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The Canadian Mining Review

Established 1882

Vol. XIII.—No 9 | 1894—OTTAWA, SEPTEMBER—1894. | Vol. XIII.—No. 9.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

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WM. HAMILTON MERRITT, M.E., F.G.S., Associate Royal School of Mines, England,
Lecturer on Mining Engineering, The Economic Geology of Ontario, and The Discovery and Winning of Minerals.

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FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,

SCHOOL OF MINING, - KINGSTON, ONTARIO.

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: Victoria Chambers, Ottawa.

VOL. XIII., No. 9. SEPTEMBER, 1894. VOL. XIII., No. 9

EN PASSANT.

Mr. Robert Archibald, C.E., M.E., the subject of this month's portrait, succeeded, about a year ago, Mr. James Baird, in the management of the Joggins Colliery, operated by the Canada Coals and Railway Co., Ltd., in Cumberland County, Nova Scotia. Like many of our mining engineers, Mr. Archibald is a Scotchman, born and educated in Glasgow, where he also served his indenture as apprentice to a well known firm of civil and mining engineers. His first professional work was an engagement as surveyor and assistant manager at one of the largest collieries near Motherwell, after which he was employed for some eight years by the Summerlee and Mossend Iron and Steel Co., in the varied capacities of assistant manager, underground manager, and ultimately manager. Then Mr. Archibald received the appointment of assistant general manager to the Carron Company, Ltd., where he acquired valuable experience and found full scope for his energy and ability in the supervision of this important company's Scotch collieries. Prior to his present engagement with the Canada Coals and Railway Co. Ltd., he had been promoted to the position of manager of one of the Carron Company's largest districts. Mr. Archibald's intimate acquaintance with Scotch colliery practice is evidenced by many notable improvements and a rapidly increasing output at the Joggins Colliery.

As we go to press the Autumn meeting of the General Mining Association of the Province of Quebec is being held at Sherbrooke, the proceedings opening in the Magog House on Wednesday evening, 26th instant. Among the papers to be presented we note: "The Canadian Slate Industry," by Mr. Harry Williams, Supt. of the Beaver Asbestos Co. Ltd.; "Chromic Iron: its Composition and Uses," having particular reference to the important new discoveries at Black Lake, Que., by Mr. J. T. Donald, M A, Montreal: "Repairs to Rock Drills," by Mr. A. Sangster, of the Canadian Rand Drill Co., Sherbrooke. Mr. J. Burley Smith, M.E., is also down for a paper, the subject of which, however, is not announced. On Thursday the members will be the guests of President Blue, at the Capelton pyrites mines of the Eustis Mining Co., where they will, after an inspection of the works, be entertained to luncheon. On Friday, party will leave by special train over the Quebec Central Railway, visiting first the large quarries operated at Dudswell by the Dominion Lime and Marble Co. Ltd., and then at Black Lake, the new workings of chromic iron which have caused some excitement in that district. By courtesy of the various managers, an opportunity will also be afforded fo inspecting Quebec's great mining industry, the asbestos mines of Thetford and Black Lake. Luncheon will be served in the Club House at Black Lake. In the evening, the Hon. W. B. Ives, Q.C., M.P., President of H. M. Privy Council, will entertain the members of the Association at his charming residence in Sherbrooke. By arrangement, special rates have been provided, on the certificate plan, with the Canada Atlantic, Grand Trunk, Canadian Pacific and Quebec Central Railways. There is a likelihood of a large attendance and the success of the gathering is assured.

The Ontario Mining Institute will hold its next meeting in the city of Kingston, some time in January, under the auspices of the staff of the new School of Mining.

In view of the very marked progress in the introduction and application of coal getting machinery in Canada, some statistics from Illinois, where machine mining has passed from the experimental and become fixed and successful, will be of interest. The following comparative table for the last six years shows the record of machine mining:

Year.	Mines.	Machines.	Tons cut. Lump coal.	Men employed.
1888	39	272	2,248,210	3,088
1889	35	235	2,346,713	3,439
1890	34	266	2,881,983	3,141
1891	34	241	2,423,080	3,005
1892	41	300	3,002,893	3,646
1893	41	310	3,541,944	4,314

The total number of tons of all grades mined by machines during the year 1893, was 4,595,130 tons, or over 25 per cent. of the total product of the State, and giving employment to 4,314 men. A record of 288 machines at 37 mines. shows that with an average force of 14 men, operating 250 days, 15,193 tons have been produced on each machine. There are 22 other machines located at four other mines, which have cut 219,504 tons; these are at mines where coal is partly mined by hand.

Some particulars relating to Crabb's patent clip for endless rope haulage in mines, &c., have reached us. It is described as the latest and most efficient clip in the market, and does not damage the rope. It is claimed to be cheap, simple and substantial in construction and certain in action on rising and falling gradients; automatically attaching and detaching itself at crosses, junctions and terminals: it drags the tub or waggon on the centre line; requires no adjusting, it being always in position to receive the rope; and can be adapted either to the top bottom or side of the tub. The patentee is Mr. G. H. Crabb, of Bunker Hill, Fence Houses, Durham, England.

Vancouver Island, with its rich resources in coal and iron, gives promise at no distant date to become the centre of an important iron smelting industry. Mr. J. P. Witherow, of Pittsburg, has been pushing for the establishment of a works at Victoria, with the result that Alderman Ledingham has given notice of the following motion for an early meeting of the City Council of that city:—

"Whereas the raw materials for the manufacture of iron and steel have been shown to exist in abundance and under favorable conditions for profitable manufacture in Vancouver Island;

"And whereas it would greatly increase the commercial importance of the city of Victoria and would otherwise benefit the inhabitants thereof if a first-class plant for the manufacture of iron and steel billets were to be established in or near the city;

"And whereas the government of Canada is authorized by an Act passed on the 23rd day of July, 1894, to pay a bounty of $2 per ton on all pig iron made in Canada from Canadian ore, a bounty of $2 per ton on all iron puddled bars made from such pig iron, and a bounty of $2 per ton on all steel billets made in Canada from such pig iron;

"And whereas J. P. Witherow has undertaken to organize a company in London with a capital stock of $3,000,000 for the purpose of establishing and operating such a plant at some convenient point in British Columbia;

"Be it therefore resolved that if a company is organized with a capital of $3,000,000, and at least half of such capital is subscribed for, and if the company shall have expended to the satisfaction of the mayor and two persons to be nominated by the City Council, the sum of $20,000 in acquiring a site and commencing to build a plant in or near Victoria for the manufacture of iron and steel billets, with a capacity of not less than 50,000 tons per annum, that the council will cause a by-law to be submitted to the ratepayers to authorize the city to guarantee the interest at the rate of 5 per cent. per annum on the company's bonds to the extent of $1,000,000, for a period of twenty years, such guaranteed bonds to be issued from time to time as the work progresses, and to be secured by a charge on the assets of the company and the bounties available from the Canadian government, or otherwise to the satisfaction of the council."

In the course of the discussion on the paper read by Professor Clowes before the British Association, in which that gentleman describ his apparatus for detecting the presence of foul air in collieries, Dr. Haldane, Oxford, gave the result of his observations on the effect of the deleterious gases met with in coal mines upon human health. He said that his own experiments, repeated on many different individuals, showed conclusively that air containing as much as 20 per cent. of carbonic acid could not be breathed even for a minute without serious consequences. Even 5 per cent. of carbonic acid caused distress of both body and mind, while any proportion higher than 10 per cent. produced distinctly poisonous effects. He pointed out that the danger in mines often arises from a deficiency of oxygen, or from the presence of poisonous gases such as sulphuretted hydrogen and carbon monoxide, rather than from the presence of carbonic acid.

A new apparatus for concentrating sulphuric acid, which has been invented by G. Siebert, consists of a flat, closed vessel, in an inclined position, the bottom of which is terraced or stepped, with each step inclined backwards so as to form a shallow trough. The upper part of the vessel has a dome for carrying off steam or vopors and the lower end an outlet for the concentrated acid or liquid. At the upper face of the vessel is an inlet surrounded at the outside with a basin and protected internally by a screen, so that the liquid in the basin forms a hydraulic joint. In one form of the apparatus each step or terrace has a metal ridge or rib, which is shorter than the entire length of the step, so as to leave at one end a gap for the passage of the liquid; and the gaps being on the alternate sides in successive steps, the liquid traverses at each step the whole length to and fro as it flows, step after step downwards. The vessel is heated underneath.

In his review of the Florida phosphate industry in 1893, Dr. David T. Day (*Mineral Resources of the United States*) says: "As is well known reports have made the foreign consumers think of western Florida as a smooth tract of phosphate, of which it was possible to state the available tonnage by the cubic contents of that part of the State obtained from the acreage multiplied by a theoretical depth. The utter recklessness of such a method is realized when it is understood that the floor of the phosphate section is limestone rock, with an extremely irregular surface. At places the limestone outcrops: at others it is covered with still more irregular deposits of phosphate rock, clay and sand. In one place the phosphate rock will be visible at the surface, and a few feet away it is likely to be found covered with many feet of barren sand or clay, or both. The rock must be sought, therefore, above the pitted, often jagged, surface of the limestone, and below the equally irregular piles of sand and clay. And even then the phosphate boulders and pebbles must be separated from the sand and clay with much labour and mechanical ingenuity, which has developed a system of mining that is somewhat novel, and, therefore, requiring comparatively costly supervision to adapt it to the constantly changing details of occurrence, even after expert and costly prospecting has defined the defined the deposit. With the uncertainty as to the persistency of a given deposit, the phosphate is not, as a rule, followed below water level. It will be understood that the writer is endeavouring to represent the condition of things in what is generally thought of as the Florida phosphate field, i e., the "hard rock" region. The pebble region, which, by the way, is developing more satisfactorily than the rock phosphate, is susceptible of more systematic treatment; but even here the necessity is recognized for the greatest skill in selecting only here and there a property which may be profitably worked. After the usual primitive and careless methods of effecting sales characteristic of a new mining region, have had time for teaching their costly lessons, it might be expected that the financial results would be as good as the condition of demand and supply could possibly warrant. But there is general doubt as to whether this condition has been realized. It is confidently asserted by producers in the best position to judge that the price should be nearly double that which is now realized, and further, that the foreign manufacturers, who are the best customers for high grade phosphate rock, are perfectly willing to pay this high price provided they can be assured that all must pay it, and there is to be no great deviation in the price. The most evident policy which suggests itself, that of combination, still seems difficult to effect."

Mr. Titus Ulke, reporting to the United States Geological Survey, on the soapstone mine at Hewitt's, in North Carolina, says: "The mine is located on a hill side, from which the crude talc is lowered in a chute to a grinding mill having a capacity of from 8 to 10 tons per day of ten and a half hours. Most of the product is ground, but some block and pencil talc cut to order is also shipped. The blocks are usually 6 by 4 by 1 inch in size; the pencil talc is cut to about 4 by ¾ by ¼ inch sizes. During 1893 the mill was running continuously for about three months only. The pencil and block talc is shipped in cases according to the amounts ordered; the ground talc is packed in sacks of 220 pounds each. At the mill the crude talc is first passed through a 'rumble,' *i.e.*, a rotary screen, 6 feet long by 4 feet in diameter, which removes the dirt from the talc, and the dirt thus removed passes through longitudinal slits into a water spout which carries it away. The good talc remaining in the rumble is dumped into a car, from which it is fed into a buhrstone grinding mill. The ground material is then hoisted to the floor above and emptied into a silk bolting cylinder. The bolted talc is caught in a dust-collecting chamber, into which it is drawn by an interposed centrifugal fan. The fine white ground talc is finally sent to an automatic packer and filled into sacks, each holding 220 pounds.

Gouverneur, Saint Lawrence County, New York, continues to furnish the entire product of the fibrous variety of soapstone. This mineral is used almost exclusively as a filler in the manufacture of medium grades of paper, a small amount being used in making dynamite. The product in 1893 was 35,861 short tons, valued at $403,436, against 41,925 short tons, worth $472,485, in 1892. The year of largest production was in 1891, when an output of 53,925 short tons, valued at $493,068, was reported. At the beginning of 1893 prospects were bright for a good year's business, and until the first of June the production was about equal to that of the first five months of 1892. After the first of June, however, the demand fell off, and while prices were fairly well maintained, the amount of business for the rest of the year was about 75 per cent. of that of the preceding year.

An American inventor has devised a machine for making gas for illuminating purposes out of wood instead of coal. The machinery is said to be very simple, consisting merely of a retort and purifying chamber, with a tank for holding the gas. It is claimed that the machine can be used for domestic purposes, and that by attaching it to an ordinary cooking stove enough gas to last a day can be made by the fire necessary to do the cooking. We would rather not make any remarks about this machine. We have not seen it ourselves and we don't know anybody who has.

Robert Archibald, C. & M. E.

Canada Coals & Railway Company.

ONTARIO MINING INSTITUTE.

Federation Endorsed—The Nationalization of Mines—Ontario's Cement, Brick and Building Material Production—Successful Meeting of the new Ontario Institute.

The Ontario Mining Institute, organized in April last, held its first meeting for the reading and discussion of papers in Toronto, on Wednesday and Thursday, 12th and 13th September, and notwithstanding many drawbacks, notably the attractions of "Fair" week and bad weather, was eminently successful. The sessions were held in the commodious Private Bills Committee Room at the Parliament Buildings, kindly placed at the disposal of the Institute by the Government. The proceedings opened on Wednesday afternoon, Mr. James Conmee, of Port Arthur, President, in the chair. There were present: Messrs. J. J. Kingsmill, Q.C., Toronto; J. McAree, D.L.S., Toronto; A. Blue, Director of Mines, Toronto; J. Bawden, Kingston; Prof. Nichol, Kingston; T. D. Ledyard, Toronto; J. H. Chewitt, B.A. Sc., Toronto; Edgar J. Jarvis, Toronto; R. W. Prittie, Toronto; Dr. A. P. Coleman, School of Practical Science, Toronto; B. J. Townsend, Toronto; J. M. Clarke, Toronto; J. F. Latimer, Toronto; Dr. Burwash, School of Science, Toronto; L. A. Morrison, Toronto; Fred W. Gray, Guelph, Ont.; T. W. Gibson, Toronto; B. T. A. Bell, Ottawa, and others.

Election of Members.

The following were elected members:

R. W. Leonard, C.E., Kingston,	James Pearson, Toronto,
F. Hille, M.E., Port Arthur,	Dr. Burwash, Toronto,
J. N. Glidden, Sudbury,	J. H. Chewitt, B.A. Sc., Toronto,
Jas. McArthur, Sudbury,	H. L. Hime, Toronto,
J. F. Whitson, Toronto,	Alfred Willson, Toronto,
Henry Totten, Toronto,	G. B. Kirkpatrick, Toronto,
A. Slaght, Waterford,	Prof. C. Gordon Richardson, Toronto,
Fred W. Gray, Guelph,	Aubrey White, Toronto.

Reports of Council.

THE SECRETAY reported that in accordance with resolution passed at last meeting he had issued a circular letter inviting all in any way interested in mining in Ontario to become members, and that the response had been satisfactory. The membership at date was about 70.

THE TREASURER submitted a statement of the affairs of the Association, showing a balance on hand of $40.60, with a large number of subscriptions outstanding.

MR. A. BLUE reported that the Committee appointed to consider the question of a seal had approved of a design, but as Mr. Merritt, who had it, was out of town, the matter had better stand until next meeting.

The Canadian Mining Institute.

MR B. T. A. BELL At a meeting held in Sydney, Cape Breton, on 12th July last, the Mining Society of Nova Scotia and the General Mining Association of the Province of Quebec resolved to federate into an organisation to be known as the Canadian Mining Institute. A resolution was also adopted inviting the Ontario Mining Institute to join in the federation, and asking that the president and a committee of three members be appointed to act in conjunction with a similar committee of each of the other organizations for the purpose of drafting a suitable constitution.

MR. A. BLUE What is the object of the federation?

MR. B. T. A. BELL Mainly the publication of a volume of Transactions, which would contain the papers read before all the societies in the organization. Such a federation would also place the mining men in a stronger position in such matters as Dominion legislation. I have therefore much pleasure in moving that the Ontario Mining Institute is in favor of a federation of existing Canadian mining associations, and that Messrs. J. J. Kingsmill, W. Hamilton Merritt, A. Blue and T. W. Gibson be a committee to confer with the representatives of the Mining Society of Nova Scotia and the General Mining Association of the Province of Quebec.

MR. J. J. KINGSMILL—Is there any association in British Columbia?

MR. B. T. A. BELL—Not yet, but I understand an endeavor is now being made by parties in Vancouver to organize.

MR. B. J. TOWNSEND I have just returned from British Columbia. Before I left there was some talk of the formation of an association. I second the motion.

The Chairman then put the motion, which was carried unanimously.

Incorporation Postponed.

MR J. J KINGSMILL submitted the following:

"The committee appointed to report upon the advisability of Incorporation beg leave to report that until after the question of federation is settled it would not be expedient to incorporate."

(Sgd) J. J. KINGSMILL.
J. M. CLARKE.

This was agreed to.

Motion to Amend Constitution.

MR. J. J. KINGSMILL gave notice of motion to amend Sections 6 and 7 of the Constitution and By-Laws by providing for the appointment of two auditors and defining their duties

The meeting then adjourned.

EVENING SESSION.

The members met at eight o'clock, the President in the chair.

The Nationalization of the Mineral Domain of Ontario.

MR. J. BAWDEN This subject presents itself to the consideration of the people of Ontario divested of much complexity which elsewhere surrounds it, such as the dangers of interference with vested interests, of disturbance to the channels of trade and industry, and of burdens to be undertaken for the expropriation of private property.

The Province is the nominal, though not the beneficial, owner of one of the most extensive mineral domains on the face of the globe, has no mining industry or trade that by any possibility can be injuriously affected by the operation of mines by a Provincial Department, and no vested interests belonging to individuals or to classes who may demur from such standpoint to the assumption by the Government of new functions. It is merely requisite to make the nominal an absolute ownership in order to nationalize our mining property.

It is not proposed to discuss the grounds upon which the Provincial Government have the right to operate mines. It is assumed that it is clothed with the legal right. The expediency of making this right active for the benefit of the people of to-day and of the centuries to come, will, it is hoped, not be disregarded by reason of any appearance of socialism it may wear, or be condemned without investigation because of any preconception as to what are the proper functions of government.

An advertisement of the Ontario Bureau of Mines published in an American periodical calls attention to the fact that the mineral domain of the Province extends 100 miles in width and 1,000 miles in length. It is not stated that ninety-nine per cent. of this area is mineralogically an unknown country; that from the mines already operated little beyond the mineral contents of an approximate one per cent. (1,000 square miles) of the territory can be certified. It is not stated that in proportion to the capital invested, mining has been less remunerative in Ontario than elsewhere—in great part due to lack of scientific knowledge, in part to long winters, magnificent distances, and corresponding cost of supplies and transportation. The history of the Montreal Mining Co. is a record of the folly of selling large tracts to land jobbers, who, by a pull on the Land Department obtained a patent right to induce the public to invest in chances—in other words to run the lottery business under the guise of an investment in mineral property. Happily this state of things has been closed out. But it is to be feared that Government may be induced by sectional clamor to do indirectly what it has declined to do directly. There is no reason why a solvent and honest government should sell any property without knowledge of its value. It is a violation of the great public trust committed to it, to offer valuable mines as premiums for the mere chances of discovery. It is cheap literature from the dust heaps of exploded political economy, to say that it is not the business of Government to discover mines. It is the duty of Government to know the most that can be practically learned of the resources entrusted to its administration, and it should, therefore, know as fully the value of a mineral range as of a timber limit, or of an area of agricultural land. Its knowledge should be intensive as well as extensive. The difference of cost in obtaining this knowledge as against the present system is no argument against the principle, that the Government of a great Province like ours should not encourage gambling in mining locations.

The operation of mines by the Government would seem to be expedient for the following reasons:—

1. That until it is undertaken there will always be pressure upon the Crown Lands Department to sell more mining land than there is an actual demand for, that is "actual" as opposed to merely "speculative" demand. The function of the Crown Land Department to survey such land and give title will be debauched, as it has been in time gone by for the purpose of enabling speculators to take advantage of the immoral cupidity of those who are ever ready to invest in hazardous chances; or for the purpose of enabling the buyers of such tracts to hold them against the anticipated demand, and thus rob future citizens of the equal rights they should have with citizens of to-day. The amount of money which has been turned from the lines of honest enterprise into this profitless channel is very great, and the consequent loss to the community very large.

2. It is obvious that the price of Ontario mineral land, ranging from $2 to $3 an acre, bears no relation whatever to its value. Where no mineral in paying quantity exists on the location, the price is grossly excessive, and the purchase is generally abandoned, with the result that it is tri-ennially sold for taxes, bought by lawyers and real estate speculators to be again sold, and it thus furnishes a fund for taxes which are never expended on its improvement. The kind of land thus alienated from the Crown domain has, by its patent, not any title to nobility conferred upon it, but on the contrary, each parcel serves the rascally purpose of a lottery ticket, for bringing to the Government or municipalities, money to which these bodies have no moral right, and out of the pocket of citizens to whom the Government of the country owes the common duty of protection from fraud. On the other hand, where mineral exists in paying quantities, the low price fixed by the Crown bears no relation to the value of the property. The object of the mine owner is to get the greatest possible output with the least possible expense, and by no method can he add to the original value of the mine, except by that of inducing the public to build railroads and other facilities for improving the value of the minerals. Crown timber land is occasionally sold for ten times the price per acre of mineral land, but even this is a small price in comparison with the value of an iron mine, for example, which within an area of 10 acres may turn out one million tons of iron ore, the royalty on which, at a minimum charge of 10 cents a ton, would be $100,000.

