft 62 feet deep, the ore from which is a free-milling sulphuret.

The Maple Leaf, owned by James Lynch, adjoins the Alice and Emma. On this claim a shaft has been sunk 30 feet, and at that depth free gold is found.

Three miles from the camp is the Snowdon, situated near the falls of Rock Creek; owners, Messrs. Elliott and James, who claim $50 per ton for the rock.

The Victoria, owned by the Haynes Estate, Basche & Goericke, has an incline shaft 110 feet in depth. From this claim some very rich ore has been taken. An assay made for Mr. Nicholson gave $480 per ton in gold. One lot of ore, amounting to 1,200 lbs., sent to the Selby smelting works, of San Francisco, gave a return of $127, and another lot of 100 lbs., $183 to the ton.

On the Old England, situated about two and one-half miles south easterly from the camp, $350 has been expended, sinking and timbering a shaft about 35 feet deep. The ore is similar to the Victoria.

The Slocan.—For the information of people on the coast, some of whom are densely ignorant about the Slocan, we would say that it is not a wheat raising country and farmers would do well to stay away from it. Capitalists will find it a bonanza, but the man in search of a place to plant corn and wheat had better go to the Okanagan. Silver, lead and hell are raised in the Slocan, and unless you can take a hand in the production of these articles, your services are not required.—*New Denver Ledger.*

MISCELLANEA

Speculation in Mines—Speaking of the revival of speculative interest in mining stocks during the past year or so, and especially in England, the London *Mining Journal* marks the distinction between the two classes of buyers and their different motives. "In the former case we have what may be termed commercial mining, undertaken in the same manner as any other branch of business, and we believe with as good an average prospect of success; and, in the other, speculative mining, in which profit is looked for, not so much from the mine itself, but from operations on the market, which may too often be described as sheer gambling." Perhaps the *Mining Journal* might do well to include a third class—those who buy to hold for dividends, but who do so without any intelligent understanding of the business, and whose investment is, therefore, a mere trusting to second-hand information, to the credibility of promoters, or to mere luck. This is quite as much "sheer gambling" as buying shares for a rise. But the *Journal's* estimate of the average prospects of legitimate mining, "undertaken in the same manner as any other branch of business"—that is, with full knowledge of the conditions and some insight into the character of the mining business—is entirely justifiable.

Condensation of Blast Furnace Fumes.—The condensation of dust and metallic fumes forms the subject of a communication by M. U. Le Verrier, Ingenieur-en-Chef des Mines. For blast furnaces the purification of gases has great importance, with a view to obtain the best results in stoves for heating the blast. Attempts have often been made to wash the gases by direct contact with water; but these methods appear to be generally abandoned. It is now sought to insure the cooling down of the outside of the pipes, and for this purpose suspended cast iron pipes, or squares made of hollow bricks, or very thin walls of cement strengthened by metal framework, are employed. For provoking the deposit of dust it was formerly sought to reduce the speed of the current by causing it to pass through chambers of large sectional area; but it appears that better results are obtained by interposing obstacles for increasing the surfaces of friction. Freudenberg was the first to apply this principle by placing rows of iron plates upright in the flues; and the wires suspended in the Tarnowitz conduits are perhaps still more efficacious and especially easier to manage. By increasing the number of obstacles it has been found possible to make a kind of filter; and at the De Wendel Iron Works, Hayange, Lothringen, the blast furnace gases are filtered across a bed of iron "straw."

Steel for Coal Tipples—The coal tipples of the future will be built of steel. The many tipples destroyed by fire, particularly the fine one burned recently in the Scott Haven district, have decided many operators on a verdict that the frame tipple must go. Selwyn M. Taylor has completed plans for a double tipple, to be built entirely of steel, and absolutely fire-proof, as the double flooring, which will be of wood, will be protected by asbestos. Work has been commenced on the foundation at the No. 2 shaft of the first pool, Monongahela Gas Coal Company, between Willock and Miller's Station, Pa., on the Baltimore & Ohio short line. The tipple will be 137 feet 6 inches long and 56 feet high. Cars will be hoisted 31 feet on an elevator. The work of unloading the cars, dumping and running them back to the elevator will be all done automatically. Five men will be able to load 3,000 tons of coal in 10 hours. The cost of the structure will be about $20,000, which is 40 per cent. more than a frame tipple would cost. A tipple for a drift mine could be built for $5,500. There is nothing patented about the structure, and two small steel tipples are now in use. One is at W. B. Rend's McDonald mine, and the other on the Panhandle, owned by the Black Coal Company. The coal will be weighed after it is dumped into the cars. At present it is weighed in the screening pans. The upper part of the new steel tipple is protected by corrugated steel plates, the window frames being of wood. Many new devices in handling the cars have been adopted to lighten labor. The piers supporting the building and all the frame-work will be of very heavy steel, so that the motion of the cars in transit will not weaken it by vibration. There are now about 1,000 wood-constructed tipples in Western Pennsylvania. When these are destroyed or worn out, steel structures will replace them entirely, adding another to the steadily multiplying directions in which steel-makers are finding business. Insurance rates are very high on wooden coal tipples, owing to the destruction of so many by fire. The premiums paid are for hazardous risks. These fires are usually of incendiary origin. The steel tipple will not need any insurance, as nothing but dynamite can destroy it.

A New Safety Explosive—Professor F. Kleinpeter draws attention to a new mining explosive which is said to be coming into vogue in Austria. It is known as Dahmenite A, and is said to be 33 per cent. stronger than the best gelatine dynamite, and in consequence of the large volume of gas which it produces (being approximately double that yielded by dynamite) it has a wedging rather than a pulverising action resulting in a materially increased fall of lump coal. It can be compressed without losing any of its explosive force, and in this state far surpasses every variety of dynamite. A much weaker detonator is required to bring it to explosion than any other known safety explosive, and it is better able to withstand the effects of storage. If properly packed no decomposition can take place. The last illustration of the safety with which Dahmenite A can be handled is the fact that the German Board of the State railways allows it to be carried in any trains, even in mixed passenger and goods trains. Extensive experiments are in progress in the several mining districts of the country, and when these have been completed no doubt we shall hear something further of the nature and properties of the new explosive.

Canadian Bar Iron.—The Hamilton *Spectator* says:—"The recent imposition of a higher duty on scrap iron, intended to encourage the development of the use of Canadian iron, is having its effect. The Ontario Rolling Mills Company has been putting in a puddling furnace with a capacity of four tons a day, and will puddle a special grade of iron from Three Rivers, said to be superior to the Norway iron—one of the best grades in the world. In case this new departure proves successful, it may have the effect of largely increasing the consumption of Canadian iron, and will tend to boom the smelting business." The pig iron to be used is "C.I.F." Three Rivers charcoal pig iron, an iron that at one time in the history of Canada was much prized for the manufacture of a special high quality of bar iron, equal in every respect to the best Swedish and Norway iron. The Ontario Rolling Mills Company have now made their full tests with splendid results, so that Canadian buyers will be able to get Canadian product in bar iron equal to anything made in the world.

Removal of Impurities from Iron during Casting—A novel apparatus has been devised by M. Riet to eliminate impurities from iron during the process of casting. In order to give the impurities time to separate from the melted iron before it runs in the mould, M. Riet sets on the top of the flask a sort of little bath tub, lined with some refractory substance, and presenting three cylindrical hollows of different sizes, communicating with each other by tangential channels. The iron is poured from the ladel into the large hollow, where it whirls around for a time and then escapes into the second basin, where it revolves in the opposite direction. From this it reaches the third compartment, which has a hole in the bottom, and, as this hole is set over the pouring hole in the flask, the iron then runs out into the mould. When the metal is poured into the large end of the tub, it is seen to whirl round until the surface is covered with the larger particles of impurity, which collect near the middle, the centrifugal force developed by the whirling serving to separate the purer and more liquid iron from the light and spongy scoriæ, very much as cream is separated from milk by a centrifugal churn, or molasses from sugar in the centrifugal tanks of a refinery. The operation is repeated in the next division, and, finally, the purified metal passes into the mould.

Compressed Air in Mines—At a colliery at Kleinvoigtoburg in Saxony a plant for compressed air is said to give excellent results, and as a few features in this installation are divergent and novel, it deserves more than a passing notice. At the surface there is a compressor of the type of an old model of the double acting wet compressor for compressing to 5 atmospheres or 75 pounds on the square inch. The air is now conveyed down the shaft into a main gallery where it is again compressed by a small single cylinder high pressure compressor and by this means the pressure is raised from 5 to 18 atmospheres.

Great advantages are claimed for the *high* pressure arrangement, as much smaller pipes are used for the transmission of the high pressed air into the workings.

The colliery is only a small one, and the steam engine working the surface compressor is only about 12 horse power, and the result is large pipes are not required. The main conducting pipe from the surface is only 3.14 inches in diameter, while the pipe for transmitting the high pressed air into the workings is only .98 of an inch in diameter.

The underground compressor is worked direct with an air engine and the work done by this plant is various and indicates a high useful effect; for example, at the surface, compressed air is used to actuate a stone-breaker, and in the mine the same supply of compressed air from a 12 horse power steam engine, works a windlass, the air drills and an air locomotive that does the whole of the haulage.

The cost for the tramway installation, including the conducting or transmission pipes from the neighborhood of the shafts, to the storage tank for replenishing the locomotive at the distant end of the main haulage tramway was only $1650.00.

Boiler Firing by the Waste Heat of Coke Ovens.—Sixty new coke ovens of the improved Coppee type have recently been put down at the No. 2 shaft at the Prosper Collieries at Essen, Germany, of the Arenberg Gessellschaft fur Bergbau- und Hüttenbetrich, while six tubular boilers of the Dürr type, each having a heating surface of 151·95 square metres, have also been laid down to utilize the waste heat from the coke ovens in steam-raising. The idea of utilizing this waste heat is not new at this colliery, as it had already eight Cornish boilers, each having a heating surface of 106 square metres, in operation, fired by the waste heat of a similar battery of coke ovens. The latter plant was experimentally supplemented by a Dürr tubular boiler, having a heating surface of 151·95 square metres, the results of which were so satisfactory that it was decided to put down six further boilers of this type. The arrangement of the boilers in connection with the coke ovens is in both cases identical. Several long tests were made as regards the evaporative capacity of the eight Cornish boilers, the average being 13¾ litres per hour and square metre of heating surface, the average initial temperature being 300 degs. Cent. The makers of the Dürr boilers furnished the same under the following guarantee:—That four Dürr boilers must be operated with steam of the same dryness as with the Cornish boilers, and to show an evaporation of from 18 to 20 litres per square metre per hour. The first evaporation test lasted ten hours fifty three minutes, and was so arranged that the coke ovens were then working under average conditions. The total water evaporated was 123,972¼ litres. This shows an evaporation of 18·738 litres per hour per square metre of heating surface. The average initial temperature was 275 degs. Cent. The second test was to ascertain the relative proportions of condensation water in the two batteries of boilers, the quantitative efficiency of the Dürr boilers being taken at 18·738 litres and that of the Cornish boilers at 13·75 litres per hour per square metre of heating surface. For this purpose large water separators were introduced in the main steam pipes near to the branches to the different boilers. As a result of a ten hours' test, it was found that the condensation water in the case of the Dürr boilers amounted to 732 litres, and in the Cornish boilers to 757 litres. It was further shown that, principally, insulated steam piping gave for 1 square metre of area ·554 litre of water condensation. The quantity of condensation water reckoned from the steam pipe area was:—

1. In the case of the Durr battery...... .... 263·38 litres.
2. In the case of the Cornish battery............. 291·112 "

There remained, therefore, water in the steam to the extent of—

In the Dürr boilers........... 732 — 263·38 = 468·62 litres.
In the Cornish boilers......... 757 — 291·112 = 465·888 "

The above figures give the following results:

1. In the case of the Durr boilers,—

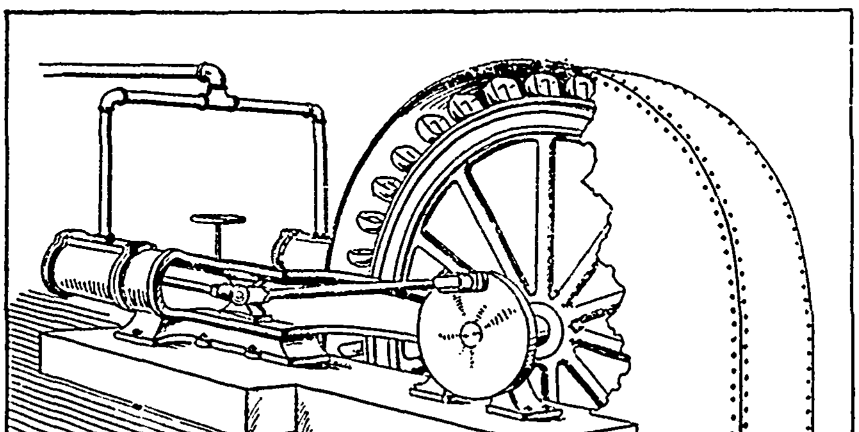
$$151·95 \times 4 \times 18·738 \times 10 = 113,889·564 \text{ litres,}$$

so that the steam humidity $= \frac{468·62}{1,138·89} = ·411$ per cent.

2. In the case of the Cornish boilers,—

$$106 \times 8 \times 13·75 \times 10 = 116,600 \text{ litres;}$$

steam humidity $= \frac{465·888}{1,166} = ·3995$ per cent.



A Special Water-Driven Air Compressor.

Our illustration shows a special design of air compressor, which is intended for the utilization of mountain streams and other water powers having a high or medium head. The compressor proper will be seen to be of the standard duplex type, the special feature being the method of driving, which consists of the well known Pelton water wheel mounted directly upon the crank shaft of the compressor. This method of driving is based upon the fact that the power of the Pelton wheel is dependent upon the size of its buckets and the diameter of the nozzle, and not upon the diameter of the wheel. It, therefore, becomes possible to adapt the wheel to the power to be developed, the speed of the compressor and the head of water under which it is to be placed, the number of revolutions of the wheel is determined by the compressor, whereas the peripheral speed of the buckets is determined by the head of water. It is hence only necessary to make the wheel of such a diameter that when running at the number of revolutions required by the compressor, the buckets shall have the peripheral speed required by the head of water. The spouting velocity of the water and the peripheral speed of the buckets increase much more slowly than the head, in fact, as the square root of the head, which fact enables the system to be adapted to an extremely wide range of head, with a comparatively small variation in the diameter of the wheel.

In point of fact the system is applicable for a range of heads between about 25 and 500 feet, the exact limit being in a measure determined by the size of machine contemplated. The machine from which the illustration was made, is at work under a head of 400 feet, which accounts for the large diameter of water wheel shown. Under lower heads, this diameter would of course, be less.

The advantages of this system are manifest at once. Its extreme simplicity renders it cheaper in first cost than any system of driving which involves transmission gear, and the absence of such transmission gearing means a further saving in transportation charges, which of course is a large item in mountainous regions. The water wheel acts also as a fly wheel, and thus the cost of transporting a fly wheel is avoided. There being no separate framework or foundation required for the wheel, the cost of transporting such framework and of building such foundation is also saved.

As shown in the illustration the wheel is covered with a casing made of sheet iron, but in points far removed from the place of manufacture, it is usually preferred to make this casing of boards on the ground, which method answers every purpose.

Where mule back transportation must be resorted to, the machine is made of the sectional form, in which no piece exceeds the weight of 300 lbs., and it is under these circumstances that the small total weight of a compressor constructed on this system, is most apparent, and leads to the largest saving.

The machine described is manufactured by the Canadian Rand Drill Co., of Sherbrooke, P.Q. A large number of machines of the type here shown have been built by this company and its American parent with whom this system of driving is original. In sending inquiries for machines to be built upon this system, our readers should bear in mind that the head of water must be known, in order to determine the cost of the wheel, as in each case the size of the wheel has to be adapted to the head. Attention to this suggestion will in all cases save delay.

All inquiries sent to the Canadian Rand Drill Co. receive the most prompt attention, and when purchases are made from points far removed from the base of supplies, they make it a special point to leave nothing undone which can in any way assist towards making a plant which shall give long continued service with unskilled attention.

Underground Haulage.*

By A. Gardiner.

The cost of underground haulage of coal, forms a principal item in the cost of production. Yet, how many mining engineers and colliery managers are keeping pace with the age, in seeking the assistance of the various mechanical methods of motive power, which will meet the requirements in the many and varying circumstances that are to be met with in the mine? We are naturally of a conservative character, and unless compelled by force of circumstances over which we have no control, we are inclined to take matters in as easy a manner as is possible.

One of these unsought-for causes has come on us, and is arousing us to a sense of duty: depression; and a large portion of our very limited population are unemployed. These and various other minor reasons have influenced me to raise this question of underground haulage, that it may be discussed with profit to our members and the colony.

Closely associated with the subject matter is the above-ground haulage from pit mouth to ship side. It is not my intention to show how the Commissioners should reduce the haulage charge of coal, as it opens too large a question to be dealt with in a paper of this kind; but rather endeavor to show indirectly that these charges are too high, notwithstanding the recent reductions made in them. With only two exceptions, all the collieries under eight miles from the dyke pay 10d. per ton f.o.b.; that rate has been in existence for some 15 years. On an average it is about 2d. per ton per mile; the trader supplies his own waggons. Where waggons are provided by the Commissioners an increased rate is charged. The minimum distance is too high; in fact, is much higher at present than it was in Scotland some 12 or 14 years ago. When we take into consideration the vast improvements made in the permanent way, more powerful locomotives now in use as compared with 12 years ago even in Great Britain, the cheaper and more economical method of working the traffic by the aid of the telegraph and telephone, it could be contended there are good grounds for some reduction in the present charge; but, as above stated, it is not the design of this paper, except indirectly, to show how these charges should be reduced.

It is proposed to investigate underground haulage, its improvements and reduction in cost, and to demonstrate advantages to be derived both from these improvements and those arising from recent inventions for economical working of the railways.

Having thus defined the duty we have undertaken, we may not only enquire into the present state of haulage underground, but review the progress of recent years, and note the methods by which economy has been affected; whereby we shall be assisted to make further progress on more economical lines.

Let us first take a view of perhaps the earliest system of underground transit and most certainly the rudest. This was the bearing system, which was in existence in places in Great Britain up to about 60 years ago, and by which the coal was removed from the working face in the mine so the surface. Boys, young women, and mothers carried the coal in baskets or creals, precisely in the same fashion that fishermen's wives in the east of Scotland carried their fish to market.

All the plant necessary for carrying the coal underground by this system was a basket capable of carrying from 1½ cwt. to 2 cwt., and a strap or broad belt of sufficient length to pass from one side of the basket to the other, and around the forehead of the bearer, when the basket was on the back; these were provided by the bearer. The cost by this mode of transit underground and up to the surface was from 2s. 10d. to 3s. 3d. per ton per mile. When it is stated that the conveyance of coal by this system 8,400 yards with a perpendicular height of 700 yards was a woman's work for 8d. per day, or 3s. 3d. per ton per mile, it will enable you to realize the difference of work in the mine to-day compared with the beginning of this century.†

The first step towards the improvement of this brutal system was the introduction of the SLEDGE SYSTEM.

The name sledge was given to a box with two runners under it, like a cradle, with a capacity varying from 1¼ cwt. to 5 cwt. These runners were sometimes shod with iron straps, according to the nature of the floor they were to be run on. The sledges were drawn along the natural floor of the mine by men, boys and women; where animal power could be applied it was done. When manual power was used, a set of harness was put on, which consisted of two straps of leather passing over the shoulders. the four ends being connected together by a chain attached to the sledge. The cost of sledging the coal entirely by manual labor, averaging it over both level and inclined roads, was 9s. 6d. per ton per mile; 2s. 6d. day's wage. The introduction of wooden rails, with in cases a strap of iron nailed to them, particularly on the level roads, removed much laborious and exhaustive work. Cost also was much reduced, being about 3s. 8¼d. per ton per mile, with the day's wage at 4s.

With the introduction of rails came wheel vehicles in several forms before the present skip was developed; wheel-barrows; a four-wheel tram or bogie to carry baskets on and save the inconvenience felt in the transfer of the coals from the barrow into the baskets or tubs in which the coal was taken up the shaft. These barrows and four-wheel trams, or bogies, were run on planks, generally three, the upper one forming a guide for the wheels.

The date of the first introduction of wooden rails and sleepers was about 1632. The certain account of cast iron rails being used experimentally was 1767. The earliest notice of malleable iron rails being used was in the beginning of this century, 1805.

The general introduction of rails into the mine did not, at first, very much modify the arrangements for collecting and conveying the coal from face to surface; it only developed the tram or bogie system, whereby the baskets filled at face were conveyed and sent up the shaft. To protect the coal in its transfer from the tram to tub, and its haulage to the surface, a system of conductors was devised which consisted in iron bars connected together with links or screws. Ultimately we arrive at the state when the wheeled vehicles were sent to the surface on cages or platforms with permanently fixed winding ropes on them, guided up the shafts by the conductors. These guiding conductors in the meantime also passed through several stages of improvement—iron bars; wooden (pitch pine); malleable iron bridge and web rails; and, lastly, specially made wire (steel) ropes.

With these latter improvements the modern skips came into existence. The capacity of the "hutches" of Scotland, or skips of our district, has been controlled by local circumstances and by the customs of districts. For this reason the writer will follow up that with which he is most conversant, as the result will be the same. Before legislative enactments came into existence compelling all coal to be weighted, the collier was paid for "per cart," which was recognized as 21 cwt. gross, containing 16 cwt. round coal and 5 cwt. slack or dross. This quantity was filled in three "hutches," each containing about 7 cwt. These "hutches" tared about 2½ cwt. each, and sold in the same manner. This being the case, the "hutches," *i.e.*, the skips, of Scotland, were as a rule tubs capable of carrying 7 cwt. to 8 cwt. of coal, gross about 10 cwt. The underground ways constructed to carry this weight were of angled cast-iron rails in about 4 ft. lengths, weighting about 50 lb. to 60 lb. per square yard, with sawn sleepers (pine) 2½ ft. x 5 in. x 2½ in. to 3 in. The cost per mile was about £220, including labor in laying. The general introduction of the malleable iron rail, though the cost per mile was about the same, involved the use of a lighter rail, and did away with the breakage trouble that was so common with the cast-iron rail.

With skips, as above described, in tare with a gross load of half ton where the inclination of the seam was almost horizontal, wheeling from face to flat was done by youths and men, and from the flat to bottom of shaft by horses; the average distance travelled per day was about 5,000 yards; and the cost per ton per mile 2s. to 3s. 2d. In mines with the strata inclined about 1 in 6, the distance travelled averaged about 4,200 yards per day, and the cost per ton per mile was 2s. 4d. to 4s. In mines where the load is upwards, or the roads were badly laid and of uneven gradients, the average daily distance travelled was 2,200 yards, the cost per ton per mile being 4s. to 7s. An instance from another district under somewhat changed conditions: With the seam inclined 1 in 12 to 14, and skips about the same tare and gross, the distance travelled on roads uphill was about 170 yards, and on level roads 230 yards, or 400 yards in all. Average cost per ton per mile, 1s. 3¾d. Another case: Roads uphill, 250 yards; distance travelled on the level, 380 yards; total, 630 yards. Average cost per ton per mile, 1s. 7d.

The owners of the famous gas-coal works in Lanarkshire, at the time when underground haulage was as above described, made an effort to make a reform in this item of cost. The position of affairs before the reform was instituted was as follows: - The average length of the level roads was 376 yards; the average length of the roads uphill was 120 yards. The greatest distance travelled by a wheeler per day, taking one fortnight's work, was 9 miles 91 yards, or a general average of 6 to 7 miles. this includes going in with empty and returning with full trucks. Average cost per ton per mile was 1s. 4d. to 2s 6d. when 4s. per day was paid to the wheeler, and 2s. to 3s. 8d. per ton per mile when 6s. per day was paid to the wheeler. The reform consisted in making the underground railway as follows:—The main roads were laid with malleable iron edge rails 2 in. x ¾ in. thick, notched into sleepers (intermediate) with cast iron chairs at the joints. In laying the rails the joining of opposite rails were never made on the same sleeper. On the roads uphill the iron bars were 2 in. x ⅝ in. thick. The cost of one mile of this railway was £300. The capacity of the skip was increased to 13 cwt. coal, its tare being 4½ cwt.; wheels 12 in. diameter, cast iron for edge rails. Horses were introduced to take the full load from flats to bottom; ponies to take empties into faces; manual labor only being used to run full skips from face to bottom of inclined roads. Manual labor, viz., running out full skips from face or bords to foot of rise roads and walking back to face, was paid for at the rate of 1·5d. or 16·6d. per ton per mile. For work done by ponies in taking empties into the faces and returning empty (the average distance travelled being about seven miles per day), the cost was 2·5d. per ton, or at the rate of 23d. per ton per mile. For work done by jig-brow or incline, full skips bringing up the empty ones, 1·6d. per ton, or 8·7d. per ton per mile was the cost. For main roads by horse travelling 12 to 14 miles per day ·8d. per ton, or at the rate of 2 6d. per ton per mile. The total cost per ton by horse labor was 6·4d. per ton, or at the rate of 1s. 1½d. per ton per mile. the average length of roads being about 836 yards.

The average cost by manual labor previous to the change was 9·6d. per ton, or at the rate of 2s. 10¼d. per ton per mile; but at that time the distance the coal was conveyed was considerably less, being only an average of 496 yards.

The writer has by him the actual cost of two pits in another district than that given in Scotland. At the first pit 49 men wheeled 400 yds. 2,912 tons, at a cost of £54 6s. 2d., or 12·64d. per ton per mile; and 34 men wheeled 800 yds. 2,022 tons, at a cost of £37 14s., or 9·84d. per ton per mile; thus giving an average cost of 11·24d. per ton per mile for the 4,934 tons, one month's work. At the second pit 45 men wheeled 300 yards 2,641 tons, at a cost of £36 16s. 6d., or 19·63d. per ton per mile; and 52 men wheeled 650 yds. 3,046 tons, at a cost of £42 9s. 5d., or 9·06d. per ton per mile; thus giving an average cost of 14·34d. per ton per mile. The cost of labor is based on the following prices, viz.: horse feed, 3s.; drivers, 3s.; hangers-on, 3s. 6d.; road men or deputy, 4s.; wheelers, 4s. per day.

The following is the cost of a colliery in Staffordshire, England, which may be taken as a fair example of the cost of haulage at the date under consideration (1861): —345 tons 12 cwt. wheeled 645 yards, *i.e.*, average distance, at a cost of £8 4s., or an average of 15·55d. per ton per mile. The prices paid for labor were as follows: Horses, 6s. 6d.; drivers, 2s.; roadmen, 4s; horse groom, 3s. 6d.; hangers-on, 3s. 6d., per day.

Thus we may sum up this section of our subject by stating that from experience we have particularly to note that improvements in the road, in the size of the skip, and in the motive power, have enabled a more economical cost of working to be arrived at. This has been evidenced from actual facts of cost. At each successive stage of advance an economy has been effected. And again, as progress was made in the motive power, another reduction was effected.

*Paper read before the Northern Engineering Institute of N.S.W. (Newcastle).

† These figures are on the authority of Messrs. Dunn, Government Inspector, and M. Ball, Mining Engineer, Alloa.

On the Estimation of Sulphur in Pyrites. *

By G. Lunge.

Under the above title, Mr. T. S. Gladding (The Journal, June, 1894), has published several modifications of the wet assay of pyrites which call for some comment on my part, since these modifications purport to be improvements on my method, contained in the "Alkali-makers' Handbook," and extensively employed in all countries.

Some of Gladding's modifications are of a less important character, and these can be passed in review very briefly. He does not, like myself, test the sample with its natural moisture, estimating the latter in a special sample, but he dries the whole sample and weighs it out in that state. He employs a whole gram of pyrites, I only half a gram; and I do so purposely, because the washing of the precipitates is much easier, and consequently the results are more reliable with the smaller than with the larger quantity. In lieu of the mixture of acids employed by me (three volumes of nitric acid of sp. gr. 1.42 and one volume of fuming hydrochloric acid), Gladding decomposes the pyrites with a solution of bromine and nitric acid. The prescription for that solution is not correct as printed, for seventy-five grams of potassium bromide cannot possibly be dissolved in fifty grams of cold water, or anything like that quantity, but this may be a clerical error, which does not matter very much, as ultimately the solution is diluted to 500 cc. I will say at once that the bromine solution works well, but no better than the acid mixture according to my prescription.

A more important modification is the following: It is well known that in the presence of iron the precipitate formed by barium chloride in a solution of sulphates

* Read at the Boston Meeting, December 28, 1894. Reprinted from the Journal of the American Chemical Society, Vol. XVII., No. 3. March, 1895.

cannot be freed from iron, and that the results of the estimation of sulphur in this case are too low; in my publication of 1879 (*Ztschr. anal. Chem.*, 19, 419) I found on the average 0.19 per cent. too little sulphur, unless the iron had been previously removed from the solution. Fresenius has also worked on this subject, and Jannasch and Richards, in 1889, completely elucidated it by proving that a double sulphate of barium and iron was formed in this case. Gladding gives a similar explanation, without mentioning the more complete investigations of his predecessors, which would have saved him the trouble of working out the matter for himself. I had already long ago dealt with that difficulty by proposing, in 1889, that method which was afterwards embodied in the "Alkali-makers Handbook," viz., precipitating the iron by ammonia, washing the ferric hydroxide, and precipitating the sulphate in the filtrate by barium chloride. Gladding asserts, however, that "the most careful washing failed to wash out all the sulphur from the ferric hydroxide," and he therefore proposes to wash the hydroxide as well as possible and to dissolve it afterwards in diluted hydrocloric acid, thereupon treating that solution with barium chloride; evidently with the tacit assumption that the small quantity of sulphide present in that solution is accurately enough estimated as barium sulphate, in spite of the large quantity of iron present; but that assumption is far from self-evident, nor does it actually represent the truth, as we shall see.

It is quite evident that Gladding, although he knows and quotes the "Alkali-makers' Handbook," and although he entirely adopts the prescription given there (page 93) for the *precipitation* of the ferric hyroxide, which deviates not unessentially from those previously given by Fresenius and others, has not completely followed the instructions for the *washing* of the precipitate given immediately after in the following words: "Filter hot, and wash on the filter with hot water, avoiding channels in the mass, but so that the whole precipitate is thoroughly *churned up* with the water each time." Many hundreds of pyrites tests made in my own and other laboratories have proved that by following the above instructions the washing of the ferric hydroxide is accomplished in from half an hour to an hour, that the number of washings need not exceed five, and the bulk of the liquid, apart from the original filtrate, need not exceed 100 to 150 cc., and *that no trace of sulphur is left in the ferric hydroxide*, as evidenced by drying the precipitate, fluxing it with pure soda, dissolving it in water, and testing the solution for sulphate. It is true that the students in my laboratory have sometimes failed to get out all the sulphur, but in *every* case through having washed in the usual way, instead of that described above; and the same men have succeeded in *every* case, after their attention had been drawn to this point.

There is another difference between Gladding's and my own manner of proceeding. I prescribe heating the solution of the sulphate to the boiling-point, as well as that of the barium chloride, adding the latter to the former all at once, allowing to stand for half an hour only, and then at once filtering and washing while the liquid is quite hot. I had convinced myself that under these circumstances the precipitate filters most easily and no barium sulphate whatever subsequently separates from the filtrate. Gladding, however, not merely adheres to the old and useless prescription of letting the liquid stand over night after the precipitation, but he adds to this a novel and most tedious way of effecting the precipitation, viz., adding fifty cc. of barium chloride solution quite slowly, one drop per minute. This will take about an hour, instead of a few seconds, as in my method.

I considered it my duty to find out whether the method recommended by Gladding is better than mine, or infertor to it, or equivalent with it; and in the last case, which of the two is easier and quicker to execute. For this purpose a sample of Spanish pyrites was selected which was triturated as usual and mixed in the most careful manner. The tests were made by one of my demonstrators, H. von Keler, under my constant personal supervision. First of all the sample was tested exactly according to the method laid down in the "Handbook," with the following results: 50.17; 50.42; 50.20; 50.23; 50.19; average, 50.24 per cent. The insoluble amounted to 1.42 per cent.; the moisture to 0.47 per cent. I abstain from reducing the percentages to the dry state, as being unnecessary in this case.