3. Due regard for the development of the mineral wealth of Ontario requires measures for the education and prosperity of a body of skilled miners, who should have fair wages, comfortable dwellings, means of obtaining provisions and clothing at fair prices, and insurance for their families against loss of life and limb. There is nothing under the present conditions of mining enterprise which calls for any expenditure on the part of the mine owner likely to benefit the locality of the mine. The hovels of miners in the vicinity of some Canadian mines are a disgrace to our so-called mining enterprise. Food supplies are generally brought in from a distance, and nearby gardening or farming meets with no encouragement. The population is migratory, and employment precarious—dependent quite as much, or more, on the financial management of the concern as upon the supply of ore. As a consequence, mining villages as they now exist in this country, and in the United States, furnish a strong argument for the state ownership of mines, if the welfare of the laborer is, as it should be, of more intrinsic value than the dividends of mining companies. If the enterprise of this country shall be so enfranchised by law and endowed from the public domain that it shall be able to maintain that the right to a maximum dividend involves the subjection of the miner to the minimum of comfort, our political life will require to be reconstructed at no little expense, probably of blood as well as of treasure. The most dangerous critics of the legislation of to-day are the social forces growing daily in strength and intelligence.

4. The mineral domain of this Province cannot be safely given over to iron barons and silver kings, or great syndicates. The "writing on the wall" condemns all such proprietorship. If the mineral industry of the United States has ministered to the upbuilding of great fortunes, to the enrichment of men who buy American senators like hirelings—men whose patriotism so nerves them that they turn not a hair while their mills roll out rotten steel for the nation's steel-clad cruisers—all this comes, not from the incorrigible corruption of human nature, but from a system of administration of state lands essentially corrupt and vicious.

What are a century or two in the life of a nation? If American enterprise has gained a present empirical success by the disregard of every duty owed from the legislators and administrators of to-day to the citizens of the future, there are not wanting those among her sons who condemn the gross breaches of trust, the shameless brazen fraud and corruption of state and federal legislatures in dealing with the public lands. It becomes those who would see planted in this country the foundations of a higher civilization and more durable progress than any existing in the United States, to investigate the all-important subject of the best system of administration of the resources of the Crown domain for the benefit of the people of this Province.

5. One condition has followed the development of the iron mines of Minnesota and Wisconsin, and in some degree the exploration for minerals in Ontario, which will

assuredly affect, as a growing evil, mining enterprises as now conducted in the western and northern districts in this Province, and that is, the rapid destruction of the forest. The construction of the Canadian Pacific Railway was attended with no protection of the forest in the public interest, with the inevitable result of the destruction of an enormous area of timber between the Ottawa River and Rat Portage. The residue within ten miles or more of the road is for the most part of little intrinsic value save as a protection to future growth and the possible re-foresting of portions of the burnt area. This gives the small timber which the prospector and miner will destroy by the square league for every camp fire, an extraneous but not inconsiderable value. No act of greater folly could be perpetrated than to allow prospectors to roam over the silent leagues of virgin forest which yet grow like islands in many of the rocky wastes of Thunder Bay and other districts,—each prospector necessarily the means of spreading fire far and wide, irresponsible and unwatched, unpunished for criminal neglgence and tolerated as a necessary, and perhaps, welcome evil, with a degree of fatalism akin to imbecility. Not protect our forests against wholesale arson? Has it come to this, that we say this cannot be done?

Prof. Coleman's description, in recent issues of the *Globe* newspaper, of his own experiences while on a survey for the Government, the recent extensive forest fires in Wisconsin and Minnesota, and the great destruction of timber which has followed "prospecting" operations in Eastern Ontario, are warnings which should not be lightly considered. It must be kept in mind that there is no measure to the calamity we incur by the neglect of safeguards against the destruction of the forest. It is neither impossible nor improbable that the Minnesota horrors of this year may be visited on this Province with tenfold fury as the natural consequence of prospectors' camp fires.

6. The scientific and economical extraction of ores under Government management will afford supplies for all metallurgical industries required, or capable of being profitably maintained, in this country, and there is no doubt the ores can in many cases be profitably sold, and yet at prices which will offer bounties to the home metal manufacturer. The extensive use of lead pipe and of other manufactures of lead, afford a good home market which should be supplied from native sources, but which is not likely to be so for a long time to come, while pig lead cannot be purchased as cheaply here as in the United States. In view of the wide distribution of lead-bearing lodes, some also rich in silver, in various parts of the Province, there is ample reason why an effort should be made to develop and mine them. The growing demand for copper for electric purposes, and the presence of the ore in various forms in the Lake Superior district are facts which, under ordinary circumstances, would concur to promote mining enterprise. We are confronted by the fact that powerful corporations control the copper market, and that there never was a time when there existed so little encouragement to the private investor to enter into copper mining enterprise as is the case to-day. The Provincial Government have it in their power to enter into such enterprises with an entire freedom from risks and expenses from which no individual investor is safe. The cost of promoting companies and raising the capital required is usually one-third, or 33 per cent. The individual is never safe against the misrepresentation of promoters, whereas the Government can employ permanently the most careful experts and competent engineers, and in their permanent employment secure a guarantee of fidelity. The Government will have in its domain the most ample choice of location and the uttermost exemption from the influence of self-interest in its operations, and may under these favorable conditions put copper, lead and other ores into the market at prices which will ensure the establishment of great metallurgical industries in this Province. Last Session, $25,000 a year for 5 years was voted to enable the iron smelter to get his ore as cheap as in the United States. This money is as likely to go into into the pockets of speculators as into those of the mine owner or smelter. It would keep 25 men employed the year round at the iron mines in Thunder Bay district, and a similar number in Frontenac or Hastings, whose output should be 25,000 tons of ore or the entire amount of the bounty. Now if the Government could sell a good 50 per cent. ore at $1 a ton, no better aid could be offered to those who would engage in smelting enterprise.

7. The acquisition of a large yearly revenue by the development and operation of silver, and especially of gold mines, becomes a necessity in the presence of the ever recurring and justifiable demands upon the Government for money for works of permanent utility, and for our rapidly growing educational requirements. Their operation by individuals or corporations will bring in no such results. In fact it is quite possible and extremely probable that mining companies will, under the present state of things, be organized to work frontier properties whose royalties and other returns will scarce pay the expense of collection together with the necessary Provincial expenses, whose machinery will be brought in duty free, whose agricultural supplies will necessarily be brought in from the United States, whose laborers will be chiefly foreigners, whose earnings and savings will benefit the United States alone, where the enriched mine owners will also spend their dividends. With more or less modification, this is likely to be the case with the greater part of the gold mining property in the Rainy River and Thunder Bay districts. I am well aware there are doctrinaires and professors, as well as brokers and commission agents, who will tell us that this state of things will enrich the country and that to hinder it will violate the principles of political economy. By all means then let us have instead another system of economy, under which this commonwealth of Ontario shall build the best school houses and raise the best men on this planet, with the help of the revenue to be won from the public mines.

The following draft of a bill for the establishment of a Department of Mines, and with various provisions respecting the management of public mines, are presented as suggestive merely, and not by any means as comprehensive of all the legislation required by the policy proposed:—

BILL.

An Act to establish a Department of Mines for the administration and management of the mineral property of the Province.

Her Majesty by and with the consent of the Legislature of the Province of Ontario enacts as follows:

CLAUSES RELATING TO THE DEPARTMENT OF MINES.

1. No lease or sale shall hereafter be made of any mining location or of the right to mine in the public lands.

2. There shall be a Department of Mines under the control of the Commissioner of Mines, who shall be a member of the Executive Council of Ontario.

3. The Department of Mines shall be composed of the said Commissioner and an Advisory Board of four mining engineers with a Financial Director, whose duty shall be to employ competent surveyors, explorers, mining captains and workmen for the public mines; to direct where such mines shall be opened and worked; to purchase machinery, mining equipment, supplies for miners, erect buildings, and engage in every undertaking requisite for the successful working of any mine; to operate diamond drills for exploratory purposes; to conduct any works for the dressing and concentration of ores, and for the reduction of gold and silver, and to sell such ores other than those of gold and silver at such times and at such prices as may be fixed by the Lieutenant-Governor in Council.

3. The sale of gold and silver bullion shall be made during the session of Parliament upon the report of the Commissioner of Mines as to the value thereof.

4. The Department shall erect and manage such works for milling, roasting, concentrating, and otherwise treating and smelting gold and silver ores as may be found expedient, having regard in such erection to facilities for private mining undertakings on such terms as may be just.

5. The Mining Engineers who shall with a Financial Director compose the said Advisory Board, shall be appointed by the Lieutenant-Governor in Council after investigation as to their fitness and special experience, and one such mining engineer shall be appointed to the charge of the following four divisions of mining operations respectiveiy, viz.: Gold mines, silver and lead mines, copper and nickel mines, iron mines.

6. There shall be borrowed on the credit of the Province the sum of one million of dollars, which shall with any premium thereon constitute the Ontario Mining Fund, the repayment of which with interest shall be a charge upon the profits from the Provincial mines, to be paid in such manner and at such times as may be ordered by the Lieutenant-Governor in Council.

7. The management and investment of said fund, payments therefrom for all mining works, salaries and wages, and the disposal of accretions from sales and profits shall be under the charge of the Financial Director of the Department, but sub ect to the control of the Commissioner and the engineering members of the Advisory Board. And the Financial Director shall prepare a yearly statement of the condition of the mining fund and of the receipts and expenditures of the Department for submission to the Legislature with the report of the Commissioner.

8. Rules for the order of business in the Department of Mines, for the management of expenditures and for the audit of accounts, shall be submitted for the approval of the Lieutenant-Governor in Council, and on such approval shall have the force of statutory enactment.

9. Two per cent. of the mining fund shall be set apart as a reserve for the insurance of miners and workmen while engaged in Provincial mines against loss of life, illness or bodily injury, and every miner and workman shall pay out of his wages such weekly per centage as may be found requisite for securing to the family of such miner or workman insurance in case of death, illness or accident.

10. The Department may accept the surrender to the Crown of any land heretofore sold as mineral land on repayment by the Crown of the purchase money paid therefor with cost of survey, and may purchase any mining locations at tax sale. But the expenditure under this provision shall not exceed the sum of $50,000.

CLAUSES RELATING TO THE MANAGEMENT OF PROVINCIAL MINES.

11. No quantity in excess of 50,000 tons of iron ore shall be exported in any year, and iron mining operations shall be so conducted that not more than two years' consumption for the furnaces of Ontario and Quebec shall be kept in stock.

12. No miner who is not a literate person, an adult, a subject of Her Majesty by birth or naturalization, and a resident of Ontario for one year preceding his engagement shall be employed in any of the public mines, but this shall not apply to Indians belonging to any reservation in the Province. No youth under 16 years of age shall be employed at any work under or above ground.

13. Miners, while engaged in the public mines, their wives and families, shall be afforded the means of procuring groceries, provisions and necessary clothing at an advance of 2½ per cent. on the cost thereof laid down at the miner's dwellings, and no officer or workmen engaged in any public mine shall sell goods on his own account or for other persons, to any miner or other workmen in the public mines, on pain of dismissal; but nothing herein contained shall prevent the miners from carrying on a co-operative store for the supply of all kinds of commodities except ales, wines and spirituous liquors.

14. No license shall be granted for the sale of ales, wines and spirituous liquors in any part of the districts of Thunder Bay, Algoma, Rainy River and Nippissing, not under municipal organization, or in any municipality here after to be organized, in which any public mine is operated at the date of such organization.

15. Allotments of land not exceeding forty acres shall be leased in perpetuity to miners and workmen on condition of cultivation and at nominal rentals. Allotments shall be made with due regard to the quality of land available for the use of the miners and workmen at any mine.

In conclusion, let me emphasize the following matters for consideration:—

1. The enormous waste of capital in the organization of mining enterprises under the present system.

2. The losses incurred by mining enterprises through the lack of skill of mining engineers and miners and through financial stringency and mismanagement.

3. The wretched condition of miners, owing to the precarious and irregular method of conducting mining operations in this Province and the lack of insurance provision for loss of life, or bodily injury or sickness.

4. The certain destruction of large areas of timber under the present system.

5. The great revenue which may be gained to the Province by well directed mining operations in gold and silver mines, and the necessity for this revenue to meet the growing demands of our educational system and other requirements of advancing civilization.

6. The incalculable importance of affording to smelters and manufacturers of metals, a cheap and steady supply of raw material, such as, iron, copper, nickel and lead ores, at prices which, while affording a moderate profit to the Province, will practically extend a bounty to smelters.

NOTE—The reporters having published that the foregoing paper advocated the operation of public mines by day labor, and with the object of providing employment rather than of making a profit out of the industry: it is hardly necessary to say that I hold no such opinion, but the explanation is due that by "a moderate profit to the Province," I mean not less than ten per cent. Mining profits, frequently large, are generally anticipated by the prospector and broker to such a degree that a 25 per cent. dividend-paying mine would return 50 per cent. but for the price paid for its discovery and the cost of raising working capital. If iron, copper and nickel ores shall be economically mined and offered to smelters at a profit of merely 10 per cent. the result will transcend the influence of tariffs or direct bounties for manufacture. The views of President Cleveland on the value of cheap raw materials to manufacturers have no need of advocacy, as they are self-evident truths. To prevent other misconception, let me add that while the acquisition of a net yearly public revenue of ten millions of dollars from gold, silver and other mines seems to be quite practicable, there will be always less danger of excessive expansion of the mineral industry, and the creation of a too powerful mining interest under the system proposed than under private ownership. Once the Government enters upon the usufructuary ownership of the public mineral domain there will be less danger of the mining interest owning the legislature than now. There is no security given us that the existing legislation relating to mining land will be permanent. Once the public get a taste of the advantages of a large revenue from mines, it is not likely they will destroy its source by turning it over to private ownership.

The following extract from the advertisement above referred to of the Ontario Bureau of Mines, is from the advertising pages of *Mineral Industry*, published by the New York *Engineering and Mining Journal*. Although "further information" to be

had from the Department is also advertised, there is nothing to indicate in the advertisemant that "sale" and "right of purchase" carry with either only a conditional fee simple:—

"Ontario's great mineral fields; an extent of 100,000 square miles. Prospectors, miners and capitalists are invited to the great mineral fields of Ontario, in Canada. The most promising ground on the continent for exploration and investment. The Province of Ontario has a mineral bearing belt 100 miles in breadth by 1,000 miles in length, lying north of the great lakes from the St. Lawaence and Ottawa rivers to the Lake of the Woods. Nickel, iron, antimony, apatite, mica, copper, gold, galena, actinolite, talc, cobalt, silver, zinc, asbestos, plumbago, etc. Thousands of square miles of virgin ground for the prospector in the minaral bearing formations, more easily reached by lake or railway than any other mineral district of the continent. Important discoveries made every season. Careful and intelligent exploration amply rewarded. The attention of miners and capitalists in America and Europe is invited. Mineral lands are sold by the Government at $2 to $3.50 per acre, or leased with right of purchase at from 60 cents to $1 per acre first year, and 15 to 25 cents for subsequent years. The first year's rental allowed as part of the purchase money."

DISCUSSION.

DR. A. P. COLEMAN remarked that the paper contained the most revolutionary set of ideas he had heard given in a public way for a long time. There were cases in Saxony, Norway and elsewhere, of mines being worked by the state, the object being more to ensure employment for workmen than to make a profit. He was not aware that any of these mines were now earning a dividend. His own inclinations were towards individualism, while the paper certainly looked a good deal like communism. Communism, however, might not be a bad thing in itself, and the tendency of modern legislation was certainly in that direction. There were some of the ideas in the paper, such as the prevention of private enterprise, which struck him as being objectionable, and he should like time for consideration before expressing a full opinion upon it.

MR. A. BLUE said there undoubtedly was an air of communism about the paper, but he was not sure that it was any the worse because of that. He doubted, however, whether any government could get efficient labor out of the large number of men who would doubtless be employed in the future in the mining industry of Ontario. What government could manage 100,000 or 500,000 men so employed, with any hope of securing proper service? The existence of so vast a body of voters dependent on the goodwill of the Government would constitute a serious menace to the liberties of the country. Under such circumstances a government would be able to practically perpetuate itself in office by reason of the influence it could bring to bear upon the men in its employ. All the evils of centralization on a gigantic scale would be the result upon the adoption of the plan Mr. Bawden proposed. In his opinion the chief, if not the only, method by which a government can properly aid an industry, is by giving those engaged in it information.

MR. JAMES CONMEE thought it was sound doctrine that the less people were governed the better they were governed. There were certain evils which the paper just read had only disclosed: waste of energy, misdirection of capital, etc., but he did not agree that Mr. Bawden had proposed the only remedy. There were others. He was not prepared to see so much power placed in the hands of any set of men, no matter what their politics might be. They had had Curran bridges—they might have Curran mines. (Laughter.)

MR. B. T. A. BELL suggested that as the paper covered a good deal of ground, it would be better if the discussion upon it was adjourned until next meeting, when members would be more fully prepared.

MR. T. W. GIBSON expressed his preference for individualism as opposed to communism. If the incentive to enterprise, industry and thrift which enlightened self-interest supplied, were taken away, what were they going to substitute? Men engaged in mining, as in any other occupation, in the hope of profit, and all the immense development which had taken place in the mineral industry of Great Britain, the United States and other countries had been the fruit of striving for gain. He feared that government control and initiative would prove far less effective in securing progress than private effort had been.

It being agreed to adjourn the discussion, Mr. Bawden briefly replied to the objections raised to his paper, after which a vote of thanks was passed to him for the same.

The Utility and Value of Some Common Minerals.

MR. A. BLUE—Five or six years ago a young man came to this city from one of our finished country villages to seek an occupation which might afford larger scope for his energies than the little annex farm at home appeared to promise. He took counsel with one or two friends, and after the merits of a number of projects were discussed, the general conclusion was reached that no business was as sure or safe as one which undertook to supply the common and everyday wants of the people. Food, clothing, and shelter, are necessaries of life, and whatever else man in a civilized state may do without, he cannot, or will not, dispense with these. Our young man had been a producer of foods on a small scale, and naturally he inclined to keep on in that line of business. But his heart was set on a specialty, and so he decided to establish a dairy farm and supply the city with milk. He reasoned in this way: "Every family in the city wants milk, and wants it every day. Being a cheap and nutritive food, and, for children especially, an almost complete diet; many people will buy as much as they require, and the poorer classes as much as they can afford. I am therefore sure of customers if I can supply a good, wholesome article, and the cash will come in as the milk goes out." This young man was wise enough to learn his trade in a well managed dairy before starting on his own account; but it was only a matter of a few months, and he began right. To-day he sells in the city the milk of nearly 150 cows, he has one of the cleanest and best equipped dairies in the province, and he is worth $25,000.

The story illustrates the wisdom of selecting a business that deals with the steady wants of the people, and while intelligence and diligence cannot be dispensed with in any calling, it is worth a good deal to remember that progress is always easiest along the lines of least resistance. Under some circumstances a business runs itself, to use a common phrase; under others it requires a vast expenditure of force and oil, and often then it fails. But many persons are so constituted that they have no pleasure in what are called the meaner pursuits of life. Nothing has a charm for them but to undertake the difficult or the impossible, wherein to succeed is glory and perchance a fortune, and wherein to fail is loss and disappointment without it may be, a compensating grain of gathered wisdom.

The two most abundant minerals in this country are clay and lime, and they are likewise among the most useful. They furnish the raw material too for mineral industries of the first importance, in which a large amount of capital and many laborers are employed. Yet in the vulgar opinion, clay and lime are not worthy of being called minerals, and the seekers after gold, silver, copper, nickel and iron would scorn to recognize the workers in clay and lime as fellow-miners. I think it will not be hard to show, however, that these very common minerals possess a value not in any degree inferior to the metals, and that they are deserving of much greater attention than they have yet received in this country, at the hands of moneyed men, and men of the best technical training in the mineral industries. But let it be premised, that in this paper lime (using the term in its colloquial sense) will be dealt with only as material for the production of cements.

As to the extent and growth of the industries, information is afforded by the census reports of the Dominion Government. But for comparative records we can only go back to 1881; no account was taken of cements in the Censuses preceding the one for that year, and the earlier statistics of the brick industry are of no use in showing its growth.

The statistics of the two industries in Canada and the Province of Ontario respectively, are given in the following table for the years 1880 and 1890:—

	CANADA.		ONTARIO.	
	1880	1890	1880	1890
CEMENT:				
No. establishments..	9	19	3	12
Hands employed	115	243	29	128
Wages paid.....	$38,151	$85,960	$7,000	$39,245
Value of product.....	91,658	251,175	29,200	153,400
BRICK AND TILE:				
No. establishments....	560	697	400	463
Hands employed	4,129	6,737	2,768	3,791
Wages paid	$608,690	$1,428,489	$405,311	$797,257
Value of product	1,541,892	3,584,713	971,158	2,154,152

The noticeable feature in these statistics is the large share Ontario claims in the progress of the ten years. Ten new cement establishments were added, and all but one are credited to Ontario. The number of hands employed by the industry increased by 128, and all but 29 are returned for Ontario works. The amount paid for wages was greater in 1890 than in 1880, by $47,809, and two-thirds of it was earned in Ontario. The increase in the value of product was $159,517, and three-fourths of it belonged to Ontario. The progress of our Province in the manufacture of brick and tile was less conspicuous in the decade, although in number of works, employees, wages and value of output, she exceeds all the other provinces combined. In the increase of works from 1880 to 1890, her share was 63 out of 137; of workmen employed it was 1,023 out of 2,608; of wages paid for labor it was $391,946 out of $819,799, and of value of articles produced it was $1,182,994 out of $2,042,821.

But assuming the absolute accuracy of the figures, there is one aspect of them which arrests attention, viz. the relativity of the cost of labor to the value of product in Ontario and the other provinces. For the whole Dominion, in 1880, the ratio of labor to product was 1 . 2.53, and in 1890 it was 1 : 2.50—a proportion which everyone would be disposed to accept as likely. For Ontario, however, the ratios of labor to product were 1 . 2.40 and 1 : 2.70 for the former and latter years respectively, while for the other provinces they were 1 : 2.95 and 1 : 2.27. The use of improved machinery would account for this disparity to some extent, although not wholly. So also would fluctuations in the price or the efficiency of labor. The latter cause can be dismissed as improbable, in view of the proximity of the provinces; and while the former might flatter our vanity, it would, in view of all the circumstances, be fatuous, to claim for it more than a very modest share of potency in the radical disturbance of ratios. The real cause will probably be found in the different scales of values adopted in different parts of the country, and it is to be regretted that in the Census enumerations account was not taken of quantity as well as of value.

In the statistics collected by the Bureau of Mines last year, the manufacturers of cement in Ontario, gave the value of their product as $127,415, while the number of workmen they employed was 224, and the amount of wages paid for labor $60,208. Their product included 74,353 barrels of natural rock and 31,924 barrels of Portland cement. In 1890 there was no Portland cement made in our province; yet the value of cement manufactured that year according to the census was greater than last year by $25,985, while the number of workmen employed was less by 96, and the wages paid for labor less by $20,963. Had we the output for the Census year in quantity, the cause of the discrepancy would more clearly appear. The Bureau's returns of brick and tile for 1893 are also much lower in value than those of the census for 1890, but this is no doubt due to the fact that the financial stringency of last year caused many works to close down early in the season, while others were idle the whole year. The number of men employed was 2,874, the amount paid for wages $531,686, and the value of product $1,339,873—the ratio of labor to product being 1 : 2.52.

It has been shown that on the basis of values the manufacture of cement in Canada increased from $91,658 in 1880 to $251,175 in 1890. The whole of this product was consumed in the country, but it was far from supplying our needs. In the fiscal year 1880-1 we imported hydraulic, Roman and Portland cements to the value of $53,765, and in 1890-1 to the value of $313,690. But since the fiscal year 1886-7 the Trades Tables give us the quantity as well as the value of cements imported, and they show that the demand has been largely on the increase. The following table gives our imports of Portland and Roman cements for each of the seven fiscal years 1886-93, the great bulk of which was the Portland variety:—

YEAR.	BARRELS.	$
1886-7.....	102,750	148,054
1887-8.....	122,402	177,158
1888-9...	122,273	179,406
1889-90.....	192,322	313,572
1890-1.....	183,728	304,648
1891-2.....	187,233	281,553
1892-3.....	229,492	316,179

The total importation in the seven years was 1,140,200 barrels, valued in the Trade Tables at $1,720,570; but to this should be added the $455,445 of Customs dues paid to the Government, the costs of freight and insurance and the profits of im-

porters, in reckoning the price paid by the consumers—an aggregate of not less than $3,250,000. In these seven years the increase in quantity was 123 per cent., and in value 113 per cent. But a more striking evidence of the growing demand is afforded by a comparison of the imports of Portland and Roman cements for 1880-81 and 1892-93. In the former year their value was only $45,646, and in the latter it was $316,179, being an increase of nearly 600 per cent. in twelve years. This is a rate that perhaps has not been equalled in any other article of Canadian importation. What is the secret of it, and is the demand likely to be maintained?

The answer to these questions may be summed up in a very significant term of very modern usuage on this continent, viz., good roads. The setting in of the era of good roads in this country, as well as in the United States, does not date back ten years, but in that short period much has been learned on the subject, and the street engineer is now as much of a specialist and quite as useful in his way as the military engineer or the mining engineer. The Roman roads of Europe, which have lasted out the traffic of two thousand years, have taught him the invaluable lesson that the only sure way to make a good road is to lay a good and strong foundation. But instead of using stone material, as the Romans did in constructing their great military roads, he has adopted the concrete used by them in the construction of temples and other public buildings, some of whose walls have been standing 2,400 years. The great dome built by Agrippa, the friend of Augustus, "the immortal monument of the Pantheon," as Gibbon described it—now the church of Santa Maria della Rotonda—is an edifice in concrete, and though ravaged by fire and assaulted by the Huns and Goths, it is still intact after more than 1,900 years. Concrete is the street engineer's material for street building, and his chief reliance in the making of it is not Roman or any other kind of natural cement, but the stronger and more durable Portland. In Toronto during the last five years not less than 150,000 barrels of cement have been used in making concrete for street construction, and of this quantity Mr. Rust tells me that not more than 4,000 barrels have been the native hydraulic cement. "Up to the last year or two," he says, 'it was all imported Portland cement from Europe." In other towns and cities of the Dominion cement is also being used in steadily increasing quantities in building sewers and streets, and the results are so uniformly good that the material promises to grow steadily in favor. It is almost certain then that for many years yet to come the demand for Portland cement will continue as experience proves the utility and permanency of the concrete roadbed.

But why should we remain dependent on foreign sources of supply for Portland cement? We have in Ontario abundance of raw material for producing it. In scores of localities beds of white shell marl of large extent and excellent quality are found, some of them at the bottom of lakes in which myriads of fresh water shells yet survive, to add to the thickness of the deposit as one generation follows another, others of them on the sites of lakes long ago filled up with peaty mould or drained by continual elevations. This marl, if unmixed with sand, clay, peat, or other matter of mineral or vegetable origin, is almost pure carbonate of lime, and furnishes the principal material for the manufacture of Portland cement. The necessary proportion of clay is a matter of experiment, but in all cases the purer and more uniform the quality of the marl, the easier it is to get a right mixture. Our manufacturers in Ontario have acquired their experience slowly and dearly.

Mr. Rathbun told me that it cost him five years of testing, with the aid of a chemist, before he was convinced that it would be safe to start his works. Mr. Butchart also told me that it cost his company several thousands of dollars, a visit to some of the best Portland cement works in England—where he was admitted as a special favor—and the service of two experts in the construction of a suitable plant, before they could produce a commercial article. But the Rathbun Company and the Owen Sound Company have succeeded, and during the last two years they have been producing a Portland cement which satisfies every requirement.

Mr. C. H. Rust, Deputy City Engineer of Toronto, makes this statement concerning it, in a letter which I have just received from him:

"Since 1892 we have used a quantity of Portland cement made by the Rathbun Co. at Napanee mills, and by the Owen Sound Co. at Shallow Lake. Both these brands are quite equal to the majority of the imported cements, and no doubt, when their facilities for manufacturing are increased nearly all the cement used in this city will be of home manufacture."

The Owen Sound Co. has recently had the misfortune to lose its mill by fire, but it is understood that a new one is in course of erection. The company has a large supply of raw material alongside of the works, suitable clay for mixing being found immediately below the marl, and doubtless the capacity of the new mill will be made to meet the growing requirements of the trade.

The only other Portland cement works in the Province are at Marlbank in the County of Hastings. The site was chosen because of its nearness to a very large deposit of marl; but although English capital was put into the business, and presumably English experience also, the enterprise had to pass through the usual ordeal of disappointment and delay before a successful beginning was made.

The output of those three mills last year was 31,924 barrels, but one of them did not start until late in the season, and another worked only half the year. Had their capacity been six times as great they could hardly have supplied the quantity of Portland cement imported by Canada during the fiscal year 1892-3, and obviously therefore there is ample room for home manufacture to grow. With raw material so abundant and accessible, and with capital seeking new channels of investment, and labor seeking employment, why should we not produce in the country all the Portland cement that our market requires. An article of uniform quality will always be in request by customers, and with care on the part of the manufacturer there is no reason why he should not be successful in supplying a distinct brand. But as long as we are dependent on foreign makers we cannot hope to be supplied with cement of uniform quality, for where large orders have to be filled it is the common practice even of large mill owners to buy lots from other manufacturers and so make a prompt shipment. The result is that there are as many brands as makers, and with cements of different qualities, some quick setting and some slow setting, it is hardly possible to make a first-rate concrete. This is a risk which may easily be avoided if orders are placed at home, with the home manufacturer, and the good results obtained from our Ontario cements are no doubt due to the fact that orders are honestly made up, each manufacturer being jealous of his own reputation.

As regards the products of clay, it is not necessary that much should be said. Taking the various articles of common and pressed bricks, terra cotta, tile, sewer pipe, and pottery, the number of men employed in their manufacture in Ontario last year was 3,109, with earnings of $601,686. The aggregate value of their products was $1,684,873, or more than one-fourth of all the mineral products of the Province in the same year. This fact alone suffices to prove the importance of our clay industries; yet it is obvious that they are capable of greater development. The manufacture of pressed brick and terra cotta began here only five years ago, and last year, in spite of the collapse in the building trade, the value of the output of six works was $217,373. It gave employment to 224 workmen and paid them wages to the amount of $80,686. The improvement already noticeable in the architecture of our cities as a consequence of the use of pressed brick and terra cotta is bringing this material fast into favor, and it may be said that the earth affords no better building material than a properly burnt brick, and none which so readily lends itself to the production of handsome architectural effects. In the strong and fine-textured shales of our Hudson river and Medina formations, conveniently situated and easily quarried, Ontario is favored above most Provinces and States in America.

The same shales are also found to be suitable for the manufacture of sewer pipe, with proper mixtures, and last year the output of two establishments employed in this industry was $230,000.

Another clay industry is now on the eve of commencement, and if successfully established it promises to be a great boon to our towns and cities, viz: the manufacture of vitrified brick for street paving. In Ohio, Illinois, Iowa and other American States this has now grown to be a very important industry, and it is supplying a material for street construction which on all points of merit is not equalled by any other material hitherto employed for the purpose. Many mistakes were committed by the first makers of paving brick, and there is much yet to be learned as to the clays or clay mixtures which give the best results, as well as to the proper degree and duration of heat to produce a hard, tough and impervious brick. But much is already known, and with careful experiments and close observation many works are enabled to produce with regularity a high percentage of paving brick of uniform quality from every charge of a kiln. A number of experiments have recently been made in Toronto, Hamilton and elsewhere in this Province, and although each expert will assure you that he alone knows the secret, and that no one else has the clays for a right mixture but himself, you may rest assured that in a matter of this sort the key and the ward are not so hard to match as the tribe of experts would have you believe. In several instances encouraging progress has been made, especially with the Medina and Hudson River shales.

We may, therefore, I think, look with confidence to an early beginning of the production of paving brick in Ontario; and when that time comes we shall be no longer at the mercy of trust concerns like the owners of Pitch Lake asphalt, as illustrated the other day in the case of a contract for paving in the city of Hamilton. When we are producing Portland cement from our own shell marls and clays to the full extent in which it is required for street concrete, and paving brick from our own shales to cover the concrete, we shall be as independent as we ought to be in supplying ourselves with the materials of such everyday requirements as are called for in the building of good roads. In so doing also, we shall be utilizing our raw materials of clay and lime, otherwise of no value, finding profitable investment for capital lying idle in the banks, and giving employment to hundreds, if not thousands, of men who for lack of work to do are finding it hard to win their daily bread.

With one suggestion to the professors and instructors in the School of Practical Science, Toronto, and the School of Mining, Kingston, I close. Reference has been made to the experiments conducted by the manufacturers of brick and cement, preliminary to the building of works to commence production on a commercial scale. These experiments demand patience, exactness and scientific method, as well as the use of costly appliances Why should they not be taken up in our technical schools, where there are professors having the necessary expert knowledge and training, and the appliances for making tests and ascertaining results with unerring accuracy? The importance of the clay industry has been so well recognized by the State Legislature of Ohio, that a course of practical and scientific instruction in the art of clay-making and ceramics has been added to the educational work of the State University, and the first term of the department opened yesterday. Work of that character is as much needed in Ontario as in Ohio, and the professors of our scientific schools cannot too soon prepare to enter upon it.

DISCUSSION.

MR. R. W. PRITTIE said he had been for a number of years interested in the brick industry, particularly in the manufacture of paving brick. This article was coming largely into use in the States, and he had seen pavements which had been down for 16, 18 and 20 years, with but little repairs. It was giving the utmost satisfaction, and made a superior pavement in every respect, being smooth, lasting, easily cleaned, and affording a good foothold for horses. He was interested in a large vitrified brick factory which had been started at the Humber, near Toronto, last year, and was got partially under way when the financial crash on the other side affected the enterprise and brought it temporarily to a stop. He hoped, however, that the operations would yet be begun. It was the company's intention to put up a plant capable of turning out 50 millions of brick per annum, and employing 400 men.

DR. A. P. COLEMAN, in reference to a remark in Mr. Blue's paper, thought it only fair to say on behalf of the School of Practical Science, that they had begun the work of testing cement, brick and similar materials. If provided with proper appliances, the authorities of the School were perfectly willing to engage even more extensively in such work.

MR. J. LATIMER asked if there had been any development in fire clay.

MR. BLUE—Not in Ontario.

MR. BELL—There are good deposits of fire clay in Nova Scotia, but they are not made use of.

MR. J. M. CLARKE said it was well known that the manufacture of articles like vitrified brick in Ontario had engaged the attention of outsiders more than of the people of the province. Outsiders were now investigating the subject with the view of beginning the manufacture of paving brick here.

The Rainy River Gold District.

DR. A. P. COLEMAN—Mr. Chairman, I have been unable to write out a paper as I promised to do, owing to the fact that I returned home from the trip I took this summer only yesterday at noon. In fact, I have hardly had time to throw my ideas into consecutive shape, and I must therefore ask your indulgence while I give you some rambling talk on the subject of the western gold fields of Ontario. As Mr. Blue has suggested, such humdrum things as clay and marl have no great attraction for ordinary men, and a brick of gold is looked on with a good deal more interest than even a brick made of the Don valley clay. Partly on this account, and partly because the resources of the province are of great interest to all of us, it will be worth while for me to give you a little account of the work done this summer,, and of the region in which perhaps in the future some important mines will be developed.

The little expedition that was sent out by the Bureau of Mines, consisting of my friend, Dr. Burwash—who was in many ways well fitted for such work, having been assayer and mineralogist for the province of New Brunswick—myself, and three men, set out about the middle of June. We had to make a tremendous round to get at the scene of our work. Rat Portage, Lake of the Woods, Rainy River—by this circuitous route we were obliged to reach our destination on Rainy Lake. Our object was to examine specially the gold fields of the region, and also incidentally to note anything that appeared to indicate other mineral resources of importance.

The only map of the district we were able to examine is one made by Lawson and published by the Dominion Geological Survey in connection with his report on the Rainy Lake region. It is an admirable map, and I found it in constant use by prospectors, steamboat captains and all others. Even the Americans who came there had to depend upon the Canadian map, which shows part of the American territory as

well. I found I could steer my course by this map; all the portages, channels, etc., are marked upon it, and I could practically go into an unknown country without a guide, and make my way by the aid of this map alone. The topographical work of the map is admirably done, and the geological work in the lower part of the region is quite as admirable. I found a few places, however, here and there where blunders had been made in the geology, especially in marking the contours of the various formations.

This whole region consists of two great groups of rocks - Laurentian and Huronian. On the map the Laurentian rocks are colored pink, and the Huronian green. The special rock which is of interest to us is the green one, called by Lawson the Keewatin, in reality a member of the Huronian series, so far as one can judge from its general associations. The other rocks are Laurentian granite, gneiss, and rocks of a similar description. For several reasons this region is one of the most interesting in the world from a geological point of view. I shall give you one. We find the gneissoid Laurentian rocks, not generally looked on as eruptive, coming up through the green Huronian schists, which at one time probably formed a great sheet covering all the rocks beneath. These Laurentian bosses have thus enfolded between the schists, and in consequence wherever you go in that region you find the latter nearly perpendicular, a fact of great importance to the district as a mining one. These green rocks—green on the ground as well as on the map—have proved to be the most interesting from the mineralogical standpoint. They consist of hornblende schists, chlorite schists, and a mixture of these and a number of associated rocks. In many parts these schists contain veins of quartz, which in the majority of cases are bedded veins. True fissure veins, *i.e*, those which cross the strike, are rare. As a rule bedded veins are not so continuous or so certain as ore bodies as the other kind.

One of our first efforts was to see the only mine working in the region, the Little American. This is situated on a small island, not larger than the site of these Parliament buildings, in the state of Minnesota, three miles south of the international boundary line. They had reached a depth of only 45 feet when I visited it, but there is an admirably equipped 5-stamp mill at work actually turning out bricks of gold at the present time. The mill, though small, is very well arranged.

There is no geographical or other reason why the international boundary should mark the limit of gold bearing rock, and I am convinced that there are as valuable properties, and probably much more valuable ores, north of the line. At the Little American I was shown a brick consisting of about $500 worth of gold, which was the result of about 48 hours' work and the product of about 30 tons of ore. I was told that the yield is about $20 of gold per ton, but I think this estimate a little high, and that $16 or $17 per ton would be more nearly the truth. There was also on hand about half a ton of concentrates that would run between $320 and $350 per ton, which I was informed they intended to ship away for treatment. A large part of the ore is of the free milling kind, notwithstanding that the sulphides come very close to the surface in this region, scoured as it has been by the ice of the glacial period. The decomposed, rotten quartz so common in other districts has been all scraped away. Part of the gold is held in the sulphides and will be refractory. However, $16 per ton will pay, even if the concentrates be neglected altogether. I believe the Little American has paid from the start. On the strength of this mine a "city" of 300 inhabitants has sprung up. On the Canadian side there is a mine called the Little Canadian, on a still smaller island, which may prove to be a producer like the other, but we could not examine it to any advantage.

A good deal of prospecting has been done. We visited Seine river and Seine bay; along part of the latter a large number of iron locations have been laid out. The ore is magnetite. We examined one or two of these locations; whether they will amount to much in the end or not, one cannot say, but should a railway pass through the district they may prove of considerable value. A large number of gold properties have been located along Shoal Lake, and one of the most interesting of them is on a spot, which on Lawson's map, is marked gabbro. I disappointed the gentleman who owns it, Mr. Thomas Wiggins, very deeply by telling him his mine was in granite, for he was in the full belief that it was in gabbro. There the veins are true fissure veins and can be traced for a mile. The largest one is 5 feet wide at some points. A little development work is being done, and I understand the mine is turning out very well. There is probably a continuous body of ore and a valuable property here. It is not very usual to find rich gold-bearing rock in granite, but the granite here must be looked on as an eruptive rock, deriving its gold from the surrounding schists.

Our next expedition was into the Pipestone Lake region, whence we portaged over to the Manitou district. We went north of the country shown on the map, where we found segregation or bedded veins enclosed in the green schists just as below. No claims have yet been taken up here, but there are a number of veins, and probably something of importance may turn up. In the Manitou section a good deal has been done, and a few claims worked to the depth of 15 or 20 feet. Some extraordinarily rich specimens come from the upper part of Manitou Lake; whether the deposits will hold out in depth of course one cannot say. There are some true fissure veins 6 or 8 feet wide at points, so that there is plenty of material, and in places it is very rich. Only one mine was being worked at the time of my visit. It had a considerable body of quartz, and carried free gold, as I saw with my own eyes.

I visited the famous Atik-okan iron range, where there is certainly a large body of ore. Some of it will probably prove to be of Bessemer quality, but other portions of it contain sulphur.

The whole trip meant 1,000 miles by canoe, and consumed nearly three months' time. We brought back a large amount of material which we intend to have assayed to ascertain what are the relationships of the gold-bearing veins to the surrounding rocks. We have samples from veins that occur in granite, in gneiss, in various sorts of the green schists, and we wish to settle if we can whether or not there are horizons at which gold is more commonly found. One definite result already arrived at, is that over a region 200 miles long and 50 miles or more wide, every here and there free gold is found in the rock. I think the majority of the veins will not justify large development work. It is my opinion that a custom mill in the Rainy Lake region and another in the Manitou country might serve a good purpose and open up a very important field. Many of the mines might be small and would not warrant the erection of a stamp mill, but they might well repay the cost of taking out the ore, if it could be treated at a custom mill, because it is rich. Some of the mines will probably prove to be be large and continuous and will justify expense. The ore in general appears to be free milling, although a considerable quantity is retained in the sulphides and will have to be treated accordingly. One interesting fact is to be noted, wherever you find galena you find free gold. What the relationship between the two is I have not worked out, but this appears to be the case and is borne out by my own observation as well as by the testimony of explorers. Some better mode of access to the region is required. It is very difficult to get into the Manitou district, though that lake is only 30 miles from the C.P.R. Six portages have to be crossed, one of them a mile long. You cannot take mining machinery over that, and some improvement will have to be made before the region can be developed at all. There is probably as great an area of the gold bearing formations north of the C.P.R. line as there is south, and prospectors are just beginning to go in there. It is to be borne in mind that Rainy Lake is a large body of water, and has a coast line almost as long as that of Lake Ontario. This fact very much facilitates travel and exploration. (Applause.)

The Hon. A. S. Hardy Elected an Honorary Member.

Mr. Kingsmill moved, seconded by Mr. J. M. Clarke, that the Commissioner of Crown Lands, the Hon. A. S. Hardy, be elected an honorary member of the Institute.

THE CHAIRMAN in putting the motion, remarked that since the present Commissioner of Crown Lands had taken office there had been more interest taken in mining by the government, and a greater advance on previous legislation had been made than at any previous time. The present mining law, though not incapable of improvement was, as he had stated elsewhere, perhaps the best worked out law and the most liberal in its provisions of any on the statute book.

HON. MR. HARDY—Mr. Chairman I certainly had no expectation that this honor would be conferred upon me this evening when I ventured to intrude upon you. I can only thank you for the very complimentary resolution that has been moved, and the very kindly manner in which it has been carried. What I am afraid of is, that I shall hardly be able to bring myself within the terms of the by-law, or the conditions under which it may be applied. Perhaps, however the position which I hold may act as sponsor for me in the matter, for I fear this is the only way in which I can claim to be a fit and proper candidate for honorary membership in your association. I am pleased to be present at this meeting of your Institute. I know it is not what is called a mining convention, but it is perhaps built on a more solid foundation, and fitted to discuss matters more carefully and satisfactorily. I am pleased, sir, to hear some of the remarks which you yourself made. When you stated that we in Ontario have had more mining legislation during the past five years than for the previous twenty, I accept it as acompliment, not merely to myself but to the officers of the Department, and indeed to yourself as well. We have had many pressing invitations from you, sir, to even more active legislation. Perhaps my own connection with mining has been confined too much to legislation. I have been compelled to leave the practical and scientific work of the Department to other hands; but in Mr. Blue and his assistants we have a body of men earnest and euthusiastic in pursuit of the duties devolving upon them to whom these interests may very safely be committed.