As the next step, a number of samples were decomposed by Gladding's mixture of bromine solution and nitric acid. We found his prescription in this item to be perfectly correct; it is not feasible to hasten the process (which is much lengthier than that used by myself), for instance, by filling the water-bath from the first with hot water. Any attempt to do such a thing ends in an over-violent reaction, and a loss by spurting and separation of free sulphur. We tested, of course, our bromine and potassium bromide, and found them quite free from sulphuric acid.

Three of the samples thus decomposed, according to Gladding, were precipitated exactly according to his method (one hour's precipitation, twelve hours' settling), another three samples according to mine (precipitating all at once and filtering after half an hour). The results were:

Gladding's Method.	Lunge's Method.
50.24	50.24
50.24	50.22
50.30	50.28
50.26	50.25

We see that both methods of precipitation give identical results, and these also entirely agree with the tests made from the first according to the "Handbook" method, viz., 50.24. The conclusions to be drawn therefrom are: 1. Since both methods of precipitation yield the same result, my expeditious method of precipitation and filtration, which, inclusive of washing, takes about an hour, is preferable to Gladding's method, requiring about twelve hours. 2. Since Gladding's bromine method for decomposing pyrites yields results identical with that prescribed by myself, there is no reason for abandoning the latter and adopting a more tedious method, unnecessarily employing such a disagreeable re-agent as bromine.

I understand from a private communication of Mr. Gladding's that he attributes the greatest value to his manner of precipitating the barium sulphate, and that in his opinion by operating in my way barium chloride is always carried down with the sulphate, making the results too high by 0.20 to 0.40 per cent. It would have been most remarkable if that point had been overlooked in the many thousands of tests made according to my methods by perhaps a hundred different chemists; but in order not to incur any reproach, I had this point put to another searching investigation. Mr. W. Jackson made five most careful tests of another sample of pyrites, decomposing and otherwise treating them absolutely in the same way, but making the precipitation in two cases by Gladding's, and in three cases by my method. The results were:

Lunge's Method.	Gladding's Method.
50.59 per cent.	50.60 per cent.
50.63 "	50.66 "
50.56 "	.... "
Average, 50.59 "	Average, 50.63 "

This affords another thorough refutation of Gladding's assertion.

In all analyses made up to this point the ferric hydroxide had been precipitated and washed five times, exactly in the way described by me; in every case it had been afterwards tested by fluxing with soda, but no trace of sulphur had ever been found. This furnished an additional (although unnecessary) proof that Gladding's assertion in that respect is equally unfounded, and that the treatment described by him (dissolving the ferric hydroxide in hydrochloric acid and precipitating by barium chloride) is quite useless, when observing the precautions in washing, pointed out by me. Still I thought it advisable to find out how Gladding's process would work in cases where, by some mistake, a little sulphur had been left in the hydroxide, and I grant that in important cases the latter ought to be tested in some way or another for any sulphur left behind. I further grant at once that in this case Gladding's method, as described, is more expeditious than mine: drying the ferric hydroxide, detaching it from the paper, mixing it with pure sodium carbonate, fluxing it in a platinum crucible (in such manner that no sulphur from the gas can get into the mass, *e.g.*, in a hole made in asbestos cardboard), dissolving in water and precipitating the sulphur by barium chloride. It is hardly necessary to say that I did not choose this plan without first considering the very simple method described by Mr. Gladding; but I rejected it, since Fresenius had proved that barium sulphate is very distinctly soluble in an acid solution of ferric chloride. But as Gladding now asserts that the direct solution of the ferric hydroxide in hydrochloric acid yields accurate results, it became incumbent on me to examine this statement.

Eight samples of our pyrites were decomposed, and the ferric hydroxide was precipitated under absolutely equal conditions of dilution, temperature and quantities of re-agents. The washing was purposely not continued as far as it ought to have been; and as some previous experiments had shown that no uniform degree of exhaustion can be attained by incomplete washing, we estimated in all cases the *total* sulphur, separating, of course, that which was found in the filtrate and that which was left with the ferric hydroxide. Four of the eight samples were treated by Gladding's prescription, and four by my own system. The results were:

Lunge (fluxing with sodium carbonate).			Gladding (dissolving in hydrochloric acid).		
Filtrate.	Precipitate.	Total.	Filtrate.	Precipitate.	Total.
49.64	0.60	50.24	48.98	1.03	50.01
49.36	1.01	50.37	48.84	1.39	50.23
49.07	1.21	50.28	49.02	1.07	50.19
49.25	1.04	50.29	49.30	0.73	50.03
Average,		50.29	Average,		50.09

This proves that Gladding's method does not, in this particular, give accurate, but *low* results (by 0.20 per cent.); with less complete washing the discrepancy would evidently have been even greater. The total sulphur found by my process, on the other hand, agrees quite satisfactorily with the correct analyses quoted before.

The final conclusion of this investigation must be: That in most points Gladding's method is correct, but in *not a single case* more so than my method; his modifications can not be approved, as they greatly lengthen the time required for the analysis, without any corresponding advantage whatever. In one point which forms the principal novelty in Gladding's process, he is decidedly *wrong*. It is not true that it is unavoidable to leave any sulphur in the ferric hydroxide; on the contrary, this is very easy to avoid. If it has, after all, happened by incorrcet manipulation, Gladding's plan will *not* get out all the sulphur, but my plan (fluxing with soda) must be adopted.

I have shown that there is not a single point recommended by Gladding, in deviation from my method, which is fit for adoption, and I must conscientiously advise my brother chemists to adhere to the method just as I have laid it down in the "Alkali-makers' Handbook."

In conclusion I would add that I have also tried the method recommended by F. Johnson (*Chem. News*, *1894*, 70, 212), omitting to precipitate the iron, but reducing it by sodium hypophosphite to the state of protochloride. Even when working precisely as described by the author, the results were so widely off the truth, that I can make nothing whatever of this plan.

Steel Structures for Collieries.*

By Harry J. Lewis.

The very material reductions which have taken place in the price of structural steel work during the two years just past place within easy reach of mine operators a type of outside equipment which has heretofore been considered a luxury. Some of the first experiments in the use of steel structures have not been entitrely satisfactory, because the purchasers did not place the matter in competent hands, and in consequence obtained in some cases a framework which was ill designed and entirely too light for the work it had to perform. In other cases they were loaded up with a lot of unnecessary material. The first case is by all means the poorest bargain of the two, as the apparatus never gives satisfaction from the very first day it is put in service, and its cost is very little less than that of a good one. It takes practically the same number of columns, beams, bracing, roof trusses, &c., for a light structure as for a heavy one, and a comparatively small amount of additional material enables the designer to obtain the benefit of much larger and much stiffer sections. It is an axiom among engineers that a structure which is too heavy in all its parts never gives any trouble except through a slightly increased interest charge on plant, and this is, therefore, not a serious fault if the extra material is kept within reasonable bounds.

The service strains developed in a head frame or tipple frame are of such a character as to render their exact determination difficult, arising as they do from a combination of static and dynamic loads. A good instance of this sort is where the throttle of a first motion hoisting engine is pulled wide open at the beginning of the lift, in which case the strain in the hoist rope while the load is being started is often more than twice the static weight of cage, tramcar and load. This strain must be transferred from the head sheave through the different members of the head frame to the foundation, and the designer who fails to take account of this extra load will not get a stiff structure.

Another thing which should not be neglected is that the horizontal component of the strain in the portion of the hoist rope leading from the head sheave to the winding drum varies from its maximum to almost nothing every time a load is hoisted rapidly and dropped upon the cage keeps at the top. This strain also alternates from side to side of the head frame with each lift, and sets up a combination of racking and twisting strains which must be taken into account if a stiff and durable structure is desired. In attempting to provide for these strains the author has found it advisable to do away altogether with adjustable rods in the bracing, and use stiff members throughout, with solid rivet connections. This avoids entirely the necessity of continually screwing up sleeve nuts or turn buckles, and any engineer who has had experience in the adjustment of bridges will hail with delight any device which will relieve him from the horrors which may be perpetrated with a monkey wrench in unskilled hands.

Some of the first steel head frames turned out badly because the arrangement of

* Paper read before the Ohio Mining Institute.

the supports for the head sheave bearings were copied from the older wooden type, in which the tops of the columns were subjected to transverse strains in addition to their legitimate work. In consequence of this the columns' heads deflected every time a lift was made, and threw the bearings out of level, thereby causing them to cut and give trouble generally. In endeavoring to correct this feature, the author has devised an entirely different arrangement of head sheave supports, in which each member has its own legitimate work to perform and is proportioned for the load transmitted as nearly as this can be determined.

A word as to the proper inclination of the hoist rope between the head sheave and winding drum may not be out of place, as in case the angle is too steep there is a considerable force acting to lift the winding engine vertically off its bed, and if too flat the racking tendency on the head frame is equally destructive. The best results appear to be obtained by using inclinations varying between 35° and 50° with the horizon.

In taking up the problem of strains in the tipple frame, the author finds that in this also the horizontal strains need to be provided against very carefully. These arise from suddenly stopping on the tipple horns a load of from 2 tons to 4 tons moving at a speed of 1 foot to 5 feet per second. Probably the best plan for handling this is to provide a heavy floor on the level of the dumps and firmly attached to them, the proportionately greater mass of which first receives the shock and lengthens the period of time of transference into the framework and thence to the foundations. In order to provide space for the passage of the trams under the tipple, the columns must be left unsupported in the direction of the greatest strain for a height of 8 to 10 feet from the bottom. They are therefore subjected to transverse strains, and must be proportioned accordingly. The author is free to admit that this is largely a matter of judgment, and the proper proportions can only be arrived at by experience. This difficulty can be obviated in some cases by attaching the tipple to the head frame, which latter should always possess a complete system of longitudinal bracing clear to the bottom. In some other cases a panel containing complete bracing can be placed in the rear of the span over the tracks, but for the most part this latter plan is more expensive than to enlarge the main columns and beams.

Simplicity of design both in main members and connections should always be aimed at in a tipple frame, so as to rend[illegible]asy any changes in screening apparatus which the varying demands of the trade may require. The tipple house should consist of a steel framework and covering throughout, no wood being allowed except in doors, windows, partitions, and floors. Wood should never be used in such a manner that the stability of the structure would be impaired by burning it away entirely. Absolutely fireproof construction is not an economical possibility at present, but the danger from fire can be greatly reduced by proper designing.

The roof and siding should be of heavy corrugated iron, rivetted fast by means of metal clips to steel purlins and side girts. It is the poorest sort of economy to use a lightweight sheet in the covering, and the author would recommend that nothing lighter should ever be used than No. 20 for siding and No. 18 for roofing. For structures intended to last in one place for 20 or 30 years heavier sheets than the above can be used to advantage, as the extra expense is mainly in the added weight of material.

Another thing which should be looked out for where possible is the introduction of a fire insulating space between tipple and head frame, tipple and shaft opening, or tipple and slope mouth. This space should be at least 10 feet or 15 feet wide, and across it no continuous line of inflammable material should be allowed to exist; not even those two streaks of oil which seem to follow wherever a mine rail is laid.

The use of screens, chutes, hoppers and pans made entirely of metal has become so nearly universal that it is hardly necessary to say anything in their favor. Some makers of this class of equipment have, in their efforts to cheapen it, used material which was altogether too light, and scattered their rivets so far apart that they were hardly on speaking terms with each other. This policy is certain to result in an equipment which is a rattletrap at first and a wreck before it has had a chance to get old. The dump plate at the head of the screen should be from $\frac{5}{16}$ inch to $\frac{3}{8}$ inch thick, so as not to be dented by the fall of the coal. All other bottom plates over which the main body of the coal runs should be from $\frac{1}{4}$ inch to $\frac{5}{16}$ inch thick. The sides of main screens and chutes may be from $\frac{1}{16}$ inch to $\frac{1}{8}$ inch thinner than the bottoms, as they do not receive the scour of the coal to the same extent. The bottom of the sides should be joined by angles with a thickness equal to the thickest plate, and with flanges wide enough to take $\frac{1}{2}$ inch or $\frac{5}{8}$ inch rivet driven hot. Where necessary, the top edges should be stiffened by similar angles. The pitch of rivets should not be ordinarily more than 6 inches and in very thin plates less than this. For the nut and slack chutes $\frac{3}{16}$ inch and $\frac{1}{4}$ inch plate may be used, as these handle only a small percentage of the coal, and are therefore less subject to wear.

There are but few cases where the engineer in charge of a new opening will find it difficult to provide plenty of height from dump to railroad tracks, and it is to be regretted that so many mistakes are made on this point. This height depends on the number and kind of separations that are to be made, and the screen plan should be carefully worked out before the general plan of opening is finally decided on. A failure to do this has often resulted in a fixed charge for elevating, &c., which in view of the narrow profits of mining should always be avoided where possible. For a modern apparatus making three separations, viz., lump, nut and slack, it is safe to assume that this height should never be less than 30 feet. Many of the older types having a height of 26 and 28 feet, and which were all right in their day, are now giving a great deal of trouble because their discharge chutes will hardly clear the tops of the new gondolas, and trimming the coal to a neat ridge is not to be thought of.

Great latitude is required of an apparatus which is to load neatly, and with minimum breakage, all cars which may come to it at the present time. A table of extremes in dimensions of cars is approximately as follows: Floor to rail, 3 feet 8 inches to 4 feet 3 inches; top to rail, 6 feet 6 inches to 8 feet 6 inches; extreme width, 9 feet 3 inches to 10 feet 6 inches; length over all, 20 feet to 36 feet. Sorting these cars so as to give an hour's run on a similar kind is not to be thought of, and the apparatus must pounce on high and low alike without so much as letting out a rod or taking up a chain.

It is not an easy matter to give an idea of the cost of metal as compared with wood, for the reason that when the purchaser has made up his mind to use metal he demands a better apparatus in every way than he could possibly get in wood. Taking this into account, the advance over the price of wood will probably average 50 per cent.

Among the advantages which a properly designed metal structure has over a wooden one are these: Comparative safety from fire. The bill for pumping alone in some mines while replacing a burned out tipple would more than pay the difference, to say nothing of other losses. Durability: a metal structure which is heavy enough for its work is much more durable, on account of its greater elasticity, which enables it to sustain shocks without permanent deformation. In consequence of the above a good metal concern should last 20 or 30 years, even if taken down and put up in different locations, while a wooden one which has seen six or seven years' service is not worth taking down, much less putting up again.

In conclusion, it may be said that as the tipple is the focus towards which all the other operations of the mine are directed, and through which all the product must pass, the progressive operator will see to it that it is of the best and most durable, both as to material and design.

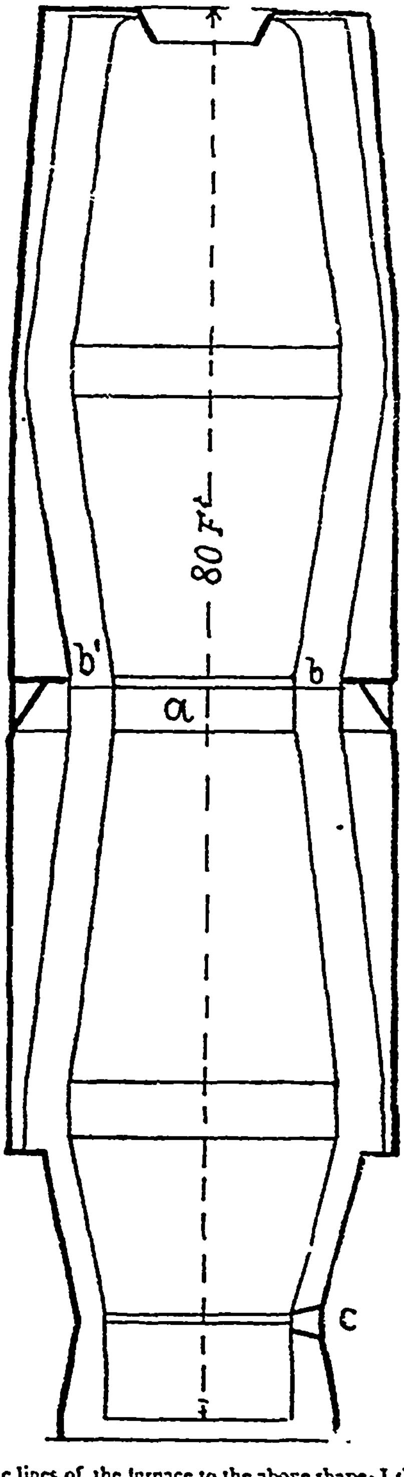
New Lines for Blast Furnaces.