The Government have put in a consolidated form the entire mining law and regulations, established a Bureau of Mines, imposed working conditions on those who acquire mining lands from the Crown, introduced the leasing system by which land may be obtained on easier terms and at a lower cost, lowered the minimum area of mining locations, and adopted the plan of staking out claims, of which you, Mr. Chairman, were so enthusiastic an advocate. We have endeavored to assist the mining industry by aiding railways on a considerable scale, and are now attempting to help on the work of development by means of a government diamond drill. We have adopted all the methods of assistance that were fairly within our power, even to the extent of establishing summer mining classes, and of making a grant of $125,000 to encourage the opening up of our iron mines. It would be difficult to ask a Legislature in four or five years to do much more or go much faster. With all the advances we have made in this line there is in the mind of anyone perhaps only one drawback—the imposition of a small royalty on ores. This may be claimed by some to stand in the way of mining development, but perhaps the taxpayers will be strongly inclined to support it.

It will afford the Government pleasure to be of any assistance to you as an Institute. The rooms in these buildings will always be open for your meetings, and any other facilities which we can offer you are at your disposal. Meetings of this kind are one of the means by which our mining industry will be ultimately developed. That it should be so slow of development seems a marvel to some of us. Our lives are passing away, but the mining industry is not making the progress or producing the wealth as rapidly as we would like. It can hardly be expected that the Government will pour out money to bring about the dovelopment of the industry, but whatever will increase the desire of mining men and capitalists to go into the mining business may be legitimately expected from the Government; beyond this, and perhaps the opening up of roads and waterways, I do not know that you can expect the Government to go.

The education of the country in mining matters must come from bodies such as this. I am glad to know of its existence, and heartily wish it prosperity. I again thank you for the honor you have done me in making me an honorary member of your Institute. (Loud applause.)

Deep Water-Ways Convention.

ALDERMAN J. E. THOMPSON, on behalf of the Committee of Arrangements, extended a cordial invitation to the Institute to send delegates to the Deep Water-Ways Convention to be held in Toronto on 17th September and following days.

MR. J. J. KINGSMILL, seconded by the Secretary, proposed the following delegates:—Mr. A. Blue, Director of Mines; Dr. Coleman, School of Practical Science; J. Bawden, Kingston; J. J. Kingsmill, T. W. Gibson, R. W. Prittie, J. M. Clarke and T. D. Ledyard, Toronto.

The Delegates being approved the Secretary was authorized to issue their credentials.

Next Place of Meeting.

PROF. NICHOL, inviting the Institute to Kingston for its next meeting, said he was quite sure the Faculty of the School of Mining would do everything possible to make the meeting a success.

MR. J. BAWDEN having seconded the invitation, the Secretary was authorized to convene the next meeting at Kingston in January, 1895, at such time and place as seemed most suitable by the Kingston members of the Institute.

A vote of thanks to the Chairman having been passed the meeting adjourned.

Nickel Steel—In the course of a paper lately read, on "Nickel," before the Society of Arts, London, the author, Mr. A. G. Charleton, A.R.S.A., mentioned that it was not till 1779 that it was recognised as a metal. The growth of production and of consumption have been slow, but of recent years its uses as an alloy have attracted the attention of metallurgists, and as a result of experiments many important adaptations have been discovered. Mr. Charleton states that whilst 1,000 tons of nickel flooded the market in the early years of the century, 10,307,375 lb., or, roughly, five times as much, was produced in 1891, consequently the large excess of metal produced must have gone into nickel steel, yet this alloy has scarcely begun to be used in the arts of peace. As its price tends steadily downwards, he confidently expects that it will eventually enter into competition with other materials for other purposes than armour plates and guns. The ordinary carbon steel used for steel propeller purposes, has a tensile strength varying from 60,000 lb. to 65,000 lb. per square inch, whereas the nickel steel shows a tensile strength of 90,000 lb. per square inch, the elongation in both cases being about the same, 20 per cent. Use of this stronger steel will warrant boring ont the shaft, materially lessening the weight whilst preserving its efficiency, and such cored shafting can be hollow forged when the hole islarge enough, to admit a mandril. If it is found possible to apply it to the constructi on of boilers the tensile strength of nickel steel being 1½ times that of ordinary steel, it will enable their thickness to be reduced one-third, effecting a saving in weight, which is a great consideration.

Gold Ore Treatment in South Africa.

(Abstract of paper by Mr. H. De Mosenthal on "The Treatment of Gold Ore at the Witwatersrand Gold Fields," read before the Chemical Society, London.)

The Witwatersrand gold fields are situated on one of the highest points of the South African plateau, some parts of the main reef being 5,000 feet above sea level. It is worthy of note that on this account air compressors have to be made some 25 per cent. larger than they would need to be on the coast. Johannesburg, which is only about six years old, now contains some 30,000 white inhabitants, whilst the mines employ 21,000 native laborers. It is only the discovery of coal in close proximity to the gold fields that has made the present great development of these latter possible. The cost of transport of fuel is, however, still high, owing largely to the refusal of the local railways to carry coal in bulk. It now costs about 22s. per ton delivered at the gold mines. It only yields a very inferior coke, so that this article has to be imported for assaying and smelting, imported English coke being worth about £14 per ton.

The ore is different from any known elsewhere; it consists of pebbles of quartz held together by a siliceous cement, which contains in the lowest levels crystals of iron pyrites. At the surface the pyrites was oxidised and the ore was more friable, but the greater the depth attained the higher the percentage of pyrites appears to be. The gold is contained in the cementing material; it is so fine as to be scarcely ever visible to the eye, and much of it is combined with sulphides of the base metals, which latter are known as "sulphurets."

The ore when mined is hoisted up by means of head gears, which are seen dotted in all directions over the area covered by the gold fields. They are of two types. The first is a simple head gear, which delivers the ore into trucks, which are then run into the mill building where the ore is dumped on to a "grizzly" made of bars of iron, and then passes into a rock breaker, from which it falls broken into a hopper to go to the stamp mill. As the country is very flat, and the mills are often some distance from the mines, it was found more economical not to have the rock-breaker in the mill building, but rather to place it on the head gear, and most modern head gears are so constructed. Rock breakers are either of the well-known Blake or of the Gates' or Comet type. In these the ore is broken down to about 2 in. cube.

The mills are of the usual California pattern, with self-feeders. Their weight used to be 850 to 900 lbs., and they used to have a 9 in. drop. The most modern mills have 1,200 lb. stamps, and are worked with an 8 in. drop; some of these modern mills run as fast as 92 drops per minute. In consequence of having such powerful mills, the best are able to crush 4½ to 5 tons per 24 hours per head, through a 900 mesh screen. The average for the entire gold fields for the month of December last was 3·7 tons crushed per head per 24 hours.

The batteries have amalgamated copper plates inside them, and the crushed ore is discharged on copper tables 12 ft. long and 6 ft. wide, these tables being amalgamated so as to catch the gold. It is found that most of the gold is caught inside the battery, and on the first 3 ft. of the ouside copper plates. The amount of gold caught on the plates is 55 to 60 per cent., an amount which compares unfavorably with many other plates where the percentage is said to be 80 to 90. The amalgam is collected, and is cleaned in pans, and then heated in retorts, when the mercury is driven off and recondensed; the spongy gold so obtained is then melted. The loss of mercury in the entire treatment is about ¼ oz. per ton of ore; at the Robinson mine it is 0·65 oz. The melted gold is usually 800 to 825 fine. It contains silver, lead, copper, and other base metals.

After the pulp has passed over the plates it is run into concentrators, which extract the sulphurets. There are various kinds of concentrators used, but the Frue vanner is the most popular. The percentage of concentrates obtained is about 3, and these sulphurets assay from 5 oz. to 8 oz. of gold to the ton. Most of the mines sell their concentrates to one of the two combination works on these goldfields, the price given being 90 per cent. of the assay value, less £4 per ton. In the chlorination process 95 per cent. of the gold contents of the ore is extracted. This process, is however, only suitable for rich material; it is not, like the cyanide process, suitable for poor grade stuff, such as are the tailings.

The concentrates are roasted in reverberatory furnaces, this being the most important part of the whole operation. The roasted stuff is then damped till it contains 6 per cent. of moisture, and charged into vats furnished with covers fitting gas tight. Chlorine gas is then passed upwards through the roasted ore: this combines with the gold, forming soluble chloride of gold, which is then washed out, the solution being filtered off and the gold precipitated from the solution by means of sulphate of iron, which is made on the spot. The process is costly, owing to the high price of sulphuric acid, which costs £25 per ton. The consumption of acid is 300 to 400 tons per annum.

After the pulp leaves the concentrators it is run into dams, where the tailings are allowed to settle. These tailings constitute about 60 per cent. of the ore, the remaining 40 per cent. forming the slimes, which are run to waste and are totally lost. The tailings contain 4 dwt. to 7 dwt. of gold to the ton, and the slimes 4 dwt. to 5 dwt. The tailings are charged by hand into huge vats, the largest holding 400 tons. Then a solution of cyanide of potassium is allowed to flow through them. Some mines employ a system of repeated percolations of this solution, whilst others object to it. A strong and a weak solution are employed, the first cantaining from 0.6 to 0.3 per cent., and the second from 0.3 to 0.1 per cent. of cyanide. The whole tendency recently is to work with very weak solutions. Each solution is allowed to act from between 12 and 18 hours, and is then run off into zinc boxes, where the gold is thrown down by means of zinc shavings. Theoretically, 100 oz. of gold should be dissolved by 4.3 lbs. of cyanide, but in practice 300 lbs. of cyanide are required. Some mines consume as much as 2 lbs. of potassic cyanide for each ton of ore treated. The zinc precipitates the gold from the solution, forming a mass of so-called zinc residues, which contains a very great deal of zinc and other impurities. The zinc residues are calcined, and then melted with a mixture of carbonate of soda, borax, and fluorspar, when gold is obtained 720 to 750 fine, the principal impurity being lead. There appears to be no difficulty in refining this gold, which is very brittle. The average extraction of gold by the above process in 1893 was 14 dwt. per ton, the assay value being about 15 dwt. 8 gr. per ton.

John G. McGuigan, one of the owners of the Noble Five group, in Slocan district, was in Nelson the other day. He says there are 8½ feet of ore in the breast of No. 2 tunnel in the World's Fair, and that the mines never looked better than at the present. Three tunnels were started on the Bonanza King, two of which are now in the World's Fair. No. 1 tunnel is in 200, and an uprise made from it to the surface. No. 2 tunnel is in 310 feet, and an uprise connects it with No. 1 tunnel, near the mouth of the latter. At 98 feet a level was run from the uprise a disance of 102 feet. This level is connected with No. 1 tunnel by a winze. No. 3 is in 300 feet. On the World's Fair a tunnel is in 75 feet, There is ore in the breasts of all the tunnels except No. 1. A thousand tons will be shipped this season, part of which is now being sacked.—*Tribune.*

On Cage Conductors in Shafts.

By Mr. T. C. Hair.

(South Wales Institute of Engineers.)

In introducing this subject it would perhaps not be out of place to take a brief survey of the commencement of the system of tubs, cages and guides.

The writer is indebted to Mr. Robert Simpson, of Ryton-on-Tyne, for the plans and particulars of the first tubs, cages, and guides, that were used for coal winding. That gentleman, as an assistant of the late Mr. T. Y. Hall, was immediately connected with the introduction of this system.

To Mr. Hall is due the credit of introducing it. It would be superfluous at the present day for the writer to attempt to describe the great advantages that have followed upon this change of system.

The following extract from the *Mining Journal* of September and October, 1858, will place the position of affairs previous to Mr. Hall's improvements, clearly before the members of the Institute:—

"In the whole history of mining industry there is no chapter more interesting than that unwritten one which relates to the introduction of the tub, cage, and guide-rod system.

"It is impossible to exaggerate the importance of the change which the adoption of that system wrought, not only upon the coal trade generally, but especially, and in a marked manner, upon those by whose industry that trade has flourished and become great. For the first time since the invention of the Davy lamp, science was brought to bear powerfully and successfully upon the means of preserving life and limb; and that which was considered an unenviable, because a most dangerous, occupation, was rendered more tolerable because infinitely less hazardous. A brief description of the state of things which existed prior to the change is necessary to a full comprehension of the benefits derived from its adoption. Within the recollection of the then youngest mining engineer, the produce of the pit was brought to the surface in what was called a corf, or corve. These corves, composed of wickerwork, in the shape of huge baskets, varied considerably in size and appearance in different localities. Originally constructed to hold about ten pecks of coal, equal to about three cwts., they had for some time previous to their abandonment attained much larger dimensions, and were generally capable of holding sixteen or twenty pecks, equal to five or six cwts. of coal, the size being regulated in a great measure by the height of seam and by the strength and lifting power of the machinery employed to raise them to the surface. Much breakage was occasioned in the journey through the mine, but in the ascent of the shaft, the corf, in swinging to and fro, frequently struck so violently against the side as to shatter its contents until they were small and almost useless. (See Fig. 1, Plate 26.)

"Arrived at the surface, the spring hook by which the corf was attached to the rope had to be removed and an empty corf substituted; and as during this operation the engine did not stop, the rope had sometimes begun to descend again before the empty corf could be affixed, and there was no alternative but to fling the corf in also, which, accordingly, went crashing and smashing down the pit to certain destruction of property to a very large amount annually.

"In addition to these inconveniences, the ascending and descending corves frequently came into collision, and sometimes the corf which was on its way to the pit's mouth would bring up that which should have descended, occasioning much trouble and confusion.

"The means by which the miner descended to and ascended from his labour, was of the most primitive and dangerous description. The rope, with its terminal chain, to which the corves were attached, formed the sole vehicle of his transit. To this he must cling, and run the risk of being severely bruised against the sides of the shaft, besides enduring the pain which the chain produced upon the legs and hands.

"The general practice in proceeding to or leaving the shaft bottom was for two men to sit, each with a leg in a loop of the chain; and frequently five or six boys would cling to the rope, one above another, trusting their lives to their capability of holding fast while the rope traversed a distance of 1,600 or even 1,800 feet.

"Remedies for all these inconveniences had been the subject of much study among professional men, but no very satisfactory plan had been devised. About the year 1825 or 1826, Mr. Thomas Easton, of Hebburn Colliery, brought into operation an improved plan of conveying the coals from the workings to the bottom of the shaft by placing the corves upon bogie wheel trams; but the difficulty of keeping the baskets upon the trams, and the objections of the boys employed as putters to continue their employment, compelled him, after a short trial, to fall back upon the old arrangement.

"A little earlier, a very imperfect plan of raising the coals by means of 'skips,' and a kind of conducting rod, was introduced by Mr. Curr, of Sheffield, and partially adopted in some of the Yorkshire and Derbyshire collieries, where the pits are of little depth; and several eminent engineers from the North of England, accompanied by the Rev. John Hodgson, of Heworth, compiler of the 'History of Northumberland,' visited a few of the mines for the purpose of ascertaining the applicability of the plan to pits in their own locality. Their impression was favorable, though it could not be satisfactorily adopted in the great northern coal field, where the thinness of the seams required shafts to be of an extraordinary depth, and the large demand for coal for exportation rendered it necessary to raise such enormous supplies.

"From this it may be inferred that the new plan was slow in its operation.

"In 1833, Mr. Hall, when at South Hetton colliery, introduced the tub system of drawing coals, which consisted of a number of tubs of oblong shape, mounted on wheels. The tubs being made low compared with corves, admitted of being filled with greater ease and quicker despatch. The contents of four of these were emptied at the bottom of the shaft into a large round iron tub, constructed to hold 1¼ ton of coal, which was drawn to bank and struck on to a tram to convey it to the screens. A division for each tub in the shaft was cleaded round slightly larger than the size of the tub, so as to enclose it, thus using the whole surface as a guide, thereby rendering guides in this case unnecessary, without having any guides fixed to the shaft or shoes on the tubs. This plan of guiding the iron tubs was used in the first cages adopted by Mr. Hall, at South Hetton, in December, 1834." (See Fig. 2, Plate 26.)

The next improvement by Mr. Hall was of great importance, viz.: the introduction of conductors or guides and shoes fixed to the cages. So strong was the adverse opinion and prejudice against the adoption of such a great change as the introduction of cages, which in those days caused considerable delay in changing at bank (keps or fans not then having been invented), that on the occasion of Mr. Hall leaving South Hetton, the iron tub system was again introduced, and the cage laid aside; but the advantages of the cage and tub system soon became so apparent that they were quickly resumed. The advantages of this system were so manifest by what had been done at South Hetton colliery, that Mr. Hall, without delay, next introduced it in a more complete form, viz.: cages fitted up with shoes running on wood conductors fixed in the shaft, as seen in Fig. 3, Plate 27, at Woodside Pit, Townley Main, and Whitfield, collieries belonging to the Stella Coal Company.

CAGE CONDUCTORS.

FIG. 1

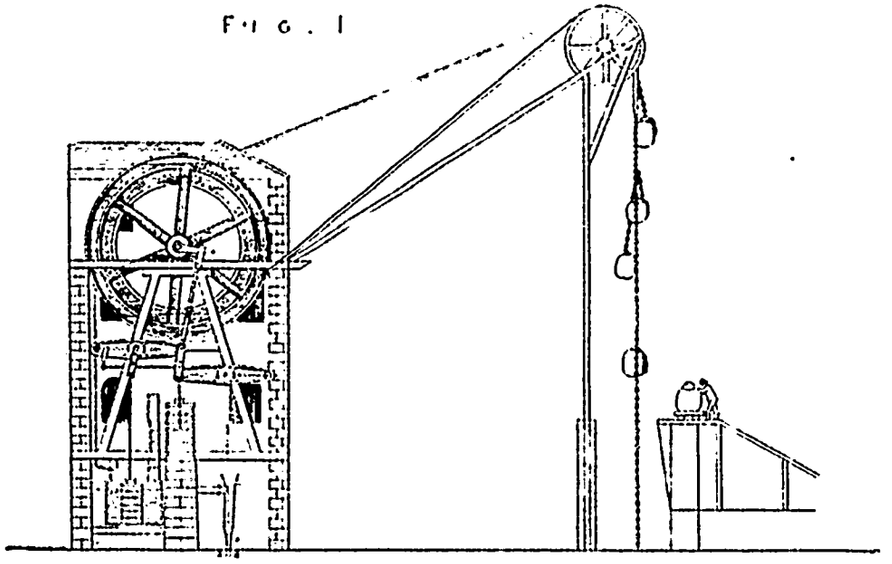
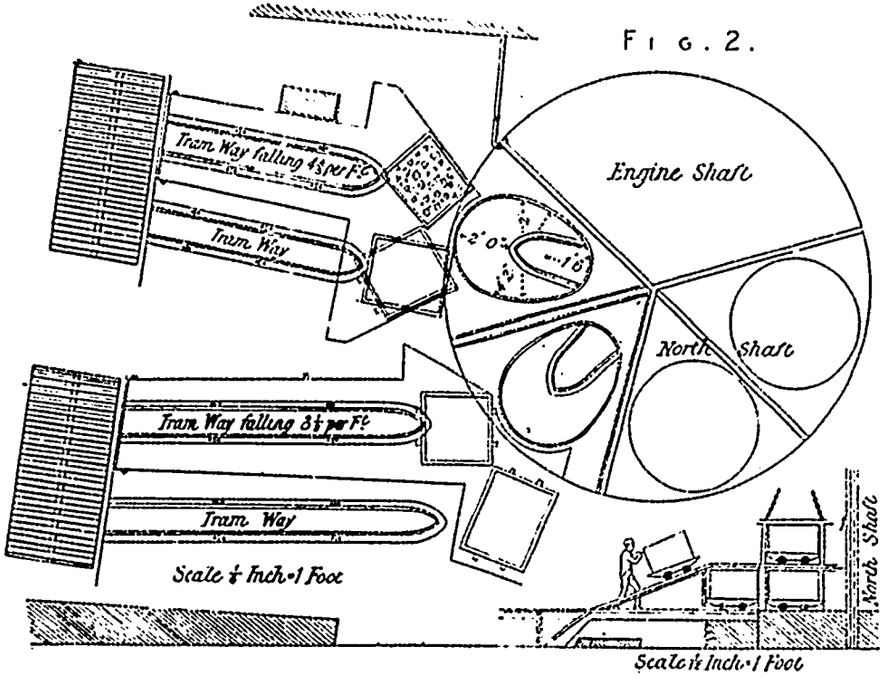


FIG. 2.



CAGE CONDUCTORS.

FIG. 3.

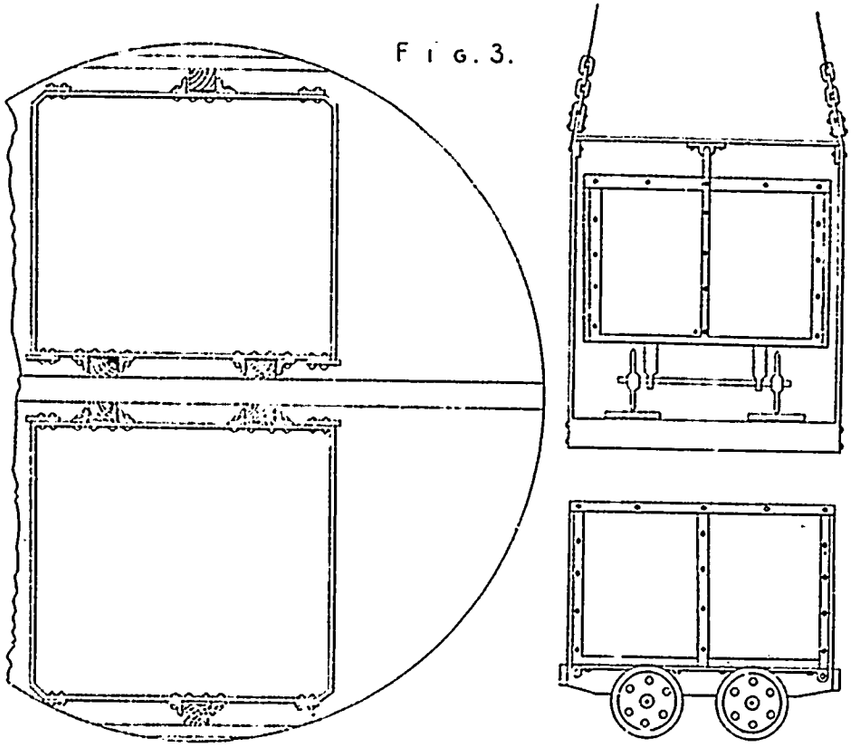
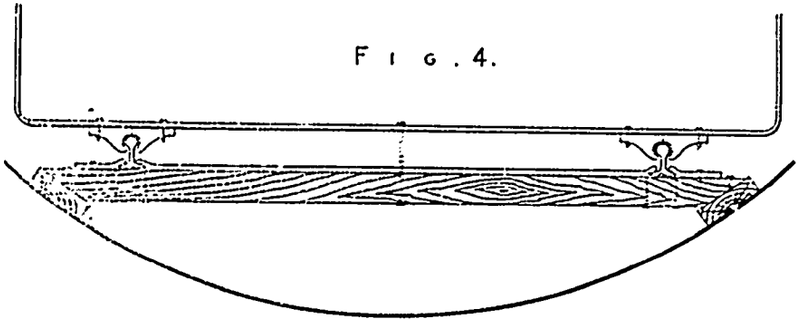


FIG. 4.



In this case he gave most powerful proofs of the practical utility of his innovations, as some termed them at that day, in more than doubling the quantity of coal drawn from the pit. Here, with an engine of only 20 horse power, he drew from one pit, 65 fathoms deep, 100,000 tons of coal per annum, being more than double the quantity previously drawn by the old system. This increased quantity was not only due to rapidity in winding through the guide system, but also to the improvement in changing tubs at bank by the introduction of keps or fans.

The advantages of the numerous improvements originated and carried into practice in the adoption of Mr. Hall's new system of winding soon became publicly acknowledged by the adoption of it by one colliery after another, until it became the acknowledged system in the coal trade, and to Mr. Hall is due the honour of producing one of the most beneficial revolutions in the system of winding coals that has ever been introduced into colliery operations, not only in the interests of the employer, but in the interest and safety of the employed.

Having thus referred to the practice and conditions under which the winding of coal was effected up to a comparatively recent time, it will be readily understood that it is beyond the compass of a single paper to do justice to the various systems of fixing pit cage guides. The diagrams will show the progressive stages that have taken place since their adoption in the year 1833.

Fig. 1, Plate 26, shows the system in use before cage guides were adopted.

Fig. 2, Plate 26, the tub used as a cage and guided by the sides of the shaft, used at South Hetton. Year 1833.

Fig. 3, Plate 27, the first cages fitted up with shoes and wood conductors in the shaft, at Woodside Pit, Townley Main, and the Whitfield collieries, belonging to the Stella Coal Company. Year 1835.

In the year 1854, Mr. Hedley first used iron rail guides for cage conductors at Kelloe colliery, in the County of Durham, and in 1859 wood guides, faced with iron, were tried at Thornley and Thresiltone collieries, which led Mr. Johnstone, of Seghill, to the idea of trying rail guides.

After that date rails were used at several collieries, and shortly after came into general use in the Northumberland and Durham coal field.

Fig. 4, Plate 27, is a fair sample of rail guides as adopted with cast iron chair sleepers, at Cowpen, Backworth, and other collieries.

Fig. 5, Plate 28, shows the single chair made of wrought iron with related rail joint, at Lambton colliery, Durham.

Fig. 6, Plate 28, shows the chair sleeper made out of rolled wrought iron having two recesses planed out ¼-inch deep to receive the rails. This forms a good and cheap chair, and may be used with advantage where the load is not very heavy. Used at Kimblesworth colliery.

Fig. 7, Plate 28, is a forged iron chair sleeper with four recesses planed out to receive two sets of guide rails, as used at Harris's Navigation colliery. This plan, in the writer's opinion, seems to be the most complete of any yet adopted that he has been able to obtain information of, for deep and quick winding with heavy loads. It provides for a spare set of guides, which, with a proper adaptation of gauges and shoes, can be made to assist and strengthen those in use.

Fig. 8, Plate 29, shows a narrow gauge of road of only 18 inches for the rail guides, fixed only on one side of the cage, used at Elswick colliery, and by comparison with the other examples it will be seen how the gauge varies in different places to suit the special circumstances of each case.

Fig. 9, Plate 29, gives the channel iron guide applied to the opposite ends of the cage at Ryhope colliery, and which with a few modifications has been introduced in other places both in the North of England and South Wales. In one of the pits at Ryhope the channel iron guides run into sidings at the meetings 1 foot out of plumb, and in another case run into sidings at meetings 2 feet out of plumb.

Fig. 10, Plate 30, shows a section of guide rail and shoe used at the Avon colliery, Abergwynfi, and which, in the writer's opinion, makes a very suitable, secure, and durable conductor.

Fig. 11, Plate 30, shows the wire rope guides used in the Clydach Vale colliery, and exhibits a fair sample of this class of guide, and also the practice of using intermediate wire rope guides between the cages.

Fig. 12, Plate 30, shows the wood guides at the Wearmouth colliery, B pit, which have been in use for twenty years, and are still in good condition; they also run into sidings at the meetings, 3 feet out of plumb, and at the point where the cages pass each other the space between them is 4 inches, and the clearance from the corner of the cage to the side of the shaft is from 1 to 3 inches.

The A pit shaft at the Wearmouth colliery is fitted with wire rope guides, giving a distance at meetings of 14 inches, and the nearest point at the corners of the cage is only 1 inch from the side of the shaft. As might be expected, the corners of the cage rub against the side of the shaft, notwithstanding that a load of 11¼ tons is raised from a depth of 600 yards. Although not desirable to run cages in wire rope guides so near the sides of the shaft, this affords a striking instance of what may be done.

Fig. 13, Plate 31, shows a class of girder which when put in the middle of the shaft makes a strong, secure girder, but it failed to secure the guide rails, which were only fixed on with bolts and side clips. The present tendency is to adopt iron girders for carrying the guides, but the writer's experience leads him to the conclusion that they are inferior to the recessed chair sleeper, as in the iron girder all depended on the bolts, but in the chair sleeper the solid recess secures the guides against transverse side strain, as well as keeping them in correct gauge. Of course the chair sleeper could be bolted to an iron girder as well as to an oak byat. If iron girders could be made of suitable size, and recessed properly to receive the rails, at a reasonable cost, then they would be equal to the recessed chair sleeper on oak byats, but even then the writer fails to see any advantage they would have over the latter.

The system of securing the joints by a fishplate on the back of the rail is in some cases adopted, and the joints are made between the byats and not on the byat; where this is done, and screw clip bolts or dogs similar to railway fastenings used to secure the rails to the byats, it is evident the whole weight of the guide rails rests on the bottom, with the only other holding assistance of the grip of the dog clip. This, it will be readily seen, makes it more difficult to renew or change the rails in the shaft. In those systems where the rails are held secure in their position by their own fastenings, they were more easily dealt with for repairs.

It has been stated in former discussions (in other places) on cage conductors, that very little power is required to retain the cage in position when in motion. It may be so, but the exact amount of force necessary for this purpose has not yet been satisfactorily demonstrated by experiment. All practical colliery officials, however, know that if sufficient and secure fastenings are not adopted for the conductors there is a considerable amount of trouble and annoyance in maintaining them in working order.

RAILS.

In the use of iron and steel rails for pit cage guides one deficiency is very apparent, viz., the section of the ordinary F. B. rails, which, although suiting the purpose, might be greatly improved upon; the drawback to this being the cost of altering or preparing the rolls for so small a quantity as would be required for one shaft, users not having agreed on a uniform suitable section. This being the case, the selection has to be made from the sections of rails designed for another purpose, and the railway sections are all that can be obtained, causing a heavier rail to be used than is actually necessary. As an illustration of this see sections of rails Figs. 14, 15 and 16, Plate 31, which have been in use. The black or outer lines show the size of rail when new and put to use, and the dotted lines show the section of the rails after having worked (Fig. 14) 6 years, (Fig. 15) 12 years, and (Fig. 16) 6½ years. It will be seen that the flange at A is the same in both the new rail and the old worn rail, but at B the amount of wear is shown by the dotted lines. The simple deduction from these facts is that more wearing surface is required at B to have rails to last longer and do more work, and this can only be obtained by having suitable rolls for making the rails as required.

With regard to the various rail sections used as guides, it is interesting to note the weight per yard used for guiding the loads to be raised. In some instances the proportions are as follows:—

RAIL GUIDE SECTIONS.

Weight per Yard of Rail Guide.	Weight of Load.	Guide Rail, Weight per Yard per Ton of Load.
Lbs.	Tons.	Lbs.
42	3	14·00
46	7½	6 01
80	12	6·66
72	20	3·60

WEARING SURFACE.

Wearing Surface.	Weight of Load.	Wearing Surface per Ton of Load.
Inches.	Tons.	Inches.
Wood Guides, 11	6	1·83
Channel Iron, 10	12	0·833
Rail Guides, 8	12	0·666
9	20	0·45
7	5	1·40

DURATION OF GUIDES.

Some of the wood guides in Killingworth Colliery, Northumberland, were in use for 40 years, especially the guides in the lower portion of the shaft, where they were wet. The upper portion of the same shaft, where the guides were dry, had to be renewed. At the present time there are wood guides that have been in use for 35 years at Bebside colliery, Northumberland, the depth of the pit being 200 yards, and load, 6 tons, and they are still in good condition.

At Cambois colliery, Northumberland, rail guides have been in use for 26 years, and are still in good condition. The depth of the pit is 220 yards, the load 7½ tons, and the weight of the rail guide 46 lbs. per yard.

At Abergwynfi the rail guides have worked for nine years, and are still in good condition. The depth of the pit is 502 yards, the load 12 tons, and the weight of rail guide 80 lbs. per yard.

At Merthyr Vale colliery, in the upcast shaft, the guides wore out in six years, the depth of the shaft being 500 yards and the load 11 tons. Section of rail used is shown in Fig. 16, Plate 31.

At Harris's Navigation colliery in the upcast shaft, the guides wore out in six years, the depth of the shaft being 735 yards and the load 14 tons. The section of rail used is shown at Fig. 14, Plate 31.

In the downcast shaft, 700 yards deep, with a load of 20 tons, the section of rail guide, Fig. 15, Plate 31, worked ten years.

These facts go to show that light loads, shallow pits, and downcast shafts are very much more favorable for the working life of guides than upcast shafts in deep pits with heavy loads.

The section of rail for a suitable guide, in the writer's opinion, should give sufficient strength to resist the vibration of the cage and ropes, and have a size of flange for properly fixing them to the byats, depth of web to allow ample room for the shoes, and size in the head to allow a thorough grip of the shoe on it, and should also have an ample substance for wear and tear. They are usually made of steel and in 27-foot lengths, and should be perfectly straight and cut quite square at the ends.

In the writer's opinion, the system of putting dowels into the ends of the rails is unnecessary, and does not give additional security to the joint; the most secure joint, and the one that seems to be the least objectionable, is shown in Fig. 21, Plate 31. At the parts marked A it will be noticed that the bolt heads are thoroughly locked in the recess of the chair sleeper, thus preventing them coming loose.

Sleepers, or chairs, with a recess in them to receive the rails, either made of cast or wrought iron, seem to be the most secure way yet adopted in which to fix the guides. Girders, or byats, either of H iron or channel iron, are much used, but as in ordinary girders there are no recesses, and the security of the guide depends entirely on the bolts, this is an objectionable feature.

Oak or pitch-pine byats, on which the chair sleeper can be bolted, give a much better fastening. (See Fig. 20, Plate 31.) It may be mentioned here that provision can be made in the chair sleeper for an extra set of rail guides, which can be put in when required for renewing the guides. This can be all done and completed without in any way interfering with or stopping the pit working, and the only thing necessary is to change the portion of the shoes on the cages to put the new guides in use. These extra guides can be fixed in such a position as to assist and strengthen the guides in use by allowing proper space for the back of the shoe to be slightly guided by the

CAGE CONDUCTORS.

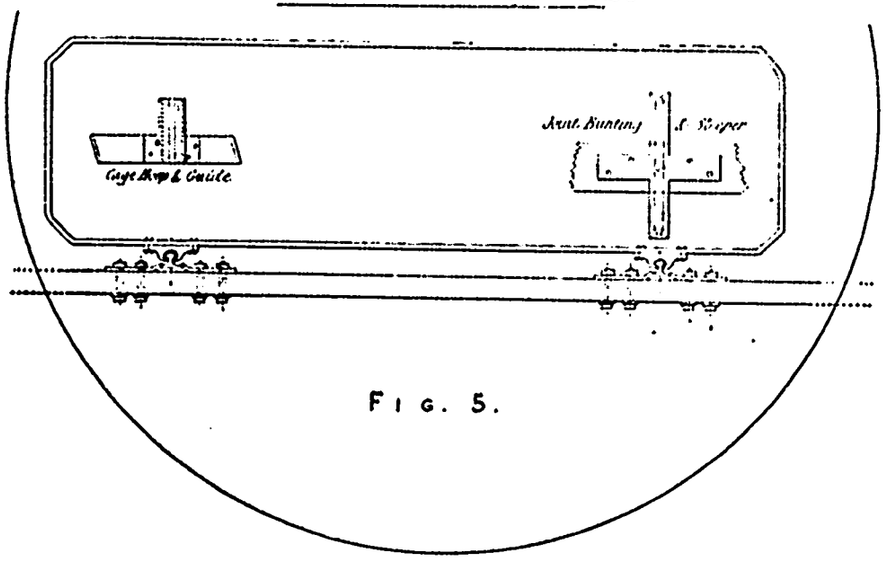


FIG. 5.

FIG. 6.

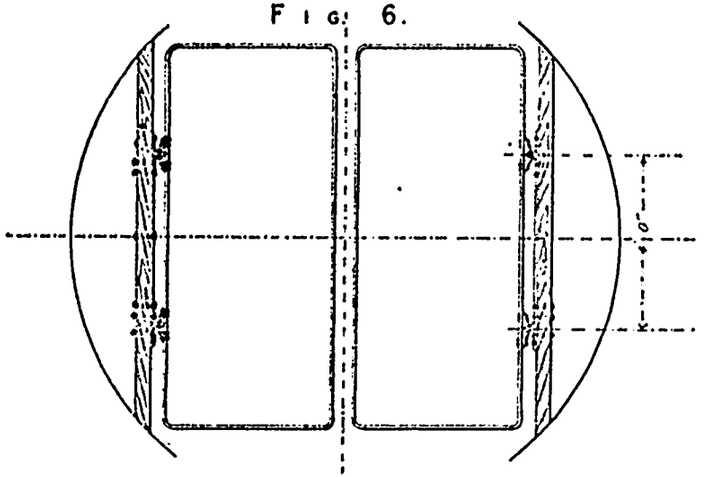
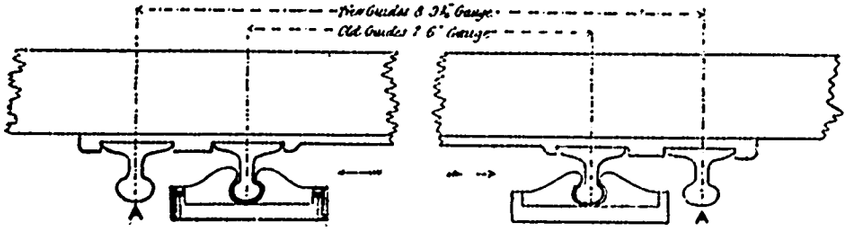


FIG. 7.



CAGE CONDUCTORS

FIG. 8.

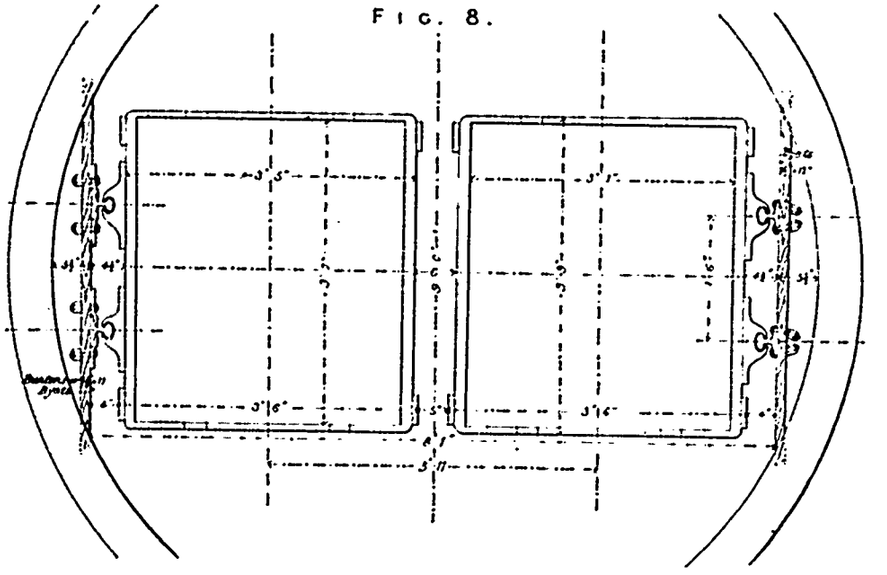
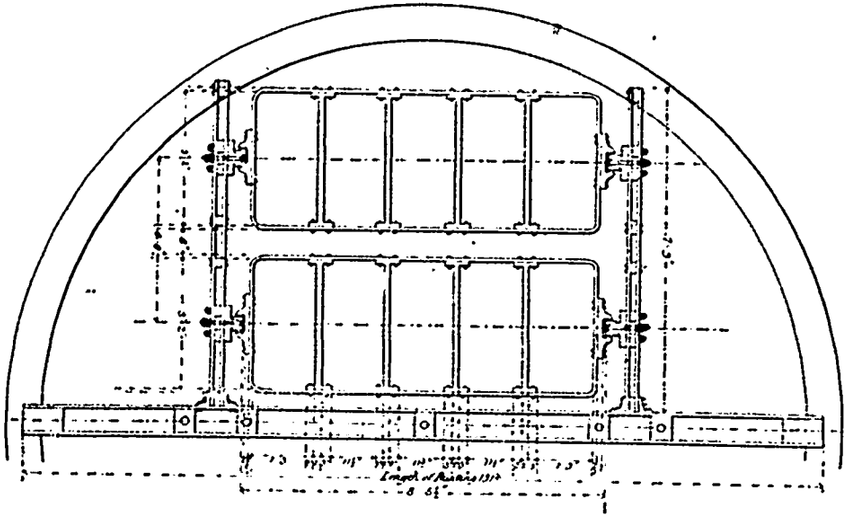


FIG. 9.



spare guides. (See Fig. 7, Plate 28.) It is important that the sizes of the shoe and clearance be carefully made to get them to work right.

Special conditions will determine in a large measure whether the byats should be fixed either at the side of the shaft or in the middle of the shaft. Of course it will be readily seen that a byat in the middle of the shaft has advantages over the byats on the side of the shaft, and can more easily be secured.

LANDINGS.

In fixing main girders, buntons, or byats for surface landings, it is desirable that they should be a sufficient distance from the cage, to allow the cage, or anything that may happen to project over the cage, to pass without touching, or putting any undue strain on the cage, rope, cap or bridles. From 4½ inches to 5 inches from the outside end of the cage to the nearest part of the guider in some cases works well. The tram rails or sheets can be put 1½ inch from the cage, as these do not offer much resistance or give excessive strain should the cage come in contact with them. For other landings in the shaft it is desirable to give even more allowance than this; 7 inches will not be too much in some cases.

It will be seen from the table that considerably less guide area is required in the shaft by wire rope guides than any other form of guide, and thus they are more favourable for ventilation.

EXPANSION.

It would appear that there are no acknowledged rules for allowing space at the joints for expansion, as in some cases the rails are put close to each other, and in others $\frac{1}{16}$ inch, $\frac{1}{8}$ inch, and even ¼ inch space is allowed between the ends of the rails.

The proper allowance to be made for expansion will of course, depend on the variation of the temperature in the shaft. Assuming that the difference of temperature does not exceed 40° F. between the coldest day in winter and the hottest day in summer, the expansion of steel from 32° to 212° F. for temperature raised, 1 F. = 0·00000636 per foot in length, thus making the expansion for each rail 27 feet long = 0·006868S0.

The practice of allowing $\frac{1}{16}$ inch or $\frac{1}{8}$ inch is ample, and the writer's experience agrees with this.

In upcast shafts where mechanical ventilation is used the same rule will hold good, but where the furnace is used it is very doubtful whether rail guides are suitable; they have been tried and had to be taken out on account of the displacement of the rails by the expansion which took place.

SHOES.

Shoes are made of cast iron, steel, and wrought iron. Steel shoes seem to be the most suitable and meet the requirements best, and they also last longer than the others.

It is necessary to have the shoes properly fixed to the cage and in such a manner that they can be readily renewed, for defects in doing this will materially affect both the efficient working and the durability of the cage and guides. To ensure this being done properly, the shoes are fitted into a gauge, and all correctly drilled to the same template, so that any shoe will go on to any part of the cage and be a correct fit. Simple as this is, it is very important, for when badly fitted, the shoes put extra friction and strain on ropes, cages and guides, and therefore wear them out sooner.

It will appear from the information gleaned by experience that the most suitable guides for quick winding are iron or steel guides and wire rope guides. It is obvious that the special circumstances and conditions in each case must have considerable influence in deciding on what is most suitable to adopt.