J. W. Thomas, Catasauqua, Pa.

That which chiefly interests blast furnace managers during times of cheap iron is how to produce the largest output of merchantable pig iron with the least consumption of fuel. Any reasonable suggestion to this end is eagerly examined, and if found to contain merit, experimented with, and if successful, adopted. All suggestions offered, however, are not feasible, and many go no further than the suggestor.

I have a suggestion to offer to this end, which, I believe, has merit, and which, I think, will accomplish all that is claimed for it. The plan has been submitted to several successful furnace managers, and received their unqualified approval.

The departure I advocate would be new lines for the furnace, as per accompanying illustration, with the aid of superheated steam. In this illustration is represented an 80-foot furnace constructed on the lines I suggest, in which A is the neck, *b b*¹ steam inlets, and C the tuyere line.



By changing the lines of the furnace to the above shape, I think the consumption of fuel in the blast furnace will be reduced considerably. The main departure is the blowing of superheated steam into the furnace at the neck at *b b*¹, the amount to be regulated by the working of the furnace. The reduction of the ores will begin at this point and continue downward. The stock passing through a larger area of high temperature, and in a greater zone of reducing gases, under a high pressure, caused by the gases contracting at the neck, will enable the chemical reactions to take place under more favorable conditions.

The superheated steam, coming in contact with the heated stock, will form gases having higher reducing properties, and also furnish abundant gas for stoves, boilers, and other purposes. There will be an expansion of the gases after passing through the neck, causing combustion, which will prepare the ores more advantageously for the action of the gases in the lower zone.

Openings in the shell at the neck large enough to give easy access for the regulating of the superheated steam, etc., would be required. The neck can be protected by water plates of any desired pattern.

Underground Pumping in Westphalia.

A. Demmler, in the *Bulletin* de la Société Minérale, describes the underground pumping engine of the Hugo mine, Westphalia. The Hugo mine, near Buer, in Westphalia, which was opened by a Lyons company, and passed into German ownership in 1889, is one of the most prosperous of the Westphalian collieries, in spite of its great depth. It has two pits at work and a third in process of sinking. The oldest and deepest of these, No. 1, works the coal in the bottom of a basin at the depth of 644 yards, while No. 2 cuts the same seams on the northern rise at 517 yards, at a distance of 1,000 yards from No. 1, while the new pit, No. 3, is intended to reach the measures on the southern rise. The flow of water into the workings amounts to about two tons per minute, but this quantity is likely to increase considerably with the extension of the workings, particularly to the eastward, in which direction it has already been necessary to put in several dams pending the erection of new pumping machinery. As the surface arrangements did not admit of putting a second main rod in the principal pit, it was decided to use underground engines, forcing the water to the surface in a single lift. Owing to the loose character of the ground at the bottom of the mine, it has, however, been necessary to place the engines at a considerable distance, about 280 yards from the pit bottom, and about 25 ft. above it. The sump water is conveyed by a siphon, 235 yards long, to a lodge level at a depth of 652 yards from the surface, placed immediately below the engine room floor. The engine, of the horizontal compound type has two cylinders of 700 and 1,150 mm. diameter, and 1,200 mm. stroke, their relative capacities being as 1 to 2.75. The forward end of the piston rods are coupled at right angles upon the same flywheel; the back end of the high pressure engine works two plunger pumps by a three armed lever, which raises the water from the bottom level to the feed cistern of the plunger pumps, a height of 45 feet. The steam from the low pressure cylinder and the jackets is condensed by the water lifted by these pumps, which, therefore, also do duty as air pumps for the condenser. The temperature of the water in the sump is 22 degs. Cent., which is raised to 35 degs. after passing the condenser, and to 40 degs. in the feed cistern of the plunger pump. As the quantity lifted, 3·8 tons per minute, is in excess of that forced to the surface in the same time, 2·4 tons, the difference, 1·4 tons, returns to the sump by an overflow pipe. This arrangement is necessary on account of the large quantity of water required by the condenser, the vacuum obtained being nearly absolute.

The force pump attached to the low pressure cylinder is double acting, on Girard's system, having two single acting plungers on the same rod, their diameter being 192 mm. and that of the rod 100 mm. The pump barrels are of cast steel and the plungers and their rods of delta metal. The valves on Fernies' patent have four annular passages formed of conical bronze rings, the valve plates being built up of a lower conical ring in bronze, and an upper cylindrical one in iron with a well tanned leather disc between them, which is slightly cupped so as to close the passage when the return pressures are applied. Air vessels are applied over each valve box, in addition to a large one which is placed at the bottom of the rising main. This is made of sheet iron, and is 28 in. internal diameter and 12 ft. high, and is supplied with air from a special air compressor. The rising main of 9¼ in. inside diameter has a total length of 1,027 yards, with a vertical rise of 641 yards, the difference representing the length of the drift between the engine room and the shaft. The steam pipe, of about 1,100 yards total length between the boilers and the engines, is of 9½ in. diameter, and is carried down the pit and along the connecting gallery side by side with the rising main, provision being made for expansion by sliding joints in delta metal in the pit, and curved copper pipes on the level. The pipes are in 13 ft. lengths, united by flanges with packing rings of india rubber in the joints, the asbestos packing originally used having been found to harden and crack when exposed to the steam heat for any length of time. The non-conducting covering is formed by a layer of infusorial earth ¾ in. thick, covered by 1⅜ in. of paper pulp; next follows a cover of jute canvas lapped with galvanised iron wire, with a double coating of sheet iron and lead, painted with asbestos paint outside. Drain cocks are placed on the steam pipe at four different points between the boilers and the engines, three of them being automatic with floats, while the last discharges into the cistern of the force pump. The amount of condensation has been determined by experiment to be 0.914 litre per square metere (0·0187 gallon per square foot), of the external surface of the pipe.

In designing the works provision was made for two similar engines to be placed in separate rooms, but having their steam and discharge pipes in common, but at first only one engine was ordered. About fifteen months were required from the first breaking of the ground until the first engine was set to work. The results obtained from trials continued for three months and a-half showed that the work developed in the engine was 348½-horse power, and that of the pumps 287.55-horse power, or a useful effect of 82½ per cent. The actual discharge of the pump is 98·7 per cent. of the theoretical quantity. The consumption of steam under these conditions is 3,531 kilogs. per hour, of which amount 790 kilogs. was condensed and removed by the drain cocks, which reduces the actual amount doing work in the engines. It appears, therefore, that in spite of the great care taken in protecting the steam pipe by non-conducting coverings, the loss by condensation is very considerable, being 22·4 per cent. of the whole steam supply. This, however, is likely to be considerably reduced when the second engine is set to work.

The cost of the two engines and the necessary underground works is given as follows:—

	£	s.	d.
Cost of engines, rising mains and steam pipes. ...	12,000	0	0
Buildings and preparatory works underground.. ...	5,779	15	0
Total ...	17,779	15	0

Each engine when making 40 revolutions per minute lifts 960 tons of water in the shift of eight hours, at a total cost—

	£	s.	d.
For steam...	1	14	0
Wages...	0	6	8
Lubrication ...	0	3	3
Lighting and current repairs...	0	7	1
Total...	2	11	0

for 960 tons of water lifted 1,968 ft.—*Foreign Abstracts of the Institution of Civil Engineers.*

A New Diamond Drill.—There has been patented by Theodor Lange a method of setting diamonds in the crown of a drill, which, according to the *Chemiker und techniker Zeitung*, has shown itself to be remarkably durable. The crown was employed in a coal mine for boring a hole 377 feet deep, and remained at the end in a condition which would permit of further use. The diamonds were firm in their setting and the crown had done equal work around its periphery. The diamond drills arranged according to former methods have, as a rule, lasted only a short time, and it follows that this fastening for the Brazils is at least fully as good as others. It has also the advantage of superior cheapness.

Electric Coal-Cutting at Glenclelland Colliery.*

By George A. Mitchell.

The writer resolved a few years ago to make the experiment of applying electricity to the working of coal-cutting machines at Glenclelland colliery. This resolution was taken after careful examination by the writer and Mr. Thomas Dewar, manager of the colliery, of the different compressed-air machines working in Scotland, and with some hesitation, on account of the fact that for coal-cutting, electricity, so far, at least as generally known, had never been successfully employed in this country. There was only one previous attempt for such an application of electrity made in Scotland—that by the late Mr. Durie at Elphingstone colliery. The machine was not successful, but its non-success was possibly due to the unsuitable nature of the seam to which it was applied. Some machines had been introduced in England, such as the Goden bar-cutter machine, but, as far as could be ascertained, they were still in the experimental stage, and little information could be obtained concerning them.

There seemed no good reason, however, why the application of electricity to coal-cutting should not be as successful as its applications to haulage and pumping, for which purposes its use was rapidly extending, and the advantages of electrity over compressed-air for the transmission of the power required, if successfully applied, seemed undoubted.

As the experiment seemed worth making, after corresponding on the subject with various electrical firms, an arrangement was made with Messrs. Ernest Scott & Mountain, of Newcastle, to make a machine to the writer's instructions. They agreed to share the risk attached to the experiment, and in the construction of the machinery they spared no trouble to make everything as it should be.

The plant has been in operation for about nine months.

The writer thinks that it will be of interest to the members, in describing the machinery, to give at the same time some notes regarding the various points considered in its construction, and also some of the results of the experience in its working.

On the Surface.—The dynamo is of the improved type known as the Tyne dynamo, it is shunt-wound and constructed to give an output of 166 ampères at an electro-motive force of 300 volts, when running at a speed of 750 revolutions per minute. It is complete with sliding bed-plate, tightening screws, brackets, etc. This dynamo is to be converted into a compound-wound machine, as this is considered more suitable for the permanent arrangement.

What is necessary in an installation of this kind, where there is considerable variation in the power required, is to have the electro-motive force as nearly as possible constant for the same speed of engine, and independent of the amount of current required. This result is attained fairly well by the use of a shunt-wound dynamo when it is working well within its capacity, but when it is overloaded the electro-motive force rapidly falls, and, if the load be maintained, there is a possibility of the current falling to zero. A compound-wound dynamo may be so made that the electro-motive force is practically constant within the limits of certain current-variations. These variations for different dynamos are shown by their characteristic curves, which are to the dynamo what the indicator-diagram is to the steam engine. A description of these curves may be found in text-books on the subject.

The engine which drives the dynamo is horizontal, with a cylinder 18 inches in diameter and 3½ feet stroke, with scroll expansion-valve, and ball-governor, and works at about 50 revolutions per minute. The steam-pressure at the boilers is 45 pounds per square inch. The engine drives from a turned fly-wheel 11 feet in diameter, and there is a counter-shaft with pulleys to bring the speed of the dynamo up to 750 revolutions per minute. The engine is connected to a counter which indicates the number of revolutions worked for each shift.

The switch-board, besides switches, has a voltmeter and an ampèremeter, and there is also in circuit a recording ampèremeter or ampèreograph, which indicates the variation of the current during each cut.

Cables.—There is at present in use a temporary cable of 19 18 wires, insulated with vulcanized indiarubber and braided, carried down the shaft and along the underground workings, on insulators, to the coal-face, a distance of about 2,200 feet.

The permanent cables, which are yet to be put in position, are (*a*) for the shaft 37 15 cable covered as follows: (1) one coat of pure Para indiarubber, (2) two coats of vulcanizing india rubber, (3) one coat of vulcanizing tape, (4) the whole vulcanized together, (5) braided hemp, (6) armour of galvanized iron wires, and (7) braid and preservative compound. The insulation-resistance is 1,000 megohms per mile, and the cable is of sufficient size to carry without excessive loss the whole current which the dynamo is capable of producing. This cable will be attached at the bottom of the shaft by means of water-tight switches to (*b*) the smaller cables, which will each be large enough to carry the current required for one coal-cutter. These cables have each 7 wires, No. 15 wire gauge, insulated with vulcanized indiarubber (the insulation-resistance being not less than 600 meghoms per statute mile, then armored with one covering of galvanized iron wires, and braided and compounded over all. These cables will be carried on insulators. The size is sufficient to carry 30 ampères without undue loss. (*c*) Flexible concentric cable, insulated with vulcanized indiarubber, and spirally armored outside, will be used at the coal-face.

Coal-cutter.—The first machine supplied, which, as stated, has been working about nine months, had certain slight defects, which are being rectified in the second machine which is not delivered yet (Figs. 1 and 2, Plate VI.) This machine is 7¾ feet in length, 40 inches in breadth, and 23 inches in height. The frame is made of steel, and the total weight is about 32¾ cwts., which is considerably lighter than the first machine which has been in operation. There is a strong sheet-iron covering over the motor, and there are also bands over the toothed wheels to prevent breakage by falls from roof. The motor is series-wound, which seems to be as good as any form for the purpose. The only disadvantage in this form of motor is that the speed becomes rather high where there is no load, the revolutions increasing, as tested, to 1,300 per minute. A shunt-wound motor would give a more constant speed, but it has not the same power for starting, although there are devices for overcoming this difficulty.

The speed for which the motor is designed is 600 to 700 revolutions per minute, and it gives 12 effective brake horse-power, although it will work up to a greater power if necessary.

The cutter (Fig. 2) is of the disc type, and is intended to combine the advantages of two well-known machines, which are worked in Scotland by compressed air—the Rigg and Meiklejohn, and the Gillott and Copley machines. These machines differ from each other in several important particulars. The Rigg machine has a disc which works on the level of the pavement at the comparatively high speed of 60 or 70 or more revolutions per minute, and which has generally only about six cutters in the circumference. The picks enter the cut in the front and turn towards the back of the cut. The Gillott machine has a disc which cuts above the rail-level; the disc works at the slow speed of about 15 revolutions per minute, and it has about 20 cutters in the circumference. The disc turns from the back of the cut to the front, the aim

* Proceedings Mining Institute of Scotland.

Fig. 1.

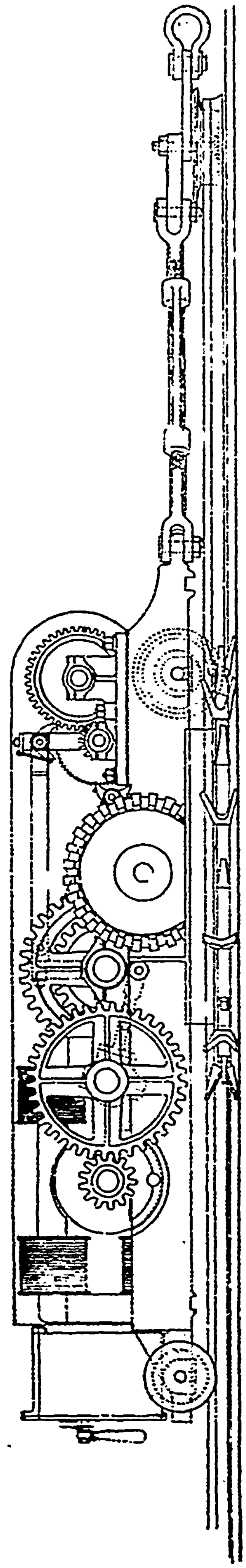
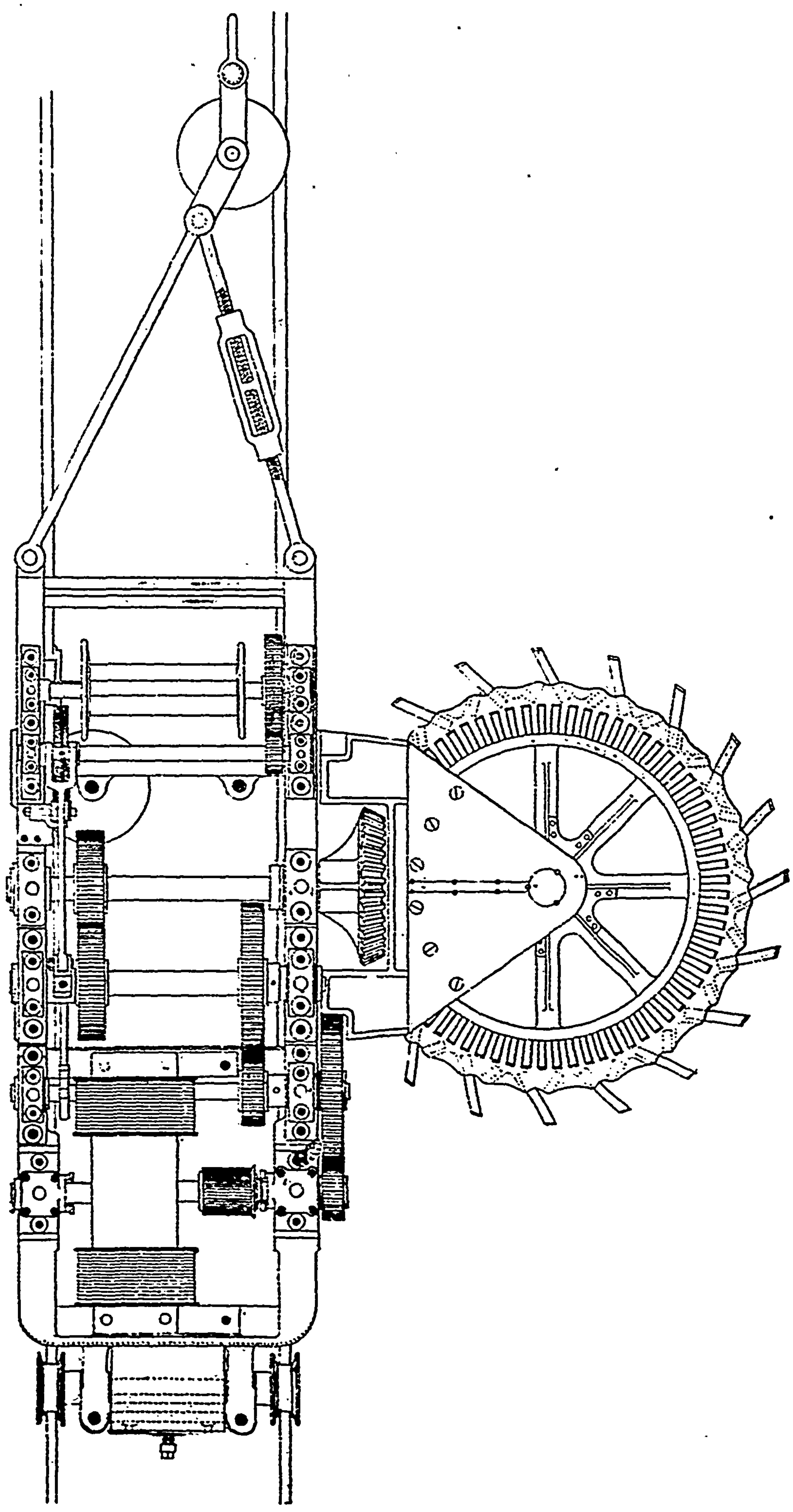