Wood guides, although they make an excellent conductor and have doubtless done good service, are being superseded by wire rope and iron or steel guides. There is one feature in connection with them which is the same in reference to channel iron guides and wire rope guides, and that is, as a rule, where they are used it is necessary to have guides on the opposite sides or ends of the cage, and in the case of wood and channel guides they require byats on opposite sides of the cage; whereas in the use of rail guides it is only necessary to use guides and byats on one side of the cage, thus leaving the pit more open and with less material in the shaft.

It would be presumptuous of any one to lay down a rule that any special class of guide should only be used, as it is evident the conditions in each case require careful consideration before deciding what class of guide should be adopted and is suitable for the requirements. Different circumstances must be met and dealt with according to their conditions.

It may not be out of place to suggest a few of the salient points worthy of consideration, such as space at meetings between the cages, and at the corner of the cage and side of shaft; depth of pit, weight of load, speed of winding, and to avoid reversing guides at pit top and bottom; what effect water and upcast air will have on the guides, also whether there is any diplacement in the shaft from pressure or otherwise.

When the guides are out of plumb, or necessary to put them out of plumb for want of space, and the depth is over 600 yards, rail guides seem to be preferable. The advantage of this class of guide under any of these conditions appears to be the grip of the shoe on the head of the rail to keep the cage better in the guides, and in cases of drawing water out of old shafts by cages or water tubs, the rail guide is superior to any other class of guide the writer has seen used for this purpose, the water tub or cage being best retained in its position while under water, and stops can be put on the bottom ends of the guides to prevent them going over the guide ends.

It is evident that where wire rope guides can be used to advantage, they can be put in at less first cost than either wood, channel iron, or rail guides; but one very necessary condition of their success is that they must be put in quite plumb, thus preventing vibration, which with the wire rope guides is a very objectionable feature; also proper precautions should be taken to prevent the possibility of their being "stripped" by the shoe of the cage taking hold of a stray wire. This occasionally is a source of danger with this type of guide. So far as the writer can ascertain, their life varies from two to ten years or even longer.

The transverse strain on the class of rail guides acts in the direction shown by the arrow on Fig. 20, Plate 31, and the only resistance to this strain is the security of the fastenings.

The same strain on the fastenings does not take place on either wood or iron channel guides, where they are fixed on opposite sides or ends of the cage.

Where the safety catch for cages is used, provision in strength of guide and fastenings is necessary to provide for any strain that may occur in case the catch comes into operation.

LUBRICATION.

The lubrication of cage guides is a matter that deserves some attention. The practice differs very much. In some cases it is not thought necessary, and no lubrication is used; in others oil, soft soap and water, and water alone are used. The writer has used liquid grease similar to tram grease, put into small boxes on top of the cage, with just a sufficient outlet to allow of the necessary quantity of grease to run on to the rails while the cage is in motion. These boxes are fitted with hinged lids, so that when the box is filled with grease the lid can be closed, and thus prevent dirt or other matter mixing with it; the application of the lid alone has in some cases made the difference of effective greasing. Before the lid was put on the greasing was very unsatisfactory, but afterwards it was all that could be desired. As an illustration of the necessity of some sort of lubrication being required, it can readily be imagined what would take place if the guide bars or other working parts of an engine were not lubricated. Although the illustration may be extreme, it points in the same direction both in pit cage guides and in engine guide bars.

How best to obtain a good, safe, and durable pit cage conductor, is worthy of careful consideration. This, it will appear, is more easily accomplished in shallow pits with light loads than in deep pits with heavy loads and quick winding; for depth, weight of load, and speed in winding are all important factors to take into consideration on this subject. And as future mining operations will tend to increased depths and weights to be raised, any addition to our limited stock of information and experience on these matters cannot be other than interesting to responsible persons connected with mining.

It would appear for depths up to 600 yards, with loads not exceeding 13 tons, and where no displacement in the sides of the shaft takes place, by pressure or otherwise, that wood, channel iron, and wire rope guides can be used to advantage; but over that depth, and for loads exceeding 13 tons, so far as experience indicated at present, it would seem that rail guides are the most suitable, and meet the requirements best.

It may be advanced that channel iron guides have many advantages over any other class of guide, such as more wearing surface, greater strength, and practically they can be used to any depth. This will be admitted by anyone who carefully considers the subject. The disadvantages appear to be, as they are fitted up at present, the narrow joint surface and the necessarily small number of countersunk bolts fixing them at the joints. But what seems a greater disadvantage as compared with rail guides under some conditions is, for instance, where displacement takes place in the sides of the shaft, with the channel iron guides at opposite ends or sides of the cage; and where this occurs the guides may be put out of position, so that the cage will come out of the guides altogether; or the displacement may take the opposite direction, and thus be thrust too near together, so that the cage will not pass down the pit, and therefore sticks in the shaft. This is not an imaginary case, for such occurrences have happened in the use of channel iron guides. But take the same circumstance and condition where rail guides are used with the chair sleeper. The chair sleeper maintains and keeps the guides in proper gauge, and in whatever manner they are thrust out of position to a certain extent the cage follows. Cases are known where the guides have been displaced as much as 14 inches out of their proper position, and not interfered with the working of the cage. Of course it is desirable and necessary to have them put back into position as soon as opportunity affords. It is an advantage where a system of guides will thus allow of the work to be carried on until this can be done.

The writer may here be allowed to introduce a quotation from Mr. Herbert W. Hughes' work on coal mining, giving a description of a French system; but as there is no data of the length of time they last, or the depth of pit, weight of load, or speed in winding, it is not so valuable as it otherwise would have been had this additional information been given.

Rollers are used on the rail guides, and a system of fixing the guides to a centre iron girder with "notches or recesses" in the flange is adopted, and by a simple pair of glands with only one bolt used to hold them in position. It is very interesting to observe the different designs used in fixing guides, and, in comparing the French system with the practice adopted in England and Wales, the system described by Mr. Hughes seems to be of a good temporary character, but only a temporary one. The novel application of the double glands with one bolt, to meet the difficulty of the rails being opposite each other, to a practical man seems only a temporary expedient.

"On the Continent the common system of fixing rail guides is that due to M. Al. Briart, which consists in dividing the shafts by a single series of buntons of H steel girders. . . . They are notched to receive the rails. To secure the rails to the buntons two steel glands are fixed, one on each side of the rails, which they firmly grip, a bolt passing from one gland to the other. To prevent any chance of movement a block of cast iron is placed between the rails, and is furnished with a slight projection, which lies in a corresponding groove rolled in the flange of the rail. At buntons where joints occur, two sets of these glands and blocks are fixed, one above and one below, but at intermediate buntons only one set at the top of the girders is used.

"With a view of reducing resistance, rolling has been substituted for sliding friction, and at Anzin Colliery, France, the guide shoe is composed of two wheels, one on each side of the rail guide, revolving on a pin bolted to the side of the cage."

The duty which cage conductors had to perform might now be appropriately considered. They were all aware that mineral products were brought to bank at a speed almost unknown a few years ago; but as this fact has a very important bearing on the cage and conductors, the annexed table, giving some of the working particulars of a few collieries, may be of interest. From this table it will be seen that the greatest maximum speed of the cage in the shaft appears to be attained in the Rosebridge Colliery, where it reaches 5,100 feet per minute—*i.e.*, equivalent to a little over 57 miles an hour—a speed which almost comes up to the fastest railway trains.

The average speed indicated in the table is given at 47·4 feet per second, or 32 miles per hour, which is generally admitted to be a safe working speed. In addition to these data, the table gives the average time occupied in landing to be only 26 seconds, and in one case as low as 15 seconds; whilst the average number of single cage up and down journeys is represented by 516 in a double shift of 24 hours, on the 1876 table. In the 1893 table this is increased. It is interesting to compare the loads dealt with before and when cage conductors were introduced. At that time 5 or 6 cwt. of coal in one corve and the cage with 1¼ ton were considered very large loads.

At the present time loads of coal of 4 and 5 tons or more, and a total load of from 10 to 20 tons, are not unusual. Having increased the speed and increased the load, it necessarily follows that additional strength of conductor is required to do the extra work.

Take, for instance, a cage on conductors at rest and without any motion; it is evident they would last in that position until their component parts naturally decayed by rusting away.

Again, take a cage on conductors and imagine it possible to put it into the highest possible motion (say lightning speed, as far as our limited ideas can grasp such a state of motion). Under these conditions we would expect, from our knowledge of the component parts of the cage and conductors, that they would be destroyed and rent asunder.

Now between these two extreme cases it is desirable that some reliable knowledge may be obtained from the practical experience of our daily work of what is the highest safe point of speed compatible with the strength of the materials and construction of colliery cages and conductors.

The following tables of speed indicate what was done in some collieries in the years 1876 and 1893:—

CAGE CONDUCTORS.

FIG. 10.

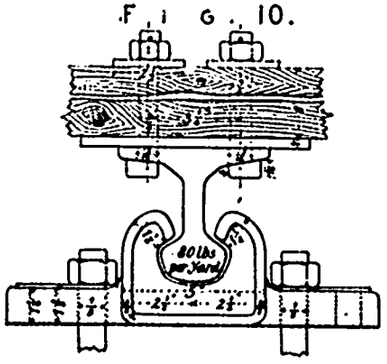


FIG. 11.

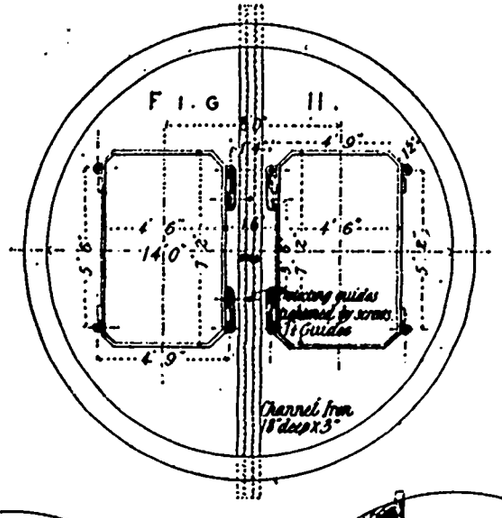
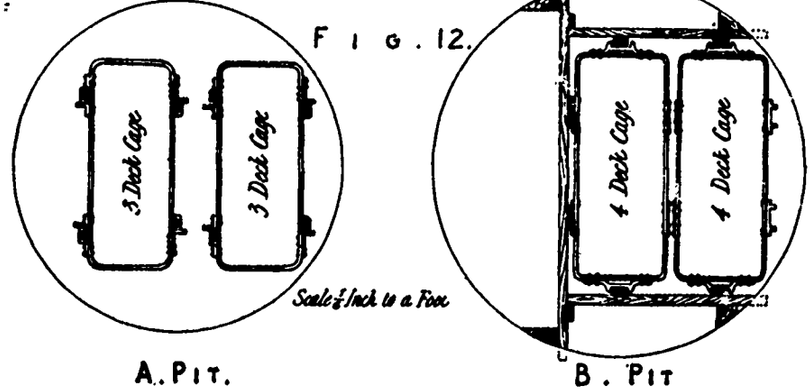


FIG. 12.



A. PIT. B. PIT

CAGE CONDUCTORS.

FIG. 13.

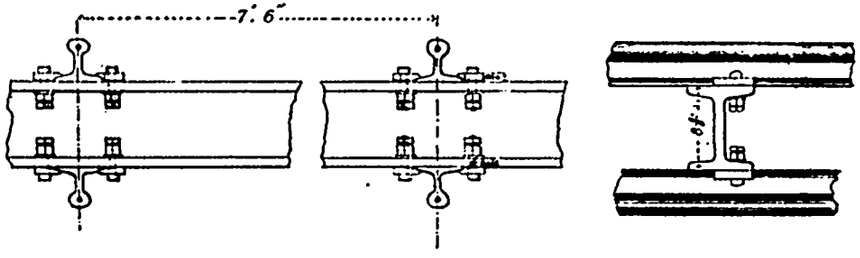


FIG. 14.

FIG. 15.

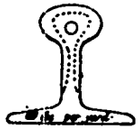


FIG. 16.

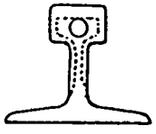


FIG. 17.

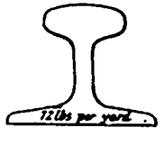


FIG. 18.

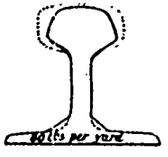


FIG. 19.

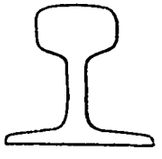
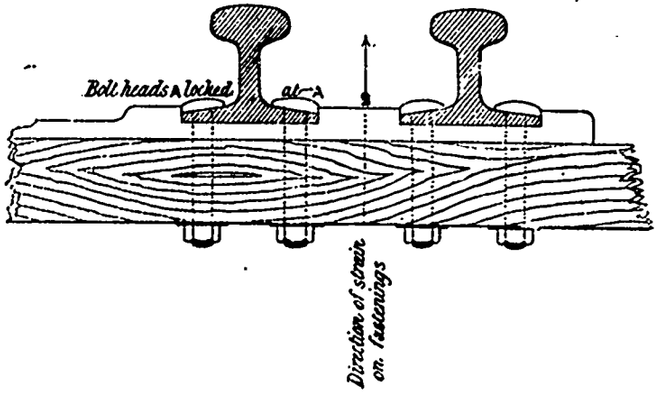


FIG. 20.

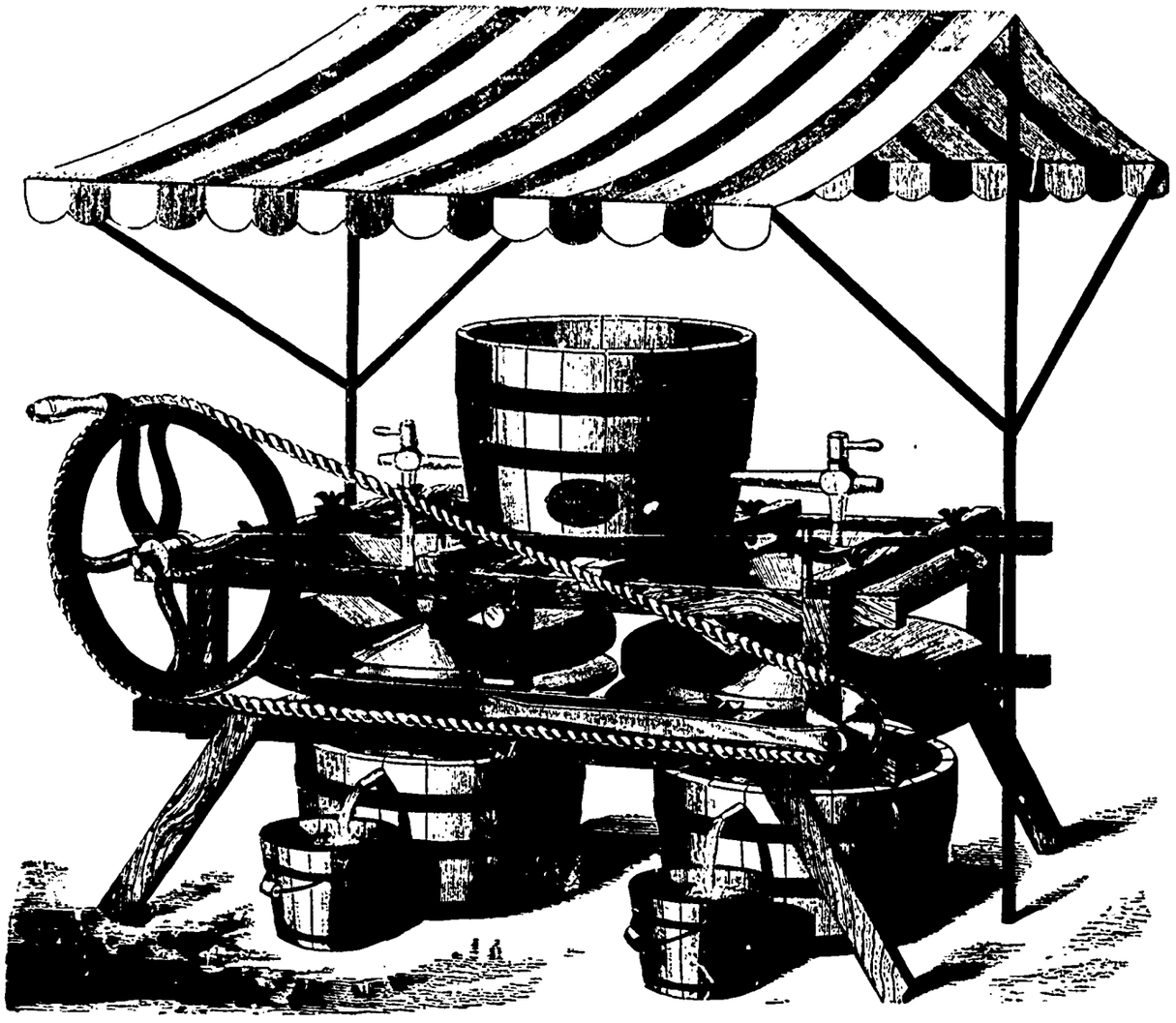


COAL WINDING—TABLE OF CAGE SPEED FROM NORTH OF ENGLAND COLLIERY ENGINEERS' TRANSACTIONS, YEAR 1876.

COLLIERY.	Weight of Cage.	Weight of Load.	Mean Cage Speed in Shaft.	Maximum Cage Speed in Shaft.	Depth of Pit.	Time Occupied in Running.	Time Occupied in Landing.
Year 1876.	Cwt.	Cwt.	Feet per Minute.	Feet per Minute.	Feet.	Seconds.	Seconds.
Silksworth	60	80	2,180	3,560	1,620	44	40
Harton	50	..	1,020	.....	1,278	75	30
Boldon	40	..	1,689	2,788	1,548	55	..
Wearmouth	42	110	1,180	.....	1,770	90	20
Usworth	22⅓	..	1,300	1,706	966	45	..
Denaby	48	..	1,691	3,080	1,351	47	21
Douglas Bank	20	..	1,765	3,100	1,530	52	25
Rosebridge	22	..	2,590	5,100	2,418	56	25
Houghton-le-Spring (upcast shaft)	35	55	1,278	1,750	745	35	35
Cowdenhill, No. 1	25½	..	1,320	.....	666	30	30
Hucknall	30	..	1,652	.....	1,239	45	25
Kiverton Park	20	..	1,624	.....	1,218	45	15
Biddick	9½	..	821	1,500	684	50	..
Ryhope	27	193	1,080	.....	1,524	85	22
Usworth	21	54½	1,306	1,882	1,002	46	50
Year 1893.	Cage.	Trams and Coal.					
Harris Navigation, South Wales	120	152	2,100	4,600	2,100	60	15
Cage Bridles and Rope from the Pulley to Cage at Pit bottom	..	128	.....	.....	....	..	..
Cage	..	120	.....	.....	.....	..	..
Total	..	400	.....	.....	.....	..	..

TABLE—COAL WINDING, 1893.

NAME OF COLLIERY.	Diameter of Shaft.	No. of wood guides on cage ends.	No. of steel or iron guides on one side only	Lifetime of Guides.	Depth of Pit	Distance of Byats apart	Highest speed of winding per minute	Time changing Trams at top and bottom	Clearance of Cages at meetings.	Clearance of Cage from side of Shaft.	Allowance for expansion of Rails at joints	Total Weight of Load, including rope	Size of Joint Byats	Size of Intermediate Byats	Weight of Steel and Iron Guides per yard	Wire Rope Guides.	Wire Rope Guides between Cages	Weight on Wire Rope Guides.	Size of Wood Guides	Diameter of Down-cast Shaft
	Feet.			Years. Upcast.	Yards. No. 1.	Feet.	Feet.	Secs.	Inches.	Inches.	Inches.	Tons.	Inches.	Inches.	Lb.	Each Cage.	No.	Tons.	Inches.	Feet.
Nixon's Colliery	..	2	2	6½ Downcast. 12	436 No. 2 500	9	..	..	4½	6	¼	11	14×5 Oak.	12×4½ Oak.	..	..	..	..	..	..
Tredegar	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.	..	..
Dowlais	..	..	..	..	..	..	..	..	..	.	..	.	..	..	..	..	..	..	..	.
Harris Navigation	.	..	2	6 to 10	735 700	9	4600	15	7	6	⅛	14 20	11×5	11×5	72	..	..	..	..	..
Ocean Collieries	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clydach Vale, No. 1	15	..	..	..	395	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..
" No. 2	14	..	..	..	430	..	..	.	..	..	..	10	..	..	..	..	..	..	..	..
Cowpen Colliery	..	..	2	Still in use.	220	6	..		6	3	..	..	9×4½	..	46	..	..	5½	..	..
Lewis' Merthyr	.	..	..	..	370	..	..	..	10	.	..	9½	..	..	..	4	2	4	..	..
Wearmouth Coal Co.	..	..	..	20, still in use.	600 Upcast and Downcast.	7	.	..	14	1	..	13½	11×3 Reduced.	..	..	4	..	2½	6×3 Oak.	13½
Harton Coal Co.	..	..	..	.	..	..	..	..	..	..	.	..	.	..	..		..	..	..	..
Avon Colliery	..	.	..	Still in use.	502	9	..	.	14	6	..	12	14×10 Each plate	10×9 Each plate	80	..	..	..	..	..
Elswick Coal Co	..	..	..	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..
Bebside Coal Co.	..	2	..	Still in use.	200	..	..	..	..	..	..	6	11×3 Reduced.	..	..	..	..	..	..	..
Cadeby Main Colliery	16	..	2	..	750	8	..	.	18	18	..	15	8×5 Steel Chain	..	65	..	..	..	..	..
Denaby Main Colliery	14	2	...	..	450	8	..	..	16	16	..	11	6×5 6" sqr.	..	..	..	..	..	..	.



A Portable Gold Miner.

The want of a machine that will diminish the labor and lessen the cost of mining, and at the same time increase the earnings of the miner has long been felt. Our illustration this month shows a novel appliance invented by Messrs. A. B. Cohn & Co. 197 Water Street, New York.

In the first place it is portable, and is made with special reference to its durability and facility of repair wherever used. It will wash from three to five tons of pay dirt per day, and one man can operate two machines by hand with ease. By the use of a small improvised undershot or overshot wheel of four feet in diameter, one foot wide, about sixteen buckets, six or ten machines can be driven with perfect regularity, or any desired number can be operated by any available power, reckoning one horse power for every twelve machines. It is claimed that a single machine will accomplish the work of ten expert miners with the pan, and yield a greater percentage of gold. It is also claimed that the actual labor is one-fourth less than the ordinary miner's labor, and, furthermore, that no skilled labor is required in operating it. One important feature of this machine is that it can be worked without the use of water if necessary, provided the dirt is well dried before being used; however, it will not work up quite as much material. It will concentrate black sand, rich sulphurets or any precious grain metal, all of great value to the miner. A rather important feature is that the amalgamating process can be used with the best of results, and that it is as perfect an amalgamator as any now in use. The following is a table showing what one man can do with one of these machines as compared with hand labor. Beginning with 10c. pay, which is known as poor pay, (meaning 10c. per pan):—

ONE MAN PER DAY.

10 cents pay	$5 00
5 " "	2 50
1 " "	50

MACHINE PER DAY.

—	$50 00
—	25 00
—	5 00

In this estimate is given the maximum capacity of the hand panning and the minimum capacity of the machine, thereby showing what the machine will do in poor diggings heretofore unavailable except by sluicing, with its uncertain results and difficult management. The machines are provided with tubs and other adequate means so as to economize the use of water; the tubs when full will work a whole day, sustaining only a trifling loss.

From figures furnished by the makers we are able to give the cost of a complete outfit for from one to five men:—

One "A. B. C." Portable Gold Miner	$125 00
One Tent	35 00
Three Short Handle Steel Shovels, railroad point	3 00
" Long " " " " "	3 00
Three Prospecting Picks	4 50
One Light Hoe	50
" Dredging Hoe	75
" Miner's Hook	1 00
" Prospecting Trowel	50
" Miner's Axe	1 25
" Hammer Head Hatchet	1 00
" Perforated Shovel	1 00
" Miner's Sieve	2 50
" Saw, one File, one Magnet	3 00
Total Outfit	$182 00

The Colliery Fireman: His Training, Treatment, Position and Duties.*

By Mr. George Elce, Altham Collieries, Accrington.

In choosing a subject for a paper to read before such a society as this there are at least two important points to be decided, viz., its importance to colliery managers, and one's own authority to speak upon the point. But in taking the present one, it is repeating an axiom to say that it is one of extreme interest and importance to every colliery manager, and I can fairly claim that it is a matter in which I have taken a deep interest for many years, and about which I have learned a little from experience. In the working of a colliery, then, the fireman is a very important factor indeed. Upon "the manner of man he is, depends the conduct of most things in the mines underground." His training, then, is a matter of vital importance, and indeed it is not too much to say that he ought to be in some measure "to the manner born," at any rate he should begin to work in the mine at the earliest age at which it is deemed expedient for a boy to enter a mine at all, having first received such an education as will enable him to perform any ordinary calculation, and to pick up at evening classes and private study, the principle of all the appliance he comes across in following the work of a miner lad, he should be put to every kind of work in the course of his youthful years, both in connection with datalling and coaling, by which two terms I mean to include all the work done in a mine underground. He ought to be taught early the value of observation in dealing with roof (especially timber drawing and its effects upon adjacent places); ventilation, whether bratticing, sheets, doors, stoppings, regulators, crorsings, or what; arching and the securing of rods, roof, and sides generally, hauling, jigging, hooking, and all matters pertaining to the expeditious output of minerals. He should be made an expert in understanding other men and boys, their various grievances (real or imagined), and one matter of vital importance is that he should be able, in due and reasonable time, to perform any part himself; so that, in the years to come, "None may rise up and make him afraid."

* Paper read before the National Association of Colliery Managers, Lancashire Branch, June 1894.

When a man has had a course of training in the mine like this extending over a term of, say, nine or ten years, and has acquainted himself with the elementary portion of the principles involved in what goes on around him, he will not be the sort of man (as a rule) who will lie down and request someone to jump on him, and he will certainly not expect or tolerate such a thing being done without his special request. The fact is he will know that, given the opportunity, he is a more useful man than the average miner, be he coaler, dataller, ripper, sinker, or what else he may, and therefore entitled to greater consideration and remuneration. I recall the story of a hooker-on, who claimed more money and authority from his manager because he said the men abused him a good deal. "Well," said the manager, "I cannot afford even 1s. per week in wages, but I will give you 5s. per week in authority." The law gives the fireman certain statutory powers which are presumably sufficient to enable him to carry out his duties as defined by the special rules, and I believe it is only proper that these privileges, so far as they really are such, should be maintained in their pristine force, and that the pay should be such as to place him above a workman, especially in regard to the exigencies of trade, sickness, or accident. So much for the qualifications of a man who is to become a fireman, but then he is only in the position of the man who got married; after the ceremony the minister complimented him, saying, "Well, you are at the end of all your troubles now, at any rate." Seeing the parson some time after, the man suggested that he had more troubles since his wedding than ever before. "Of course," was the reply, "there are two ends to everything, I meant the first one."

Thus it is with the young fireman; he finds that many of those whom he had previously counted friendly, give him the cold shoulder, suggest that he is about the most unlikely, unfair, injudicious person ever tried as a fireman; or maybe they confine their observations to questioning the means by which he attained to that position; but whatever line they take, it will mean that he will have considerable discomfort for a time, even under the most favourable circumstances, and will need all the help and comfort that his fellow firemen and superior officials can give him, as well as a strong determination to succeed on his own part, and a firm conviction in his mind that "Blest are they who to the end endure." He should (from first becoming a fireman) not have anything to do with a workman's union, I say nothing of a fireman's union, so that he can deal fairly as between man and man, when it is bewteen the miner and the owner. It is quite necessary that he be a man of temperate and regular habits, as sobriety, attention, and order are as essential, if not more so, to direct the work of a mine as any other business, and this will save him from much discomfort, as most uncalled-for controversies are carried to their acute stages under the influence of "Old John Barleycorn." He should (generally speaking) seek his pleasure in the company of men other than miners, especially avoiding such as are under his personal supervision. So much for his training and treatment up to assuming the position of a fireman. At first he will be apt to think that his power and authority are too limited to enable him to adequately perform his multifarious duties, and will have to learn the hard lesson that, like any ordinary implement, this authority is only equal to its work in skilful hands, and he will be like a miner I knew, who apprenticed his lad to a joiner, and, at the end of the second year, said to his son, "Well, lad, what hast tha' learned to mak'?" "Why," replied the lad, "I can make a wedge an inch long." Our friend hastly replied, "Any fool can do that. Reach me axe and saw," which the lad did. The old man cut an inch from the end of a narrow board with his saw and began to taper it with his axe. After doing a bit at this he missed the inch of wood and hit his thumb, upon which he desisted. The lad then sharpened the end of a board wedge-wise and cut an inch off it with the saw, as a joiner should.

However, our fireman should be made to understand from the first that in all right things, and in such only, he will be backed up by his superiors. He should be treated with sufficient confidence to know what are the ideal conditions aimed at in the conduct of the district under his care: because we know there is a little divergence between the actual and ideal build and system of a colliery, and the intelligent fireman should have a vision in his mind of the complete picture. In any case of radical change in the programme the opinion of a fireman should be one of the earliest things obtained (whether it be in the method of timbering, working, or ventilation), and if he has, or is supposed to have, or believes himself to have any objection to it, some care should be taken to afford him reason to change or modify the same, so that when he has to supervise the result he can put his heart into it, and intelligently lead the men therein. His ordinary duties, as defined by special rule and as generally known to us, are as follows: Charge of his mine or district, safety examinations, danger signals, reports, visiting men and withdrawal during danger, sending men out on rule violation, propriety of air-doors, and other air appliances, lamps (frequent examination of), supply of timber, and its use when requisite, and generally enforcing the rules. And as regards these well-defined and printed duties, I content myself with saying that they are delicate, onerous, responsible, omnipresent ones, and for their due fulfilment require men of strong calibre and strict conscientious endeavour and integrity.

But there are other duties pertaining to an unwritten law, such as dealing with the payment of the men and boys under their supervision, and of this duty I desire to say that, avoiding fear on the one hand and rashness on the other, a fireman should seek to fairly balance the value of any service rendered by those under him, and ever seek "To do unto others as he would that they should do to him," were their relative positions reversed. If any hindrance or inconvenience arises to his workmen, he should (whether there be any rule in the matter or not) do his best to set the matter right, so far as his influence will carry him. And as regards his services to his employers, he should be willing to try to serve their best interests in every way so far as his conscience will allow him (one must bear in mind that an unscrupulous man may ask more than an honest service can yield). There is a story current that the Messrs. Rothschilds wanted to send a man abroad on a very important mission, and they called before them one of their senior clerks, and asked him how he would like to go abroad in their service, he inquired particularly as to the remuneration, and asked if it was not possible for him to have time to consider, &c. They called the next man, and he was willing to go, but when asked how soon he could be ready, he said he thought in two or three weeks. Upon his retirement they interviewed a third, who at once intimated his willingness to go anywhere in their service, and when asked how soon he could be ready, he replied, "I am ready now," and he went, and where no principle is involved I commend his example to a fireman. At the same time, I must say that one of the most exasperating of firemen is the one who, like a looking-glass, reflects one's own opinions, and never, never has one of his own.

If any large body of gas by accident accumulates the firemen are the men to deal with it, of course under the supervision of their superior officers. I think the firemen in a pit should occasionally change districts, so that each man is acquainted with the whole pit. So far as is reasonably practicable a fireman should not be the supervisor of his own relations by blood or marriage, as man "cannot serve God and Mammon," and so, whilst it may be impracticable to secure men who have no relatives as firemen, there should be a gulf fixed to divide the little family parties which are so apt to form. One of the unwritten duties of a fireman is that of preventing waste, and this can only be done by a continuous active striving—waste of timber, nails, plates, rails, brattice, tools, or coals, by having left in (what a collier calls) a screen, which is variable from a foot thick to half a dozen yards. In observing what goes on under a fireman, careless in these matters, one is reminded of two lines in the "Ancient Mariner," with the variation:—

"Timber, timber, everywhere,
And not a prop to set."

A very important habit in a fireman is the one of method or order, because a man who is himself unsystematic cannot keep either men or work in any sort of regular order. A retentive memory is well worth cultivating by a fireman. We have lost one very urgent necessity for a fireman being a keen gas detector since the candle went out of general use, and I regret to be able to say that I am afraid there are still firemen who "look for what they don't want to find." If a fireman is to examine the effects of the ventilation he must be provided with a good, I would say the best known, lamp for detecting gas, and he must hunt for the slightest indication of it with the pertinacity of a sleuth hound, and not have in his mind the idea that if they have to miss firing the shots it will be a serious matter. His idea ought to be, and he should be drilled and re-drilled in it from time to time, that if there is gas to be found he will find it, leaving the economic results to people who are more affected by them. The examination of roof and sides and the timbering in his district ought to be a labor of love to him, and he should never tire or weary of taking pains in these matters. When timbering or packing is done within his direction he ought (from the beginning) to form the unalterable resolve never to have poor or slipshod work or material put in; far better no timbering than poor or mistaken, as he will realise if he bears in mind that more delays to traffic occur and more limbs and lives are lost from such causes than any other in our coal mines. An important thing for a fireman to observe is the effect changes in the atmospheric conditions (such as pressure and temperature) have upon the roof, floor and sides of the particular mine he has charge of. I know many roofs which are very liable to fall upon a rise of the barometer, especially in pillaring, and also when the weather changes from hot in the day to cold at night, thus favoring the deposition of moisture from the hot air upon the roof and sides of the roads, particularly the intakes. The tricks and manners of the roof, floor, coal and packs under his charge should be his constant care, such as, for instance, where does the gas come from—coal, roof or floor—and when? Is it a regular constant yield, or is it erratic, following weighting and heaving, forming outbursts, &c.? What shape of the face (in any method of work), is most favorable—first, to safety and the workmen; second, to the owner and round coal? Are they identical or not, and if not, why so, &c.? All these are problems which he will find worthy of his consideration, and with which he can profitably concern himself.

One thing which I personally do not care to have to deal with in a fireman is extra density: he should be alert and active, mentally as well as physically. To one inclined to be waited on and carried about, I would commend the study of a pathetic little incident in the history of a stout colliery manager of the last generation. One Saturday he got a drawer to take him into a district of his pit (when it was nearly giving over time). The young man rather growled about it, but our friend sauced him well, and so he ran him where he was requested. And then, while taking him along a low length of road, the drawer swayed the tub off the road, and told the manager to get out as best he could—he himself was going home. On Sunday morning the manager's friends became uneasy, and a search was made; he was found in the tub where his quondam friend had left him. A good quality for a fireman to cultivate is a thoroughly sound judgment, not to decide about a matter upon the first plausible tale he comes across, but to learn every possible detail concerning it from all the available evidence, and judge accordingly, and in order to become so he must learn "that great events from little issues spring," or, in other words, that there is no detail of his work too insignificant for his attention, and that it is only by keen attention to the small items that the apparently large ones come out correct.

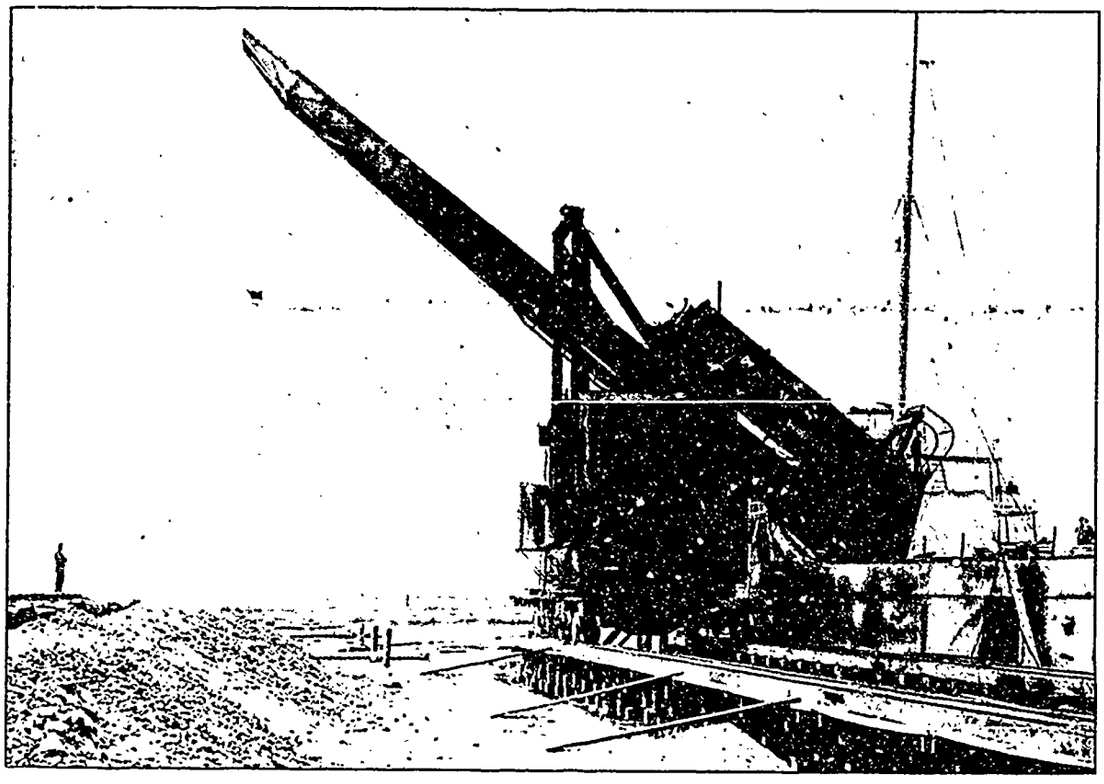
One of the most difficult duties, and quite as important as difficult, is for a fireman to maintain the necessary discipline amongst those under his charge, and on that head I can only say that whenever he has got a fool to deal with he must himself be extremely wise and circumspect and in every case walk in the line of strict law and equity. His troubles will not often come from competent, sensible men. At the same time, malice is a luxury never to be indulged in by him; he should rather adopt the attitude (towards an unruly member), of a wrestler who carefully watches every move of his opponent, and applies just the requisite pressure in the weakest place, in order to prevent his own overthrow. It cannot be too strongly impressed upon him that it is his duty (except in special cases and at certain set times), to see that other men do the actual work, and not to demonstrate to the admiring eyes of all his datallers, &c., that he can do the work of two with three watching him. Mr. Hyslop, in his splendid work on "Colliery Management," speaks of someone he knew who was a "do-all-the-work-himself" sort of a man, but he naively concludes, "His friends lament his early death, and his employer had early to replace him." I am reminded of a story of an overman, who said to one of his men, "Why, man, it takes me half of my time to watch thee alone." "Aye man," replied the workman, "it takes me all my time to watch you," and a fireman should observe the principle embodied here. It may possibly be said—Why, you ask for the qualities of a manager in a fireman; and I should remind the author of the sentiment that a Mr. Burns, from over the Border, has said:—

"The rank is but the guinea stamp,
The man's the gow'd for a' that."

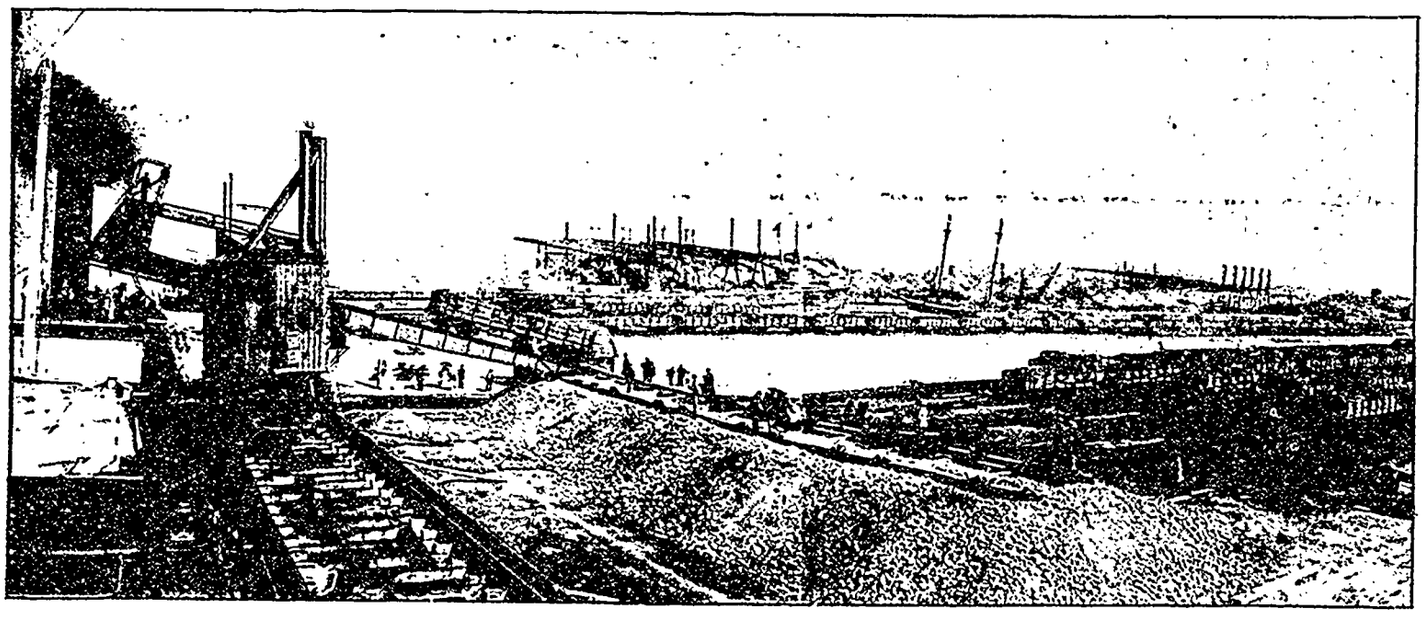
And I would further say that from the ranks of a host of such ideal firemen should come the men who in after years are to receive the guinea stamp of colliery manager's certificates, both first and second class. Because, firstly, they are most fit and qualified; secondly, they are most deserving; and thirdly, no other class of men can be really as fit and as deserving as these should be. And as an important argument in favor of this special and particular training of our subordinate colliery officials I would like to point out that, if all the firemen in all the pits in this kingdom had this trained intelligence constantly directed upon the daily problems of our mines, the result would be that every detail, every mechanical contrivance used therein, would be continually improved and developed, and the results could hardly be realized by anyone. Collieries would become what even the most optimistic dreamer has never seen in his wildest dream—in fact, "what it has never entered into the heart of man to conceive."

There are many things done, and suffered to be done, in our mines now which are barely fit for men and boys to do. Anyone who has had a fair trial at bolt and chain drawing, ventilator turning, pushing coals by hand down a too flat scuttle, turning at a crab week in week out, stiff slant waggoning, hooking at a wet pit bottom, or any such lofty, soul-inspiring pursuit, to earn his daily bread, will be able to appreciate my meaning when I say that some work is not of itself elevating. There is also the class of useless labor, such as blowing floor to make roads in seams where the roof requires artificial support almost every yard, straight cutting where every practical man must feel the longwall would be more fit, jigging coals down hill to haul them up again, drifting at random after coals where faults intervene, where following the natural signs would give proper results, etc. Such soul-destroying, debasing, and useless work would be speedily reduced to a minimum if it came under the observation of the ideal fireman I have sketched, because he would be like the Oldham man who went to gaol and was put on the treadmill. Says he to the turnkey, "Ow'd mon, have they allus turn't this wi' their feet?" "Yes," was the reply. "By gum, but if they had it i' Owdam they'd have a little engine to it i' quick sticks." It is possible for an argument to be advanced that it would be indiscreet for a manager to continue

IMPROVED COAL HANDLING MACHINERY.



The McMyler Coal Car Dumping Machine Tilted to Hatch.