Fig. 2.



apparently being to draw the machine into the coal-face rather than thrust it out from it. In working this machine is slightly tilted up by raising the sleepers at the outside, and the disc slopes from a few inches above the pavement in front of the cut to the pavement at the back. The disadvantage of this arrangement is that if the pavement below the holing be hard, the picks are apt to be blunted by striking against it at the back of the cut, and if there be a coal holing there is some waste of coal in the front, or if there be a fireclay holing there is the necessity of cleaning the fireclay from the coal at the back of the cut. The advantage is that the disc clears itself better of the cuttings than in the Rigg machine, as there is no obstruction to prevent these from going between the rails. The width of the machine can also be made rather less, as in the Rigg machine some extra width is required to allow room for the extra projection of the bevel-wheel, which gears into the rack on the disc. The question of the width is one of very great importance where the tendency of the roof is to be soft.

The general effect of the higher speed of the Rigg machine seems, in practice, to be to make it more suitable for a coal-holing, and the Gillott cutter, on the other hand, is generally more successful where the holing is fireclay or daugh. The direction of the motion of the disc seems to matter little in practice.

The holing of the virtuewell coal-seam at Glenclelland colliery, for which the cutter was designed, is daugh and fireclay, varying in thickness, but generally easily cut. As thought most suitable for this holing, the disc of the machine was designed to run at a comparatively slow speed—about 25 revolutions per minute—and there are 20 picks on the circumference, fixed somewhat similarly to those in the Gillott machine. The disc, on the other hand, is supported in its place similarly to the Rigg machine, and cuts level with the pavement. The cut is 3 feet in depth and about 3½ inches in height. It will be seen from Figs. 1 and 2, Plate VI., that the speed of the motor is reduced by gearing, there being in all four shafts, including the armature-shaft of the motor. The disc is turned by means of a bevel-wheel, which gears into a rack on the disc inside the circumference.

For oiling the bearing of the disc, there is a large cup in the cast-iron bracket supporting the disc; this cup is covered by a sheet-iron lid (which is screwed on), and is filled once in each shift with waste soaked in oil. The brass under the bracket near the frame, which keeps the disc horizontal, cannot in practice be lubricated at all.

The machine is drawn forward by means of a flexible wire rope, which passes round a drum in the framework of the machine, round a pulley fixed to a prop some distance in front, and back to the machine, where it is fixed to the frame. The drum is turned by means of an eccentric on one of the shafts, which gives a reciprocating motion to a pawl; this catches the teeth of a ratchet wheel, keyed on a shaft which is geared to the shaft whereon the drum is fixed. By means of a slot, the feed may be varied, the pawl taking one to three teeth for each motion as desired.

On the first machine, there was a friction-arrangement in connection with the drum, so that it might slip with any extra strain, but there was considerable trouble with slipping when slipping was not wanted, and the arrangement was abandoned.

The switch for reversing the motor has two sets of resistances and three steps, so that the current may be gradually turned off or on. There is also a small auxiliary rapid cut-off switch, which has been found convenient for use throughout the shift, and which is cheap and easily repaired.

Working of the Cutter.—Four men are required to work the machine. One man attends to the swith, etc., and sees that the disc is cutting rightly; he also hands the rails and sleepers over the machine, and puts up gibs along with another man who also shovels out the cuttings. The other two men lay the rails and put up timber.

A great part of the work consists in handling the rails, and on the expedition with which this is done greatly depends the length of wall that can be cut.

The machine has regularly cut 420 feet in length, 3 feet deep, in a shift of 10 hours. When cutting in the ordinary holing it easily cuts 3 feet in 1½ minutes, and can do so continuously when it is kept in rails. From the diagrams of the ampèreograph it can be seen that there are considerable stoppages. This instrument was not put into circuit until the length of wall was reduced, owing to a number of places being marched, but the following are examples of what is shown for a cut of 210 feet:

	7th March.		9th March.
Machine working.	10 minutes	..	25 minutes
" standing.	15 "	..	10 "
" working.	10 "	..	33 "
" standing.	18 "	..	15 "
" working..	15 "	..	20 "
" standing..	3 "	..	5 "
" working.	20 "	..	30 "
" standing..	10 "	..	5 "
" working.	40 "	..	13 "
" standing..	10 "	..	40 "
" working..	30 "	..	70 "
" standing..	25 "	..	8 "
" working..	45 "	..	5 "
" standing..	10 "		
" working.	20 "	Total	279 "
Total.	281 "		

Sixty to seventy minutes at a time is about the longest interval during which the machine has been shown by the ampèreograph to have been in continuous operation. Owing to the sensitiveness of the ampèreograph, there is too much vibration in the movement of the pen for the markings to be reproduced satisfactorily.

The experience in working the machine has called attention to certain practical points, some of which may be noted here:—

As has been stated, the weight of the second coal-cutter is about 32 cwts., and of the one which has been working somewhat more, considerably heavier in both cases than any of the machines worked by compressed-air. The extra weight is an advantage in giving steadiness while the cut is being made. There is less vibration than with compressed-air machines, partly on account of this extra weight, and partly because there is no reciprocating motion.

The extra weight, on the other hand, has several disadvantages. Heavier rails are required, which require more labor for shifting and laying. When anything goes wrong, the machine is awkward to handle, and there is additional expense in shifting into the new cut at the beginning of each shift. The first machine supplied takes about one to one and a half hours of three men to bring it forward to its new position, and this adds something like one-ninth to the cost of cutting each wall. There is an arrangement in the new machine, however, which it is expected will save much of this time. It will be seen from Fig. 1 that there are notches in each end of the frame, for the insertion of rails on which the machine should be easily moved. As these rails must be clear of the picks on the disc, and sufficiently far from the cross-bars on the ends of the frame to leave room for a lifting screw to work, the framework is, of necessity, made rather longer than otherwise necessary. This is some disadvantage.

Some difficulty was found at first, when the disc got jammed in the cut, in getting the machine clear. In such circumstances, the pawl being caught firmly in the ratchet-wheel, any motion of the motor increased the difficulty, and the motor could not be reversed without some loss of time. In order to get over this, there is a swivel with screw-attachment for the pulley, round which the drawing-rope turns. By turning this swivel and ew the rope may be slackened, to enable the machine to be moved a few inches out of the cut and the disc to be relieved.

To keep the rails firmly in position, and to resist the extra strains which at times tend to thrust the machine from the face, every second or third sleeper has projecting from the end farthest from the face, a piece of iron turned into a horse-shoe shape, into which a prop may be inserted, and fixed firmly between the roof and the pavement.

The wall at first in operation was at an inclination of about 1 in 8, and in coming down the machine required to be held back. At first this was done by means of a wire rope and drum, but it was found better to use a goose-arrangement to run on the rails in place of the ordinary wheels. This goose is made of malleable iron, and is all in one piece, the two ends being joined together by a bar which has two holes, into which are slipped two pins, which pass through holes at the end of the framework of the machine. The arrangement works satisfactorily.

Tests.—The writer regrets that the tests which he is able to submit are not so satisfactory as could be wished. When the testing instruments were available, the length of the wall was only about 210 feet, and on the occasion when the tests were made, the butterfly valve, working in connection with the governor of the engine, was out of order. Every care was taken to keep the voltage as steady as possible, by carefully watching the voltmeter and regulating the speed by hand, but errors may have crept in where simultaneous readings were necessary above and below ground. The figures are, however, given as recorded, and further tests may be made before the next meeting.

TABLE I.—EXPERIMENTS.

—	Revolutions per Minute.	Indicated Horse-power.	Volts.	Ampères.	Electric Horse-power.
Engine running light............	50	4·1	—	—	—
Engine with dynamo and switches	50	10·5	—	—	—
Engine with full load..... . .	50	14·2	—	—	—
Dynamo	750	—	300	—	—
Motor and cutter	800	—	275	15	5·5
Loss in cables...................	—	—	25	—	0·5
Loss in shunt of dynamo.........	—	—	—	2	0·8
Loss in leakage	—	—	—	5	2·0

It is readily seen from Table I. that the plant is not working to full advantage. The engine is large enough for five or six times the work that is being done, the dynamo shows a greater percentage of loss than would be the case if it were working with a heavier load, and the efficiency would be very much greater if there were more cutters at work. The resistance of the shunt of the dynamo is 180 ohms, and the current that is passing through it is about 2 ampères. This is in addition to the amount of current shown by the ampèremeter. There appears to be a leak somewhere of about 5 ampères (from the indications of the ampèreograph), and it is probably due to the cables in the shaft being only temporary and not sufficiently insulated. The motor is not using nearly as much power as was expected.

Results of Working.—In connection with an installation of this kind, probably the first question that will be asked is, what is the advantage of the use of machinery in place of hand labor? The writer regrets that he is unable to give a very decided answer. The machine has hitherto not been working to the best advantage for various reasons.

The section of the virtuewell coal-seam at Glenclelland colliery, taken from one of the machine walls, is as follows:—

	Ft.	Ins.	Ft.	Ins.
Roof—				
Roughband ironstone........................			0	8
Fakey blaes........................			1	6
Brushing—				
Fakes..			3	6
Working—				
Black shaley blaes.....................	0	5		
Good gas shale	0	4		
Shale and blaes....	0	9		
Virtuewell coal	2	6		
Daugh holing............................	0	3		
			4	3
Hard pavement—				

The coal itself has a bad parting from the roof, and it has been found best to take the working to the height shown, the 14 inches of shaley blaes being turned over into the stowing, after the 4 inches of good shale has been picked out to be sent to the surface. The coal has to be blasted.

Owing to the extra thickness of brushing at this portion of the field, the walls were driven 60 feet in length, instead of 45 feet as usual in other parts of the seam, to save expense. It was thought that two men might be able to fill the coal from 60 feet, but this was found on trial to be too large a quantity, and in consequence it was found practically impossible for the machine to work every shift. More than two men could not work at each wall, owing to the large turnover of rubbish. This irregularity added to the expense of working. One reason why the filling was more difficult to manage than anticipated was that the blaes fell over in large pieces, which were difficult to handle. When the coal is worked by hand the holing is not so deep, and the pieces of blaes are smaller and more easily dealt with.

It is expected when the machine is in full operation in the new wall, which is in a direction at right angles to the old one and level, that less blasting will be required to bring down the coal, and that the cost of filling will be considerably reduced.

Meantime the comparison between the cost of working by hand and by machine may be taken as follows:—

	Per Ton. s.	d.
Cutting and filling by hand .... 1s. 8d. to	1	10
Cutting by machine, including cutting-out at each end of the wail..........	0	3·5
Filling, which has varied from 1s. 1d. to 1s. 3d. per ton..	1	3·0
Fuel (estimated)............	0	0·5
Upkeep and attendance on surface, sharpening picks, etc..	0	1·5
Interest and depreciation	0	1·5
Total..................	1	10

This statement shows no saving, but there are other points which must be considered besides the actual cost per ton at the face. There is less dross and larger coal produced from the machine walls. There is a much larger output from the same faces, and therefore a less cost of upkeep for roads. There being a greater concentration of output, the haulage can be more economically managed. On the other hand, the wall advances so quickly that the driving of slope-roads will be more costly than in ordinary circumstances, as they must be made more expeditiously than is usually the case.

Various savings can be made in the items named when there are more cutters at work, and the writer anticipates that while there may not be a great saving over hand-labor at Glenclelland colliery, yet there will be some clear advantage in the use of machines. It seems to be very much, as often stated, that the use of machines is only advantageous if the circumstances are favorable, and that there is no great saving in ordinary cases when wages are low. The essentials are a clean field and a strong roof, and the harder the holing the greater will be the saving. As regards the use of electricity instead of compressed-air, there seems little doubt that the former method of transmitting power must supersede the latter, except possibly where there is fire-damp present, or where the workings are wet. There is some danger from the sparking of the brushes in an explosive mixture, though this difficulty will no doubt be got rid of in the future. Meantime caution must be exercised. With water falling it might be difficult to keep the resistance of the armature right, and any colliery owners who have wet workings should consider this defect before adopting electricity.

The only advantages of electricity that need be named here are the greater efficiency, the convenience of erecting wires instead of laying heavy pipes, and the facility with which the results of cutting may be observed. There is also the feature that the power given out by the dynamo is in proportion to the power required at the motor, and may rise, temporarily, without damage, much above the average, when for any reason extra power is required.

From experience of the machinery, breakdowns are no more likely to occur with electric than with compressed-air machines, and the parts that require renewal and repair are the parts which are the same in machines driven by either power.

There is very little difference in the first cost between plants worked by compressed air and by electricity. The cost of upkeep should be much the same. For very thin seams lighter machines should be made. This can be done by giving the motor a higher speed, and by working with less power. It is by no means clear that a lighter machine cutting more slowly will not cut nearly as much as the heavier machine, as it might be possible to keep it cutting more regularly with fewer stoppages. An important point about all machines is the regularity of feed, jerks should be avoided, and the aim should be to keep the cutter travelling forward as steadily as possible.

Modified System of Longwall Working.

At the last meeting of the North Staffordshire (England) Institute of Mining and Mechanical Engineers, held on April 8, Mr. John Heath read a paper in which was described a modified form of longwall workings as applied to thin seams of moderate inclination. He observed that the system of working to be described, though perhaps not new, had so far not been previously applied in that district. In a district like North Staffordshire the economical working of thin seams must always be one of the difficulties that confront a colliery manager, and a description of any method that tended to reduce the cost of getting coal would be valuable. In a thin seam the dead work was always necessarily costly, and it was by seeking to reduce the amount of ripping that attention was directed to what he might call the "Spunney system." As an example of practical feasibility he might cite the two foot coal seam at Sneyd colliery. In this seam, with an average thickness of 2 feet 1 inch, there was room to pack all the dirt from roads 6 feet by 10 feet used for levels, 5 feet by 7 feet used for spunneys, and from the main jigs where the ripping was 3½ feet thick. The hard ripping dirt was used for building the walls at the sides of the roads, no stone whatever being sent to bank. Where the coal seam had thinned down to 12 inches they were able to work it, although, of course, in an extreme case like this, the working cost almost prohibited its competing against coal produced from seams varying from 3 feet to 8 feet in thickness. The main object of the system was to enable the coal to be loaded into the waggon without taking it along the face, and to accomplish this object the jigs or spunneys were placed at a distance of only 42 feet apart from centre to centre. The loader reached the coal as far as possible, and in the remaining 5 or 10 feet the coal was turned back by the coal getter, as was the usual custom in other methods of working. The waggon was not unhooked from the chain, the front wheels being simply dropped over the end of the rails and the two brake wheels screwed up. In the case of the two-feet coal seam it was thus possible to load a waggon standing 33 inches high on the rails, and holding 10 to 12 cwts. of coal, at the face of a seam measuring only from 23 inches to 25 inches in thickness. The spunneys were arranged in pairs, with a single line of rails in each, the empty waggon travelling first in one and then the other of the pair, the chain passing along the face between the road ends. They were driven in this form for a distance of 240 feet, then a top level was formed, and one of the spunneys used as a standing jig. These jigs were laid with a single road at the top and bottom, so that the spunneys need not be made of extra width except at the pass-by. One stand jig would, as a general rule, serve for five or six pairs of spunneys, the tubs being jigged in runs of two or three, as the several lengths of stand jigs were connected up. In breasting out the levels, a solid pack of at least 36 feet wide was placed on the deep side, and one of 30 feet wide on the head side. Pack walls were built at right angles to the level at intervals of five feet, and the loose dirt between rammed solid up to the roof. When the pinnings were built diagonally, as was often the case when the d... side of the breasting was pushed in advance of the head side and the pack walls formed an acute angle with the level, they were found to push out much more readily than when square up. Chocks were built in at the head-side at the corners of each spunney, and on the deep-side midway between the two spunneys, so as to come alternately on either side of the road. More stress has been laid upon the question of packing than would perhaps be thought necessary, but proper packing, in the first instance, was of the utmost importance, and could not be emphasized too strongly, for not only was it essential in keeping a good level, but it prevented air leaking through into the wastes, with its accompanying evil—gob fires. In the discussion which followed, Mr. E. B. Wain, the president, thought this plan, showing a method of working a coal so thin as 2 feet, was particularly interesting. The time had not yet come when they had to work a very large quantity of coal so thin, but they did not know how soon they might have to do so; and it would be well to consider the best method of doing it. The system adopted at Sneyd colliery appeared to be somewhat similar to that adopted in the best collieries in the great Midland district, where it was the practice to make gate roads and cut them off with cross roads at such intervals as were necessary in accordance with the nature of the roof. Mr. Heath had not indicated the nature of the roof being worked by this system, but it struck him (the president) that if in a system like that they had a hard roof to contend with they would be put to serious expense in yard work and ripping. That was an idea perhaps based on imperfect knowledge of the system as worked at Sneyd colliery. He had an opportunity two or three years ago of seeing the system at work, and thought it seemed a practicable method of getting thin seams. It appeared, however to him rather a misnomer to call this kind of working longwall. His idea of longwall was continuous face of work, and in this case, where there was only a total length of continuous face of 26 yards, it could scarcely be called longwall. Mr. Heath said the roof in the seam he had been working on the principle described was good hard level.

Note on Sampling Iron Ore.*

By E. K. Landis, Pottstown, Pa

In connection with the interesting paper of Mr. Glenn on "Sampling Ores without use of Machinery," read at the Cleveland meeting, I venture to offer the results of ten years' experience in the sampling of iron ore by a method adopted when I first became engaged in the analysis of ores, and continued to the present time. This method seems simpler than the one described in Mr. Glenn's paper, and it has proved for iron ore, quite accurate, as checked by samples taken according to more elaborate methods, and analysed by such chemists as McCreath, Booth, Garrett Blair, and others, with results rarely differing more than 0.1 to 0.2 per cent. I regard it, therefore, as not less satisfactory, while it is much more rapid than other methods.

If a pile or car load of lump iron ore is to be sampled, each piece that can be reached over the entire surface is picked up, and a small fragment is broken off and kept, the size of this fragment being governed by the size of the lump from which it is broken, that is, a larger piece being taken from a large lump than from a small one. In case the lump consists of ore with adhering gangue, a piece of each is taken, the size depending, as before, upon the size of the lump and the relative amounts of gangue and ore in it.

When the entire surface has been gone over, the sample is reduced by crushing until it all passes a 10-mesh sieve. It is then thoroughly mixed on a large sheet of hardware paper, first with a coal shovel, then by turning over and over from end to end, and from side to side. When thoroughly mixed, a small portion is taken with a large spatula from points all over the heap, and this is reduced in a Riotte mortar until it all passes a 20-mesh sieve. It is then again treated on the paper as before, and the resulting sample is passed through a 40-mesh sieve and bottled. This is subsequently mixed once more on a smaller paper, and a sufficient quantity for analysis is taken out and ground to the required fineness in an agate mortar.

The above procedure is employed, as already observed, for lots consisting entirely of lump ore. When fine ore mixed with lump is to be sampled, the lump is sampled first as above; then the fine is sampled by taking pinches or handfuls from all over the exposed surface, the quantity taken being such that the same ratio is observed between fine and lump in the sample as exists in the ore itself.

While the element of judgment involved in this method creates an undoubted source of possible error, and makes such error easy through ignorance, carelessness or intentional dishonesty, the practical question is, whether the method, intelligently used on such material as iron ore, actually gives trustworthy results. An excellent test of this question is afforded by the sampling and analysis of crude ore, concentrates and tails carried on for four months at the Tilly Foster mine. The crude ore was sampled as above described. Of the concentrates, cores were taken in eighteen different places on each carload by driving through it a 1½ inch tube, slightly swedged in at the lower end, like a "choke-bore" gun. The tails were sampled by collecting four bucketfuls from each spout, allowing them to settle, decanting the water, and drying the residue.

The weights of crude ore and concentrates were accurately known, and it is evident that by applying to the results of the analyses of the samples the formula given by Mr. Birkinbine (*Trans.*, xix., 673), a figure representing the number of tons of crude ore required to produce one ton of concentrates could be obtained, which, if, sampling and analysis were correct, would correspond with the direct determination in practice. In the discussion of Mr. Glenn's paper, already cited, Dr. Raymond has applied this test to reports of concentrating experiments, arguing from the discrepancy between the results of the formula and the reported weights actually used and produced, that there must have been defective sampling for analysis.

Such a comparison was made for the operations of four months at the Tilly Foster mine, with the following results:—

	1	2	3	4
Factor directly found from weights......	2.52	2.360	2.73	2.760
Factor calculated from analyses........	2.43	2.292	2.60	2.626
	0.09	0.68	0.07	0.134

This agreement is as close as could be expected; and the almost uniform difference in one direction points rather to loss of material in handling than to defects in sampling or analysis. The latter might be expected to give variations in either direction.

*Transactions of the American Institute of Mining Engineers.

Water-Tube Boilers.

By Allan Stirling.*

Previous to the year 1880, water-tube boilers were very little used, but since that time their use has been gradually extending, until at the present time there are probably more boilers of that type built than on the fire-tube system. There were several reasons for this change from fire-tube to water-tube boilers, but chiefly because a properly designed water-tube boiler is the most safe, economical, efficient and durable.

The first meeting of the American Society of Mechanical Engineers was held in 1880, and the writer contributed a paper on the subject of "Practical Methods for the Economy of Steam." The use of higher pressures was strongly advocated in that paper as one of the elements of economy. Pressures as high as 300 pounds per square inch were suggested, and a statement made as to the economy of using steam at that pressure as compared with steam at the then common pressure of 75 pounds per square inch.

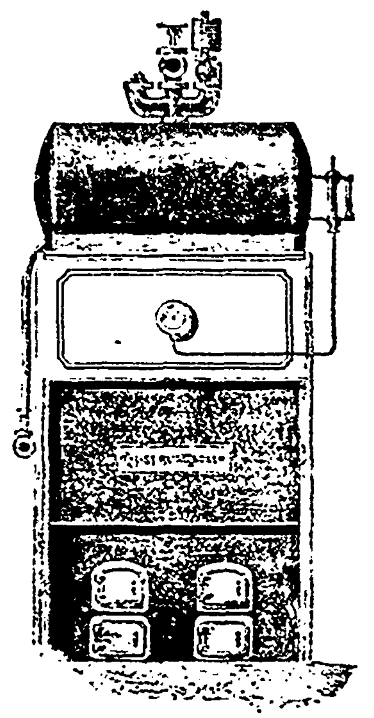
In considering the question of the most efficient boiler at that time, the water-tube system was not even mentioned by the writer, and drawings were given of a special construction of a fire-tube boiler suitable for the production of high-pressure steam.

* Proceedings Mining Institute of Scotland.

In the year 1885, the writer read another paper before the same society on the subject of "Shell and Water-tube Boilers," showing that the water-tube system had made headway during the interval between the two papers being written. In preparing the latter paper, occasion was taken to go into the relative merits of the two systems, and the writer became convinced that the water-tube system had great advantages over the older type. The only types of water-tube boiler at that time in the market were the Babcock and Wilcox, the Root, the Heine, etc.; these types consist of a series of tubes slightly inclined from the horizontal, expanded at both ends into headers, and connected to the steam-and-water reservoir above and to a mud-drum below.

In 1886, the writer constructed a water-tube boiler, which was worked at a pressure of 200 pounds per square inch. It was composed entirely of Field tubes, screwed into the bottom plate of a rectangular steam-and-water receiver. This boiler was worked for a short time, but the sediment gradually accumulated at the lower end of the tubes, and the boiler was ultimately thrown upon the scrap heap.

In 1887, another boiler similar to the former was built, with the addition of a mud-drum, to which two rows of tubes were connected, the idea being that the circulation of the water produced by means of the tubes through the mud-drum would prevent the sediment from collecting in the bottom ends of the Field tubes. This arrangement proved to be only partially successful, but this boiler is still doing good work.



The writer then decided to discard the Field tubes, and used two cylinders connected by tubes instead of the rectangular upper vessel. The two upper drums were connected with the lower or mud drum by two series of tubes divided by a fire-brick baffle wall, the flame going up the front set and down the back set of tubes to the chimney flue. This boiler proved superior to the others, but the feed-water had either to be delivered into the mud drum (thus constantly stirring up the mud), or else into one of the upper drums where the heat was so great that the deposit from the feed-water would be baked into a hard scale.

The remedy for this defect was found in the present form of the Stirling boiler, in which the water tubes are expanded directly into the drums (Figs. 1 and 2). There are no flat surfaces, no stays, and no headers, with their numerous hand-holes.

The Stirling boiler is practically self cleaning, because the water is fed into the back upper drum, and descends with a slow motion of 6 inches per minute to the mud-drum through the back group of tubes, which have an area 100 times greater than that of the feed-pipe. On entering the mud drum the feed water has reached the boiling-point corresponding to the pressure under which the boiler is working. The scale-forming matter, together with other solid matter held in suspension prior to the feed-water entering the boiler, is deposited on the bottom of the mud-drum from which it is readily blown off. This arrangement ensures the supply of practically pure water to the front and middle groups of tubes, where the steam is made.

The horizontal fire tube has deposits of coal-dust and fine ashes on the inside and of sediment on the outside; the common water tube has deposits of sediment inside and coal dust outside; and the Stirling water tube has comparatively clean inside and outside surfaces. The Stirling boilers are giving the highest possible results that are opened only once in six months, and even then very little cleaning is necessary.

With regard to utilization of heat: the heat of the fire-gases is thoroughly exhausted before they leave the water-tube boiler, because (1) the fire-gases are caused to pass successively over the whole length of the three groups of tubes; (2) the water and fire-gases are divided into small sections by the tubes; (3) the form of the current of fire-gases is changed nine times in passing from the furnace to the chimney; (4) the heating surface is comparatively clean, both inside and outside; (5) the heating surface is thin; and (6) the gases leave the boiler where the feed-water enters, thus reducing the temperature of the escaping-gases and heating the feed-water with the waste heat. This renders it possible to reduce the temperature of the escaping-gases below the temperature of the steam.

The circulation of the water in the boiler is steady and thorough. Each tube has a separate outlet to the drums of the full size of the tube. Steam is made in the front and middle groups of tubes, and these tubes are inclined at the best angle for allowing the steam to pass freely and quietly to the steam-space without carrying water with it. The geyser-like action which takes place when water is boiled in a vertical tube entirely disappears when the tube is sufficiently inclined and working under pressure. The circulation of water between the front and middle drums passes freely through the numerous tubes which connect them below the water-level.

The tubes are divided into three groups, each of which is expanded into a separate drum. This arrangement allows for unequal expansion and contraction in each group, and the bends in the tubes provide for any unequal expansion in the individual tubes.

By opening four man-holes, one in each drum, access is gained to the inside of every part of the steel-plates and to the ends and the interior of every water-tube. Openings are provided in the brickwork for the purpose of getting at the outside of the plates and water-tubes.

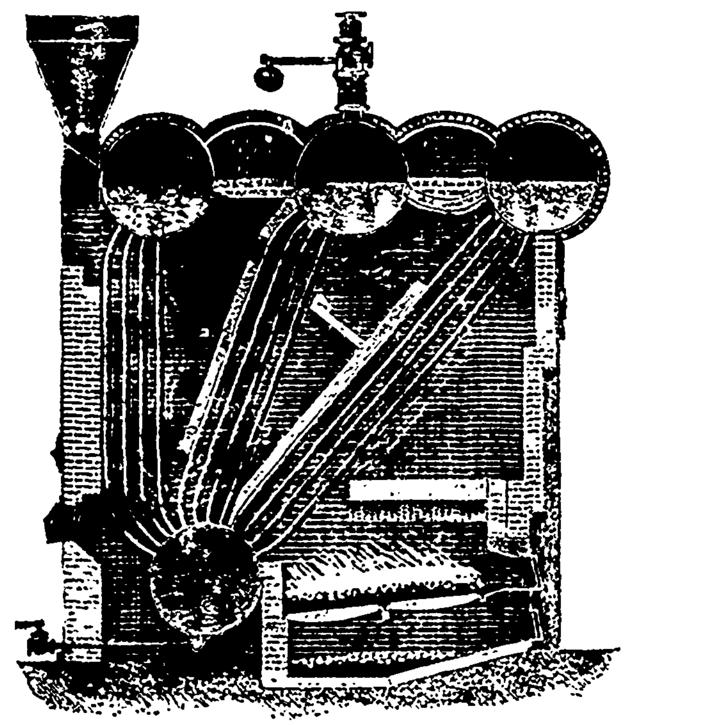
The quiet and thorough circulation of water, the large area of water-level, and the large capacity for steam and water, ensure a steady supply of dry steam.

The advantages of using high-pressure steam are widely recognized, and its use in modern engines is increasing rapidly. The merits of the water-tube as compared with other boilers for carrying high pressures, are conceded by the best engineering authorities; and the Stirling water-tube boiler commends itself because (1) there are no riveted joints exposed to the heat; (2) there are no flat surfaces, and, consequently, no stays are required; the outside surfaces of the tubes are the only parts with which flame comes into contact; (4) the ends of the tubes are in water; (5) there is no heating-surface above the water-line; (6) all the parts are of wrought steel; (7) the tube-plates are made thicker to allow for drilling the tube-holes; (8) expansion and contraction have been thoroughly provided for; (9) the water is divided into small sections; (10) the circulation is steady and thorough; (11) it is practically self-cleaning, so that the boiler seldom requires to be opened; and (12) there are only four joints to break to get access to every part of the boiler.

The numerous divisions of the water and fire-gases and the thin tube heating-surface, combined with the free circulation, ensure rapid and efficient steam-raising.

If from carelessness there should be a heavy fire in the furnace and the water left low, the worst that could happen would be rupture of one or more of the water-tubes, and the pressure would be relieved without serious consequences. Should such an accident occur to the tubes, others can readily be substituted without injuring any good tubes. The tubes are very easily removed and replaced, because they do not require to pass their whole length through the tube-hole as in other boilers, but only about an inch through the hole and back again, and they are clear. The tubes connecting the drums are readily fixed with the usual expanding tool.

Owing to its construction, the water-tube boiler will admit of a wide grate-surface, giving to each section its full quota of heat, and enabling the fireman to work the fire properly, which cannot be the case where the grate-surface is obtained by a long narrow fire-box.



There is a large draught-area resulting from the wide grate-surface and large tube-chambers. The nearly vertical position of the tubes and the arrangement of the brick baffle-plates in the tube-chambers ensure a good draught.

The combustion is good because (1) the air supply to the grate is heated; (2) the oxygen and carbon are thoroughly mixed and heated to a high temperature on the large furnace; and (3) the combustion is completed in the combustion chamber before the fire-gases reach the tubes. Radiation through the brick-setting is prevented by the erection of double walls with an air-space between. The air is drawn through this air-space to the ash-pit, and the heat that would otherwise be lost by radiation is carried back into the boiler and utilized for heating the air for combustion.

The advantage of a thin heating-surface over thick plates is apparent. The thin clean tube-surface in a water-tube boiler cannot be injured by the most intense fire, so long as the tubes are full of water.

The Stirling water-tube boiler occupies less space than any other boiler, and the fire-room can be made any width without regard to the taking out of the tubes. The small space required for boilers and fire-room effects a saving in cost of ground, foundations, and buildings.

The Stirling water-tube boiler is supported on wrought-iron columns, and is sustained independently of the brickwork. It is free to expand and contract without affecting the brickwork, which may be removed and replaced without disturbing the boiler or connections. The furnaces and grates can be arranged for coal, wood, bagasse, oil or any other fuel.

The following are the principal dimensions of Stirling boilers recently erected :—

Locality	Kilmarnock.	St. Enoch's Station, Glasgow.	Motherwell.
Heating-surface, square feet	621	2,587	4,370
Grate-surface, do	11	34	90
Ratio of heating to grate-surface.	56	76	48
Number of water-tubes.........	78	264	391
Diameter of water-tubes, inches	3¼	3¼	3¼
Diameter of drums, feet	3	4	4
Length of drums, do	5	9	11
Floor-space occupied, width, feet	7¼	11¼	14
Do do depth, do.	14	15½	17

Mr. James S. Dixon (Glasgow) wrote that Babcock and Wilcox water-tube boilers had been in use at Hamilton Palace colliery for about a dozen years. For about ten years they raised large supplies of steam, and gave no trouble. During this time they were fed with water from the pit, which contained little or no free acid, and deposited almost no scale. Since then, water containing impurities of both kinds got access from the old workings of an adjoining collery, and the tubes became both pitted and encrusted. In order to obviate this damage, water for the boilers is now being pumped from the river Clyde. The tubes in these boilers lie at an inclination, and the incrustation is chiefly found in the lower 4 or 5 feet of the tubes next to the mud-drum, and may be due to the lower temperature of the furnace-gases at that point, as the circulation through the water-tubes must be the same throughout. Mr. Stirling claimed that the back range of tubes of his boiler being placed in an upright position obviated this difficulty. If this be so, one difficulty with bad water—and a serious one—will have been overcome. Mr. Stirling also claimed that the water-tubes were kept clean, both inside and outside. There is no doubt that an upright tube will not carry dirt outside like a flat or sloping one, and that cleanliness has a marked effect on the steam-raising powers of a water-tube boiler. He (Mr. Dixon) would like to have an explanation as to how the current of fire-gases is changed in direction so many as nine times from the furnace to the chimney. If the steam passes off so quietly as described, priming would be prevented—a most desirable result. The experience of some engineer who had used the Stirling boiler would be valuable on that point. If the case of removing a bad tube was in practice, as described, it was a favorable point, as in the Babcock and Wilcox boilers great trouble was often experienced in withdrawing a bulged tube through the header. There was no doubt that the water-tube form of boiler was a move in the right direction, especially in these days of high pressures; but his experience was that good water was a *sine qua non*. Of course the matter of first cost was a consideration, and it would be desirable to know the cost of the Stirling boiler, say, per 100 indicated horse-power.

Mr. James Frew (Dunaskin) asked whether Mr. Stirling had experienced any difficulty with scale adhering to the water-tubes leading from the back top-drum to the mud-drum, and whether the providing of one hundred times the feed area in the water-tubes leading to the mud-drum entirely overcame the trouble of scale deposit, or only reduced it? In the case of the boiler being fired with coal or dross, when the temperature of the water tubes was lowered during the cleaning of the fires, he thought it probable that leakage at the tube-ends would take place. He asked whether there was any trouble from leakage at that point? It seemed to him, on the whole, that the Stirling boiler was ingenious and well-arranged, and that it would secure the utilization of the heat given off from the fuel.

Mr. R. D. Munro (Glasgow) said that Mr. Stirling need not be surprised if the steam-users of this country were somewhat slow in taking up any type of water-tube boiler. He thought that engineers were justified in being cautious before giving up the Lancashire and other well known types for a design so remote from preconceived ideas of what a boiler should be. It was just possible that they were all wrong in their estimate of Lancashire boilers, but they had before them the fact that they had done nearly all the steam-raising in this country for upwards of thirty years, and that hitherto it had not been proved that boilers of the water-tube type could surpass them in efficiency when working under the same conditions. He also felt certain that the water-tube boiler would never excel the Lancashire in the matter of durability. They had been accustomed to Lancashire boilers carrying considerable pressures for twenty-five years with the greatest safety, and they were naturally anxious to learn how the new types would behave under a lengthened working-test before they took them into their confidence. What Mr. Stirling had said would tend to direct attention to this very important question. The steam-pressures employed were now much above the average of former years, and they were rapidly being raised to a point at which it was perhaps questionable Lancashire boilers could be worked satisfactorily. When they considered the enormous weight and bulk of a Lancashire boiler, 30 feet in length by 8 feet in diameter, suitable for pressures from 150 to 200 lbs. per square inch, they found themselves face to face with difficulties in transit and greatly increased expenditure for foundations, and it was just probable that the wear and tear, which, with lighter boilers and lower pressures, was very gradual, might be such, under the altered circumstances, as would detract seriously from the usual lifetime of the Lancashire boiler. Whether the water-tube, so-called, or some other form of sectional boiler, would become the type of the future had yet to be determined; but it was evident that some of the leading boiler engineers were of opinion that a sectional boiler could be made which possessed all the advantages of the Lancashire boiler, and at the same time be free from the objections as to great weight, etc., already referred to. In his own experience of water-tube boilers, he had found that they had worked fairly satisfactorily, provided the feed-water was good and the steam requirements were steady, but in paper-mills, dye-works, and other factories where the demands for steam were of an intermittent nature, they had not proved so serviceable as boilers of the Lancashire type. This, he thought, was largely due to the small steam disengaging surface of the water-tube boiler in proportion to its heating-surface. Water-tube boilers were seriously affected by the forced firing that was too frequently resorted to when extra steam was required, the result being that foaming or priming of a violent nature very often occurred, causing great loss of economy, besides endangering the safety of engine cylinders, piping, etc. Great improvements had been effected in the water-tube boiler within recent years, and as they were being adopted by their own and foreign governments for men of war, he thought this was likely to give an impetus to their use on land. The Stirling boiler was a distinct departure from those used in this country, and as it had already attained great success in the United States of America, it was just probable that they might find it had been designed to overcome the troubles incidental to the use of impure feed-water, and priming, which, in certain circumstances, were the serious drawbacks of other water-tube boilers. In the Stirling boiler there was a combined steam-boiler and economizer, the first two banks of tubes forming the boiler proper, and the last bank of tubes forming an economizer, in which the feed water was heated by gases of low temperature. By this disposition of the tubes he understood Mr. Stirling to say that he could more effectually utilize the heat of the furnace-gases, there being no difficulty in doing so to a degree even below the temperature of the steam generated. The same claims, however, had been made by the various manufacturers of the economizers used in connection with Lancashire boilers, but there was nothing to be gained by reducing the gases to such a low temperature; and, except in cases where there was a very large chimney or some system of artificial draught, it was impossible to work satisfactorily with gases reduced below that of the steam generated. The minimum chimney temperature in good practice was about 400 degrees, but the average, unfortunately was as high as 600 degrees. He had heard of some installations for forced draught, in which the furnace-gases were so thoroughly utilized that they escaped into the chimney at a temperature of about 200 degrees; but, speaking generally, it had been found that, except in special circumstances, there was quite as much economy in maintaining good draught by an expenditure of heat at the base of the chimney, as in providing steam for fans, or jets for artificial draught. The arrangement for feeding the Stirling boiler was an ingenious one, and whilst he would like to see more of it before deciding as to its merits, he was inclined to consider it as being favorable to prevention of trouble in the use of bad feed-water, and thereby likely to promote economy and durability. He understood Mr. Stirling to say that water-tube boilers were now the rule in America, as well as on the continent, and that Britain was alone in her advocacy and continued use of fire-tube boilers. There must, he thought, be some mistake in this, as he was regularly in receipt of reports from an American company, which inspected some 40,000 steam boilers annually, and his impression at the moment was that about nine-tenths of these were of the ordinary fire-tube type. His experience of continental countries went to show that fire-tube boilers still held their own, notwithstanding the numerous patents that had been taken out for water-tube boilers, both in France and Germany. With regard to the large number of explosions in America, compared with British experience, he might state that, according to published statistics, there had been upwards of 300 explosions in the United States of America during the year 1894, many of them being of a most disastrous nature, whilst the average number of actual explosions in this country did not exceed 40 per annum. He thought that these facts pointed to the necessity for improved supervision on the part of American engineers. The boilers, it might be thought, were badly designed or badly constructed, but he was of opinion that the explosions were more the result of the reckless manner in which the boilers were worked and attended to, than to defects in their design and construction. The water-tube boiler was generally spoken of in this country as an American invention, but it might be of interest to Mr. Stirling to know that the late Mr. Rowan, the father of a prominent member of this Institute, if not the first to introduce the water-tube boiler, was at least one of the pioneers. He designed the boilers of the steamship "Propontis," and although these boilers were not successful, they formed a basis or starting-point from which succeeding water-tube boilers were constructed. In conclusion, he would like to know Mr. Stirling's opinion as to the method of discharge adopted in the Thorneycroft boiler. The tubes were arranged so as to deliver through the steam space, and it was said that this added greatly to the efficiency of the boiler. He would also be indebted to Mr. Stirling if he would give some statistics as to the performance of the Stirling boiler. The members were all fairly conversant with the duty and efficiency of the Lancashire and other fire-tube boilers, and it would therefore be very interesting to have full particulars of evaporative tests of the Stirling boiler, so as to enable them to judge of its duty and efficiency. He ventured to express the opinion that good though this boiler might prove to be, it would never surpass the Lancashire boiler in efficiency, but, inasmuch as it was better adapted for carrying very high steam-pressures, and possessed advantages over some other designs of water-tube boilers, it would probably be taken up to some considerable extent by the more enterprising steam users.

Mr. Henry Aitken (Falkirk) agreed with Mr. Stirling that the water-tube boiler was the boiler of the future, but there were circumstances where it would not be so., *e.g.*, where the water was bad. He had had great experience with bad water and scaled boilers and tubes. In connection with one, where Field tubes were used, he had obtained good results, but in the course of a fortnight the whole of the tubes had to be taken out. In doing so he closed the holes with iron plugs, which extended 6 inches into the gas space below, and 6 inches into the water in the boiler, and curiously enough nearly as good results were got as if the Field tubes had been in position. He could not understand how in the Stirling boiler the difficulty of bad water was got rid of. But for all general purposes, where the water was good, he had no doubt, particularly for high pressures, that the tubular boiler was the boiler of the future.

Mr. Stirling said that the current of fire-gases left the furnace in a solid mass, and (1) was divided in strips in passing in among the tubes; (2) it followed the front group of tubes in the form of a rectangle minus the circles of the tubes; (3) it was divided into strips in passing out of the first group of tubes; (4) it passed across the space between the first and second group of tubes in a solid mass; (5) it was divided into strips in passing in among the second group of tubes; (6) it followed the middle group of tubes in the form of a rectangle minus the circles of the tubes; (7) it was divided into strips in passing from the second to the third group of tubes; (8) it followed the third group of tubes in the form of a rectangle minus the circles of the tubes; and (9) it was divided into strips in passing out from the third group of tubes to the chimney. The Stirling cost less than any other boiler, and could be supplied for less than 20s. per indicated horse-power. There was no difficulty with the scale or leaky tubes in the Stirling boiler. He (Mr. Stirling) had found no fault with the cautious feature of the Scotch character, but in these days of keen international competition engineers found it necessary to be very wide-awake in exercising their judgment in adopting the best methods and appliances. The Stirling surpassed the Lancashire boiler when working under the same conditions, and it was much more durable than the Lancashire for modern high-pressures. Although the Lancashire boiler had done nearly all the steam-raising in this country for upwards of thirty years at low pressures, that was no evidence that it would continue to prove satisfactory at the modern high pressures. Mr. Munro questioned whether Lancashire boilers could be worked satisfactorily at high pressures. The Stirling boiler overcame all the difficulties which Mr. Munro had found in Lancashire and in other water-tube boilers: (1) It would work satisfactorily with bad feed-water; (2) the numerous divisions of the water and fire-gases, and the comparatively clean, thin, heating surface, combined with the large steam-disengaging surface, the free circulation, etc., ensured rapid and efficient steam raising, and enabled the Stirling to respond much more promptly to intermittent demands for steam than the Lancashire boiler or other types of water-tube boilers; and (3) the Stirling boiler did not foam or prime. The ordinary way of producing draught by means of heated air in a chimney was wasteful. Years ago, mines were ventilated in this way, but the fan had been universally adopted instead. Fans were used with great economy in connection with steam boilers in many cases. Particularly on ship-board. The most economical way to operate a boiler plant was to reduce the temperature of the chimney gases as much as possible, and to blow the fire with a fan driven by an engine. For large power plants the water tube system was being almost universally adopted in America. With reference to explosions, although there are over twelve hundred Stirling boilers at work in America there had never been an explosion, nor had a single person been hurt by them. He (Mr. Stirling) was familiar with the Rowan boiler that failed on the Propontis, and also with the boiler that failed on the Montana. He considered that it was very objectionable to have any heating surface above the water line. He had not devoted attention to the making of tests, but others had been kind enough to give him their experience. Mr. Eckley B. Coxe, President of the American Society of Mechanical Engineers, on April 6th, 1894, wrote: "We have been running the Stirling boilers at Oneida continuously since May last, and can give no information as to their weak points, as we have as yet found none. We have done nothing to them. We have made many experiments with them, in one case running one of them (150 horse power) up to 240 horse power without any bad results to the boiler. They have not leaked or sprung, and seem as good as when put in."

Mr. Philip D. Armour, of the Armour Canning Co., Chicago, wrote, on April 3rd, 1894: "We have purchased from the Stirling Co. over £23,500 worth of boilers within the past eighteen months, and they have given entire satisfaction. We find them a great saving on coal."

The discussion was then adjourned.

ORES AND METAL MARKET.

Copper During the past month the speculative market has been subject to some what violent fluctuations, under the influence of favorable or unfavorable reports as to the progress of the negotiations to limit European production and American exports of copper, the final conclusion of which is the determination of the Calumet and Hecla Co., of Lake Superior, to decline to be parties to any such agreement, although assented to by all the other mining companies concerned. Various reasons are assigned for this non concurrence, that publicly announced being that the manager of this company considers any agreement unnecessary in view of the present active demand for copper in the United States due to the very pronounced revival of trade, and that the desired object will be attained without the use of any artificial means. Definite proof of this improved trade is shown in the important advances in wages which are being generally conceded by Producers and Manufacturers, the Calumet and Hecla Company, amongst others, granting an increase of 10 per cent. on the wages of 3,500 men employed by them. This will represent an increase in the cost of the Copper produced by this Company of at least £1 per ton, and follows a similar advance granted a few months ago.

It appears that in the month of April, the Calumet and Hecla Co. sold a large quantity, stated to be 12,500 tons of 2,000 lbs., of their Copper at 9.50 cents per lb. for delivery up to the end of August. The recent, or any further advance, cannot therefore be of much benefit to them for some time to come.

It is stated by those most competent to judge that the exports of American Copper to Europe will probably be less than 55,000 tons for the present year. For the past five months they have been about 24,750 tons, against 30,724 tons for the same period last year, and 77,130 tons for the whole of 1894.

From £41 on the 1st ult., *Good Merchantable Copper* rapidly rose to £45 on the 13th for cash, declining with even greater rapidity to £41 17s. 6d. on the 17th, on realization of profits and reported failure of the agreement negotiations, advancing again to £43 10s on the 20th, falling to £43 next day, only to improve to £44 on the 27th. From this point values again declined to £42 15s. on the 30th, when the definite failure of the negotiations was publicly announced; but an advance to £43 13s. 9d. has since taken place, the strong position of Copper, irrespective of any limitation of supplies, becoming generally apparent. The total transactions of the month exceed 50,000 tons.

There is little doubt that the private stocks of Copper in France and Germany are very small, and that the public stocks in England and France will steadily diminish in order to supply the increasing consumptive demand.

English Best Selected Ingots sold up to £48, closing at £47 per ton. For *Lake Superior* Ingots £51 was paid, but the present value in New York of 10.75 cents per lb. (an advance of 1 cent) is the equivalent of about £53 per ton; and of *Electrolytic* Copper about £52 5s. per ton, Birmingham terms, little being offered for sale.

May 6—	11 tons	Precipitate	Spanish	about 70%	at Liverpool	on private terms.
" 13—	37 "	Ore	Chile	" 20%	at Swansea	at 7s. 9d. per unit.
" 22—	155 "	Ore	Chile (*Carbonate*)	" 20%	at Liverpool	at 8s. 4½d. per unit.
" 22—	300 "	Ore	do do	" 20%	to arrive at Liverpool	at 8s. 4½d. per unit.
" 22—	1,400 "	Ore	Mason's (44% Sulphur)	6%	at Liverpool	on private terms.
" 23—	11 "	Precipitate	Spanish	70%	to arrive at Liverpool	on private terms.

QUOTATIONS to-day are: Chile Bars and Good Merchantable Copper £43 13s. 9d. for cash, and £44 1s. 3d. for three months' prompt. Buyers. English Best Selected Ingots £47 10s. to £48, and Tough Cake £47 to £47 10s. per ton. 8s. 6d. for Ore of 20 per cent., and 8s. 9d. per unit for Chile Regulus or American Matte, free from Silver.

CHILE EXPORTS to 31st May are:—

	1890.	1891.	1892.	1893.	1894.	1895.
EXPORTED to 31st March	6,237	4,839	5,264	4,704	4,734	4,573
LOADING on do	562	....	....	....	50	....
CHARTERED to 31st May	4,351	3,008	3,761	3,367	3,497	5,029
	11,150	7,847	9,025	8,071	8,281	9,602 Tons Fine.

STOCKS of Copper—(Tons Fine)

	1st June, 1890.	1st June, 1891.	1st June, 1892.	1st June, 1893.	1st June, 1894.	1st April, 1895.	1st May, 1895.	1st June, 1895.
CHILIAN in *Liverpool and Swansea*	16,341	18,348	30,057	30,855	32,547	38,683	39,525	39,519
France	27,650	15,973	3,895	3,489	508	270	282	550
AMERICAN in *Liverpool and Swansea*	12,658	979	3,172	1,925	3,919	3,580	3,604	3,437
France	3,230	603	—	909	324	389	337	907
SUNDRIES in *Liverpool and Swansea*	3,016	1,780	2,060	1,868	1,265	1,498	1,412	996
London	5,557	7,558	7,493	6,926	5,046	5,021	4,895	4,398
France	3,878	789	689	410	169	244	184	154
ENGLISH G. M. C. in *Liverpool and Swansea.*	5,383	2,714	2,599	169	2	—	—	—
Total	77,713	48,744	49,965	46,551	43,780	49,685	50,239	49,961
AFLOAT as advised by Mail and Cable to date:—								
From Chile	3,854	2,597	3,172	2,609	3,135	2,501	3,199	3,486
" Australia	500	1,000	600	800	700	1,150	1,000	1,100
TOTAL VISIBLE SUPPLY	82,067	52,341	53,737	49,960	47,615	53,336	54,438	54,547
QUOTATIONS. Bars, per ton	£54 10 0	£55 5 0	£46 12 6	£43 2 6	£38 13 9	£39 11 3	£41 0 0	£43 3 9
Ore, per unit	10/6	10/3	8/10½	8 7½	7/1½	7 7½	7/10½	8/6

IMPORTS of Copper (exclusive of Pyrites and Precipitate to Outports) from 1st January to date:—

	1890.		1891.		1892.		1893.		1894.		1895.	
Chile into Liverpool and Swansea	10,238		5,333		6,879		7,487		7,024		7,314	
* Other Countries into Liverpool and South Wales	24,698		29,278		26,437		20,181		24,332		18,356	
" " " London	119		391		790		455		1,108		467	
Australia " "	2,832		1,922		2,205		2,909		2,715		3,481	
Japan " "	3,075	40,962	3,033	39,957	1,094	37,405	1,574	32,606	698	35,872	2,684	32,302
Chile into France	570		2,287		1,020		1,657		1,137		1,379	
America "	932		2,798		1,460		2,200		2,605		3,432	
Mexico "	—		—		—		2,530		3,215		2,165	
Other Countries into France	288	1,790	399	5,484	487	2,967	1,326	7,713	502	7,459	725	7,701
		42,752		45,441		40,372		40,319		43,331		40,003 Tons Fine.
DELIVERIES..ditto .in England and France		58,385		52,040		43,051		47,833		42,296		40,806 Tons Fine.

* *IMPORTS of other than Chile Copper* into Liverpool and South Wales during the *first five months* of the following Years:—

	1890.	1891.	1892.	1893.	1894.	1895.
From United States	9,737	12,839	10,377	9,143	13,370	8,640
" Canada	47	27	—	—	80	—
" Mexico	259	1,895	350	474	702	450
" Peru	57	83	79	185	223	86
" River Plate	50	95	117	56	94	71
" New Quebrada	1,495	1,641	2,365	598	884	360
" Newfoundland	200	80	703	321	—	—
" Spain	1,744	1,455	1,792	1,984	1,154	1,267
" " (Precipitate)	6,738	7,648	6,959	4,463	4,704	4,798
" Portugal	123	104	373	143	483	161
" Italy	315	300	303	375	316	148
" Norway	8	5	36	—	—	236
" Cape of Good Hope	3,788	3,081	2,709	2,092	2,232	1,858
" Australia	29	13	—	88	—	—
" Sundries	108	12	214	259	90	281
	24,698	29,278	26,437	20,181	24,332	18,356 Tons Fine.

Gold—77s. 9d. per oz. Standard.

Silver advanced from 30¼d. to 30⅞d. on the 13th, and after slight fluctuations closes at 30 9/16d. per ounce standard.

Quicksilver from second hands is quoted at £7 8s. to £7 8s. 6d. per bottle.

Sulphate of Copper sells at £15 10s. for prompt delivery.

Lead—£10 12s. 6d. per ton for English; soft Spanish, £10 10s.; rich in silver £10 12s. 6d. to £11 7s. 6d. per ton; ore of 70 per cent., £4 6s. 6d. per ton and fine silver value. The import of silver lead from Mexico amounts to about 550 tons.

Antimony—£31 10s. to £32 per ton.

Nickel offers at 1s. 1d. to 1s. 2d. per lb. net.

Tin rose from £64 to £67 on the 13th, declining again to £64 per ton—the closing value.

Bank Rate of Discount remains at 2 per cent.

Liverpool, 4th June, 1895. JAMES LEWIS & SON.

Advertise in THE REVIEW. It will pay you.

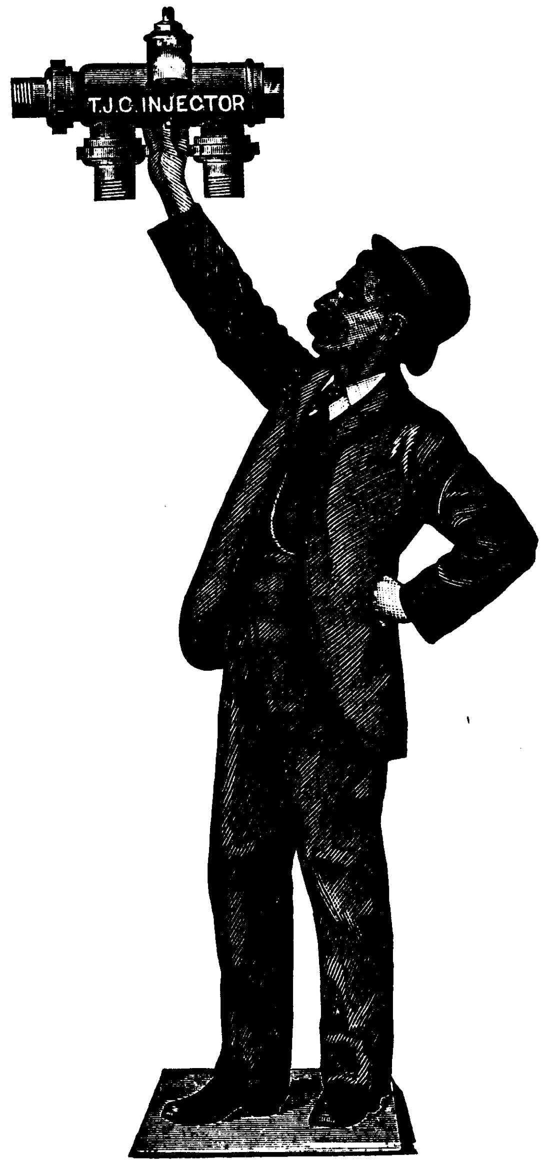
The Oldest and Most Influential Engineering Journal in Canada.

ABOVE ALL COMPETITORS.

COAL IS MONEY, WHY NOT SAVE IT BY USING THE

T. J. C. INJECTOR

THE MOST ECONOMICAL BOILER FEEDER IN THE WORLD.



20 PER CENT. saved in coal over any other make.
Absolutely Automatic. Easily Attached.
Applicable to all kinds of Boilers.

NOT EXPENSIVE.

Will outwear any other make and is simple in construction.
It is easy to operate, and is the most powerful feeder in the world.
The J. T. C. Injector is the best because you cannot possibly go wrong with it.
With high or low steam the result is equally satisfactory.
It combines the utmost simplicity with perfect efficiency, and any boy can operate it.

PRICE LIST.

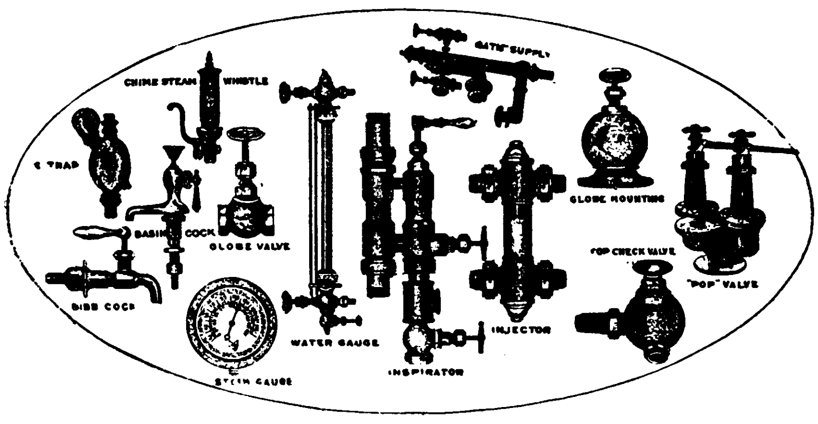
No.	Price.	Horse Power.
7	$ 7 00	4 to 8
10	7 00	8 to 16
15	10 50	16 to 40
20	15 00	40 to 72
25	22 50	72 to 120
35	30 00	120 to 220
45	45 00	220 to 300

Hamilton Brass Manufacturing Co. Ltd.

HAMILTON, ONTARIO.

THE JAMES MORRISON BRASS MFG. CO.

(LIMITED).



Engineers', Steamfitters' Brass Goods and all descriptions of Brass and Copper Work.

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WROUGHT AND CAST IRON PIPE AND FITTINGS,

ENGINEERS' AND FITTERS' TOOLS, &c.

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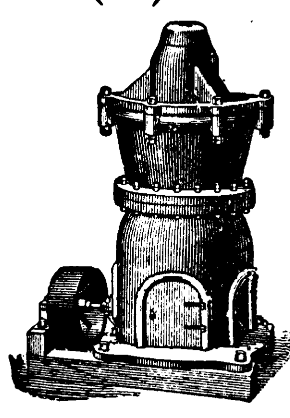
The McCully Rock and Ore Crusher



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 Expositon 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.

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WATEROUS
BRANTFORD
CANADA

UNITED MEETING
—OF—
CANADIAN MINING ASSOCIATIONS
IN THE CHATEAU FRONTENAC, QUEBEC,

Thursday and Friday, June 27th and 28th, 1895.

Under the Auspices of the GENERAL MINING ASSOCIATION OF THE PROVINCE OF QUEBEC, there will be held a United Meeting of

The Mining Society of Nova Scotia, The Asbestos Club, The Ontario Mining Institute, and The General Mining Association of Quebec.

Meetings—Thursday Evening at 8 o'clock.

BUSINESS SESSION OF INDIVIDUAL SOCIETIES AT EIGHT O'CLOCK.

OPEN SESSION AT 8.30.
The Hon. E. J. Flynn, Commissioner of Crown Lands, in the Chair.

THE DEVELOPMENT OF OUR PHOSPHATE AND FERTILIZER INDUSTRIES. WHY THEY SHOULD BE ENCOURAGED.
(*a*) Phosphoric Acid in Agriculture.
By FRANK T. SHUTT, Chief Chemist, Dominion Experimental Farm, Ottawa.
(*b*) Canada—A Natural Manufacturing Centre for Fertilizers.
By MR. HENRY WIGGLESWORTH, New York.
(*c*) Phosphate's Future.
By CAPT. ROBT. C. ADAMS, Montreal.

RECENT IMPROVEMENTS IN, AND THE APPLICATION OF ELECTRICAL MACHINERY TO MINING (Illustrated).
By MR. W. F. DEAN, Montreal.

Excursions—Friday, June 28th.

On Friday morning, leaving the Chateau Frontenac at 10.30 a.m., there will be an excursion by Caleche to the principal points of interest in and around historic Quebec.

In the afternoon, at three o'clock, the members and their friends are invited by Messrs. Carrier, Lainé & Co., of Levis, to an excursion by special steamer, visiting the Chaudiere Falls, the Falls of Montmorenci, the Dry Dock, and the large engineering works of their firm.

Any business or papers left over from the meetings on Thursday will be finished at an evening session in Chateau Frontenac at eight o'clock.

Saturday Morning—Excursion to Lake St. John and the Saguenay.

It is proposed, provided a sufficient number of members and their friends are available, to have an excursion to Lake St. John and the far famed Saguenay, leaving via Quebec and Lake St. John Railway, St. Andrew Street Depot, on Saturday 29th June, at 8.30 a.m. There is first-class hotel accommodation at Roberval, delightful scenery and famous fishing. Sunday and Monday (Dominion Day) will be spent here, and on Tuesday the boat will be taken at Chicoutimi for the excursion down the Saguenay, arriving at Quebec the same evening.

Clubs.

By courtesy of the President and Members, members of the visiting associations have been extended the priviliges of the Union and Garrison Clubs during their stay in Quebec.

Hotels.

By special arrangement reduced rates for members have been secured as follows:

Chateau Frontenac	$3 50
Florence House	2 00
Hotel Victoria	2 00

Transportation—Railways and Steamers.

INTERCOLONIAL RAILWAY OF CANADA—Members from Halifax and points on this line will, it is hoped, be carried to Levis and return for a single fare.

QUEBEC CENTRAL RAILWAY—Members from Sherbrooke and points on this line will be carried to Levis and return for a single fare on presentation of official Circular.

CANADIAN PACIFIC, GRAND TRUNK AND CANADA ATLANTIC RAILWAYS By special arrangement, members and their friends will be carried the round trip over these lines at a greatly reduced rate on obtaining Convention Certificate from Ticket Agent and on same being signed at Quebec by the Secretary. DO NOT FAIL TO ASK FOR IT AND ONLY BUY A SINGLE TICKET.

RICHELIEU AND ONTARIO NAVIGATION CO. (Boat service)—By special arrangements reduced fares as follows (exclusive of meals and berths):

	ONE WAY.	RETURN.
From Toronto to Quebec	$7 00	$13 00
From Kingston to Quebec	5 00	8 25
From Montreal to Quebec	2 50	4 00
From Chicoutimi to Quebec	2 75	

A cordial invitation to be present is extended to all interested in the mineral development of the Dominion.

JOHN BLUE,
President.

B. T. A. BELL,
Secretary.