The McMyler Coal Car Dumping Machime—Taking a Car.

ally make men qualified to take his place, but I am afraid it would be a weak prop indeed to sustain a colliery manager if he could only do it by having a body of incompetent subordinates. And indeed he would be much more likely to fare reasonably well by having a thoroughly competent set of firemen who owed all they knew to his kindness. He would be taking the line of the farmer's boy who was left to mind the house and the children whilst his master and mistress went off for the day. The master cautioned him to be quite sure and keep the children away from the fire. When the couple left home they had a fair length of a straight road to go, and, looking back just before the turn, they were horrified to see flames coming up their house chimney: returning, they found a great fire piled up in the grate. "Why is this?" inquired the farmer. "Well," replied the lad, "yo: wanted the children kept away from the fire, and none 'em dare go near that one."

There are, I believe, one or two things which the law might be made more definite about in favor of the fireman: for instance, if he gives an order to a man about his work or place the workman ought to take all the responsibility for non-obedience. The law ought to define what percentage of gas, and how determined, should be considered to prohibit working or passing in, and more particularly define the time after his visit for which he can expect to be called upon to answer. And lastly, the duty of a manager to his fireman (and the under manager in his place and degree) is to treat them and so to act before them that they may look up to him in all matters as a true gentleman and competent adviser. You cannot look up from the summit of Snowdon and Menai Bridge, and a fireman cannot look up to a man who is not in all essentials his superior. So a manager should see to that point, and, having selected and secured a staff of good firemen, he should "bind them to his soul with hoops of steel," so that at all times, but especially when the time comes, as it very well may, that his place, fortune and reputation depend on their true estimate of him, he may find that he has not "built his house upon the sands," but upon the rock of genuine sterling human nature under its best and truest aspects.

Improved Coal Handling Machinery.

Last month we gave our readers particulars of the extensive improvements in coal handling appliances at present under construction for the Dominion Coal Co. Ltd., and as the question of rapid loading and discharging of coal cargoes with a minimum amount of breakage is of prime importance to our coal masters, we have pleasure in publishing a few notes respecting a new plant recently put on the market by the McMyler Car Dumping Machine Co., Cleveland, Ohio. Next to the traffic in iron ore between the mining regions of Lake Superior and the furnace districts of Illinois, Ohio and Pennsylvania, the movement of bituminous coal from Lake Erie ports to the Northwest is the most important item of Lake commerce. For several years past shipments of coal from Pittsburg, Hocking Valley and West Virginia districts have averaged about 3,000,000 tons each season. This coal is of a high grade, suitable for fuel and steam purposes and for the manufacture of gas coke, and shippers have tried various methods of loading it into vessels without damage from breakage.

As far back as twenty years ago attempts were made to handle coal on the lakes by means of chutes, and on the Cleveland docks, of what is now the Big Fourth railway, as much as $65,000 was expended on a single plant that had to be entirely abandoned soon afterward, on account of damage to the coal in handling it. With the advent of big steel steamers and wooden boats of largely increased capacity, rotary derricks, handling, first, buckets of ordinary size, and later on buckets of five tons capacity, were introduced into the trade, but even with these the largest vessels were delayed two to four days in loading and with eight to ten men shovelling into buckets from a car three feet deep, and not taking probably more than 20 lbs. to shovelfull, there was still the disadvantage of separation in the coal and consequent breakage. The effort, therefore, has been to secure dispatch for vessels approaching that obtained in the ore trade, where ships of 3,000 to 3,500 tons are loaded in a few hours, and at the same time avoid loss in the commercial value of the coal by overcoming as far as possible the breakage referred to. A machine that, in the opinion of coal shippers generally, meets these requirements, is illustrated herewith. From an engineering standpoint it is a very novel affair, but it has been given sufficient trial in actual service at Ashtabula, O., to demonstrate its entire practicability and to warrant the statement that it will within another season revolutionize the business of handling coal on the lakes. Patents on the machine are controlled by the McMyler Car Dumping Machine Company, a new corporation, and the first of them was built by the McMyler Manufacturing Company for Pickands, Mather & Co., who are the Cleveland representatives of the Minnesota Iron Company, and who conduct a larger business in iron ore, pig iron and coal than any of the several Cleveland firms that are engaged extensively in these associated industries. Instead of the old system of derricks and buckets, the machine takes up a loaded car of about 23 tons capacity and dumps its contents into the hold of a vessel in a manner that avoids practically any fall of the coal, as the car is loaded to the mouth of the hatch, and the entire load allowed to slide out in a concentrated mass through an ingeniously arranged chute. Of course a car of 50 tons capacity could be handled in the same way and the efficiency of the machine thereby greatly increased. Several records as high as fifteen cars of twenty-three tons each, 345 tons, unloaded in one hour, have been made with the apparatus, and steamers ranging in capacity from 2,000 to 3,100 tons have been loaded in eight to twelve hours. The machine is entirely self-contained and portable, having the notable features of a revolving derrick, with the addition of the girder or bridge, by means of which the entire car of coal instead of a loaded bucket is taken up and discharged. All trestle work is avoided, and there is nothing complicated or expensive about the apparatus. Aside from the machine itself the only expense is that connected with the arrangement of the surface railway tracks.

Viewing the machine from a mechanical standpoint, its elements may be described as a bridge of two place girders turning on trunnions near the river or dock end of the bridge. These trunnions are carried on a framework of the house, which is in turn carried on about 100 12-inch wheels arranged in a circle after the manner of a draw bridge. The circular track on which these wheels move is supported through heavy plate girder framework by 16 large car wheels moving on four tracks, the outer ones of which are 24 feet apart. Back of the machine and its docks are six double lines of railway tracks, which are for loaded and unloading cars, and which are spaced about the same as the hatches of vessels and perpendicular to the line of the dock. The power is furnished by a pair of suitable engines which control the hydraulic power and all operating parts are controlled by friction clutches, requiring but one operator to handle the entire machine and only four men in all engaged in connection with the plant. The other three are a fireman, a man employed on the bridge and a man to attach the cable to the drawhead of the car.

An hydraulic ram of 18¾ inches in diameter, mounted on trunnions, tilts the bridge, which is so balanced that it rights itself, the ram forming an effective brake for it. From an accumulator having at one end an hydraulic piston and at the other a steam piston ten times the area of the hydraulic piston, is taken the pressure to operate the clutches for pumping, hoisting and driving, laterally, and also the brake controlling the winding drum that pulls the car up the incline.

In operation, the vessels being placed so that the hatches are opposite the tracks, or nearly so, the machine is moved to the hatch which it is desired to load into, the steel cable, size 1¼ inches, is hooked into the drawhead of the car and the car pulled up to the upper or shorter end of the bridge, which is so constructed as to form a bumper, against which the end of the car rests when tilted. The end bar being withdrawn automatically through the tilting operation, the coal flows out through a discharging chute, and is concentrated in a telescopic trough or spout, which at the first flow of the coal may be lowered to within a few feet of the bottom of the vessel, when the work of loading begins at any of the several hatches, or to the surface of the coal itself after the bottom of the vessel is covered. In double decked vessels this chute may be lowered to the bottom deck combins. After the load is discharged the bridge is tilted back, the cable on the end board detached, the car allowed to run down and off the incline on to the track provided for "empties," a loaded car again taken up, and so the operation continues, the machine moving from one set of tracks to another and from one hatch to another as may be required by supplies of loaded cars, or in permitting of trimming of cargo. Through this latter operation a great saving in time is gained, as occasion for shifting a vessel while the work of loading goes on is very rare. Not only can the machine be moved laterally in either direction with a car on the bridge or platform, but it may be swung at the same time to avoid spars or any other obstructions on the vessel. One of the best features of the machine is its adaptability to the kind of railway car in general use in the bituminous coal trade. The only change required is that of fitting sliding end boards in the cars at a trifling cost. Immediately upon preparations being made for the erection of this first machine at Ashtabula, the management of the Lake Shore & Pittsburg and Lake Erie railways, the two coal lines running into that port, had 1,000 cars fitted with sliding end boards, and work has been started on 1,000 more of the same kind.

The capacity of the surface track plant shown on the large engraving, and from which cars are moved on to the platform of the machine by a locomotive constantly in attendance, is 140 cars, or about 3,300 tons. Of course the number of sets of surface tracks for loaded and unloaded cars depends entirely upon the number of cars it is desired the plant shall handle, and as the entire transferring apparatus is arranged to move along a dock line it can therefore be made to accommodate any desired number of tracks and length of dock.

Note re Prospectors' Classes.

By Wm. Hamilton Merritt, F.G.S., Assoc. R.S.M.

In a young country, whose mineral resources have not even been well prospected for, such as the Province of Ontario, and a great portion of the Dominion of Canada, the first steps to be taken looking toward mineral development, naturally, is to find the mineral, and then to persuade local capital to develop the same. If this is correct, it is advisable, in a new country, to educate men to look for minerals, and the general public to take an intelligent interest in their development. The first country which has adopted this policy, so far as the writer is aware, is the Colony of New Zealand, where excellent results are stated to have accompanied prospectors' classes. Following the example given by New Zealand, the Kingston School of Mining recently inaugurated a so-called "Prospectors' Class" in the gold mining district of Marmora, in the Province of Ontario. As this is the first instance of such a class in Canada, it is thought that a few notes on the same may be of interest.

Marmora is a small village, in the vicinity of which gold quartz mining operations have been from time to time carried on for many years. The class consisted of some 20 pupils ranging from the ages of say 70 to 17. It was composed of present and past mine foremen, prospectors, hotel keepers, merchants and other investors in mining claims, thereby leading to an increased and more intelligent interest on the part of business men in mining development, as well as by those who are actual workers.

The idea of the course was more to give those attending it a start, or basis from which to start, in the direction of personal mineral investigation, or an idea of what books and outfit to obtain to assist them.

Enough Chemistry was given to enable the student to understand what a mineral is, and to grasp the distinction between an acid and basic mineral, and numerous experiments were made to illustrate. Enough Mineralogy was given to enable the student to use a mineralogical text book, and to enable him to distinguish the common ores and the minerals entering into the composition of the ordinary rocks. Specimens illustrated this part of the subject, and rough field tests were made upon the same. Sufficient Geology (accompanied by typical rocks) was given to enable the student to form a general idea of the formation of the ordinary rock families, and in connection with ore deposits, the typical classes and their mode of occurrence was touched on. Finally, prospecting and the rudiments of mining operations concluded the course.

In practical work, assaying of gold and silver was given, and a course in blowpiping, which embraced the testing of the common minerals and cupellation; also panning and short trips to geological sections and local mines. The course occupied only two weeks, and the students were working for three hours in the morning and two hours in the afternoon of each day.

This preliminary Prospectors' Class was conducted by the writer, and it had as a result the formation of a local club to carry on geological and mineralogical work, and the collection and preservation of minerals and geological specimens, thereby proving in a substantial manner the sustained interest of the class.

An Ambulance for Use in Mines.—The difficulty of carrying injured men in mines through narrow and uneven passages has often been recognized. An apparatus invented by Dr. Paul Troisfontaines, is described by the *Semaine Industrielle*, of Brussels, and seems to be simple and convenient, as well as cheap. It consists of a sort of hurdle or litter, made of hoops about 8 mm. in diameter, placed parallel and joined by a fabric of cord or mat, somewhat like a hammock, thus giving when required, rigidity in one direction and flexibility in the other. The injured man is laid in the litter with his legs extended and his arms at the side of his body; the upper part of the litter is then folded over and secured by three or four straps. The man then forms a package and can be carried without the slipping and jolting of an ordinary litter, no matter how narrow or rough the workings may be. In case of fracture there is believed to be less danger in carrying a man in this way, holding him immovable, than in attempting to keep the broken limb in place by rough splints or bandages extemporized on the spot. These litters can be easily stored in a small space, and their cost, in Belgium, is 3 fr., or about 58c. only.

Photography in Mines.*

By Herbert W. Hughes.

In a recent contribution† on the same subject the writer dealt with the difficulties met with in photographing mining operations, and the methods he had found successful in overcoming them; but as the members he was addressing were familiar with the apparatus employed and the manner of using it, no reasons were then supplied, either for the preference given to certain forms of lenses, etc., or for the manner in which the operations were conducted. Photographs of places inaccessible to the general public are usually interesting, and mining pictures do not seem to be an exception, if the writer may judge from the numerous letters he has received on the subject. Many mining engineers have expressed a wish for further particulars in language less technical than that used in the paper already alluded to, in order that they may take up similar work in their own collieries. The field is a very large one, and it is to be hoped that members may be induced by this paper to enter into the work, because the results are valuable, both from a scientific and educational standpoint, and indicate clearly how many operations are performed far better than an ordinary drawing.

The writer took up the work to obtain views showing how the ten-yard coal was worked, as he found that there was considerable difficulty in doing so with diagrams. To further instance the value of such photographs, he may say that one view obtained by Mr. J. C. Burrow showed the heavy timbering in the 412 fathoms level at Dolcoath. This place was subsequently the scene of a terrible disaster in which seven men, including the foreman timberman, lost their lives owing to the collapse of the timbering as it was being strengthened, while an eighth man was rescued unhurt after 37 hours' entombment beneath the fallen *debris*.

The subject is particularly appropriate at the present time, because our President, Mr. Arthur Sopwith, was the first to obtain a complete series of views showing the various operations from the bottom of the shaft to the working place. These were taken in 1881 and 1882, but previously Mr. W. E. Debenham, in 1864 or 1865, had obtained several photographs in the Botallack metal mine in Cornwall. In 1884 Messrs. G. M. Bretz and F. P. Dewey,‡ photographed several places in the anthracite collieries of Pennsylvania; while in 1891, a series of views by Mr. H. Borner,§ illustrating the methods of working the Freiberg metal mines were published in book form. The latter are probably the best series from a photographic standpoint that have been obtained, and many of the views, such as (17) "Fixing iron settings in the Hohebirke lode," and (18) "Setting contracts at the forebreast in the Seligtrost lode," are also excellent from their technical accuracy. Several, however, have been completely spoilt by the endeavours of the photographer to produce a good picture, two being especially mentioned, viz., (3). Inset at the twelfth level in the Abraham shaft," where a miner is depicted breaking a large lump of loose rock placed at the edge of the shaft, and (5) "Sending down timber from an intermediate landing in the Abraham shaft," showing a man engaged in sawing a piece of timber, one end of which projects over the shaft.

With the exception of several isolated attempts, nothing seems to have been done in this country since Mr. Sopwith's experiments until about eighteen months ago, when Mr. Burrow and the writer took up the subject and endeavored to obtain a complete series of views showing the methods of mining where the excavations are larger than usual. A selection of the former's results have just been published in book form. For mining work it is necessary that the operator should either be an engineer or have an engineer associated with him, and in this respect Mr. Burrow was happily situated, as he was assisted by Mr. William Thomas. Mr. Burrow and the writer have been in communication with each other, and both finally used similar apparatus and materials, the only difference being in the appliances used for illuminating purposes. The writer has much pleasure in admitting his indebtedness to Mr. Sopwith for many useful hints and advice which assisted him in overcoming several difficulties.

Cameras—For many obvious reasons it is necessary, for underground work, that a camera should be of the lightest and most compact form as it often has to be erected in awkward and confined situations. The writer's first experiments were made with the club camera of Underwood & Co., half plate size (6½ inches by 4¾ inches), which is of the light tourist pattern possessing the several movements common to that class of camera; its construction is, however, not rigid enough to stand the rough usage to which it is subjected underground. Several other designs were inspected, and for many reasons the whole plate Acme camera of Watson & Sons, giving a view 8½ inches by 6½ inches was preferred.

Like many cameras, the Acme, when closed, has a thickness regulated by the combined substance of base board, bellows-front, and focus glass, for the front folds into the base and the bellows occupy the space between it and the focussing screen, but unlike the majority of cameras, all the operations of erecting in this one are released and locked by spring catches. When setting up, the spring on the top of the body is first moved aside and the body revolved on its hinges, when the struts run down in the grooves in the side until they fall into a niche near the bottom; at this point the clamping nuts are tightened and the body is held at right angles to the base. The front is then lifted up, and two projecting pins at the foot are slipped into grooves in the front of the base, and are held there by spring catches which rise automatically and secure them. The locking of the front is an exceedingly ingenious and convenient arrangement, for while it firmly holds the bottom portion and allows of the front swinging in a vertical plane to any practical amount, yet by inclining the front backward to an angle of 45 degs., it draws loosely from its fittings and is ready for closing.

The bellows are taper, but not square in section, being deeper than they are wide, thus allowing the rising front to be used with freedom when wide angle lenses are employed. The ordinary clamping screw for the rising front is dispensed with, the fixing being obtained by means of a rack and spring ratchet on the side. The back of the camera is made with the usual reversing frame so that horizontal or vertical pictures may be taken, but it is held in each position by a spring, and is also kept in proper register by another spring.

The dark slides which carry the plates for exposure are fitted with special stops and springs to the shutters; the former dispense with the projecting screws ordinarily employed and leave the slides clear for the reception of carriers for smaller sized plates (if required), while the springs automatically hold in the shutter when closed after exposure. In addition, the dark slide itself is held by a spring catch as soon as it is pushed into the proper position for exposure, and cannot be withdrawn until the catch is pressed back, thus preventing any possibility of the slide moving by accident and spoiling the plate. The numerous spring catches alluded to are valuable on the surface, but are still more so underground, where the various movements have to be gone through in semi-darkness. It is a source of considerable satisfaction to know that the different parts are in their proper position when a click is heard.

The usual double motion is supplied for focussing and for the application of wide-angle lenses, as the front can be extended by rack work and the back moved up to the front. In order that the back may be set parallel with the front after it has been moved, marks are cut across the two grooves in which the back slides. The base of the camera may either be panelled, with a screw socket in the centre to be fitted to a separate tripod and held by a T-screw, or preferably may have a turntable. Although the latter is generally made of brass, yet it is of light construction, and as the base is cut away for a diameter of 6¼ inches, the metal introduced weighs little heavier than the wood removed. When aluminium is used in the construction the reduction in weight is considerable. For many reasons the turntable in the base is to be preferred; in the first place it saves one extra part (the tripod head), cannot be left behind, and reduces the time required for erecting, while when the latter is done the camera is sure to be rigidly attached to the tripod.

A tripod stand with the lengths of the legs adjustable is convenient on the surface, and is necessary underground, as the camera has often to be erected in confined situations and on very uneven ground. The threefold stands are best, but many of these where the joints are supposed to be held rigid by a screw are worse than useless. In the new pattern stand, the middle piece folds down into the same plane as the top third, and is then pushed upwards about an inch, thereby locking it between two brass stops, one on each side. A clamping screw is provided to hold it in this position, and forms an additional security; but even if this screw becomes loose the leg cannot bend outwards, as before it can do so the middle part must drop away from the upper piece: the weight of the camera effectually prevents this. Practically the legs are as free from any chance of collapsing as if they were made in one piece.

After the care which has been taken in perfecting small details, it is surprising to find that indicators for determining whether the back and front are vertical are conspicuous by their absence. On many occasions it is impossible to set the camera level, and consequently the back part carrying the dark slide cannot be set truly vertical unless a plum-bob is improvised from a piece of string and a stone. The better plan is to purchase two plumb indicators and attach one to the side of the back and the other to the front of the front. There ought not to be any necessity to go to this trouble; such an instrument should be fitted with indicators in the first instance.

Lenses—Within the limits of this paper it is impossible either to describe the various types of lenses which have been used underground or even the advantages possessed by several forms under certain circumstances, except in a general manner. The action of a lens is never perfect, but in many of recent construction the imperfections have been reduced to such an extent as would hardly have been thought possible a few years ago. The chief defects which have to be minimized are: Spherical aberration, caused by the rays of light being refracted more at the edges than in the centre of the lens; chromatic aberration, due to the lens bringing light of different colors to focus at different distances; astigmatism, the inability to focus horizontal and vertical lines at the same time when such are near the edge of the plate; and curvature of field, that is to say the lens brings rays of light to focus on a field more or less curved. As the plate on which the image is received is flat the latter defect is very serious.

Under varying circumstances certain of the above defects may be admissible, but others must be absent. Hence the numerous types of lenses adaptable to different uses; in one form a certain defect is allowed to exist in order to better correct some other fault, which, if present, would render the lens useless for the purpose it is intended to serve.

Practically speaking, it may be said that the rapidity of a lens depends on its aperture and focal length, and as in underground work speed is of the greatest importance, a lens possessing such advantages should be secured. The portrait lens is of the greatest intensity possible, and was used by Mr. Sopwith in his experiments, but it has not the power when working at full aperture to either focus the image sharply at the edges of the plate, or to represent objects in the background with the same sharpness as those in the principal plane on which the focus has been made. In many cases the latter is an advantage from an artistic point of view, as most people prefer to see the background subordinated to the principal object forming the picture, but in many mining operations objects of importance are situated in several different planes and if the photograph is to be of value for scientific purposes such objects must all be in focus at the same time. In order to obtain this advantage the aperture of the lens has to be reduced by the insertion of what are known as stops into the brass mount carrying the several elements of which most lenses are constructed. These stops are now generally expressed not in actual measurement but as a fractional part of the focal length, thus *f* 8 is an aperture having a diameter equal to one-eighth of the focal length of the lens it is associated with. Most English lenses are now marked with the diaphragm apertures recommended by the Photographic Society of Great Britain, each of which is half the area of the preceding one. Provided the time for correct exposure is known with any stop, the amount necessary with the others is easily calculated, as when using the next smallest stop double the time must be given. The diaphragms are marked thus: *f*. 4, *f*. 5.6, *f*. 8, *f*. 11.3, *f*. 16, *f*. 22.6, *f*. 32, *f*. 45.2, *f*. 64. The unit aperture is *f*. 4, and if an object required one second exposure with that stop, it would require two seconds with *f*. 5, four seconds with *f*. 8, eight seconds with *f*. 11, and two hundred and fifty-six seconds with *f*. 64. This at once shows the necessity of using the largest possible aperture where either the light is poor or the subject likely to move.

At one time the stops supplied with each lens were either arranged on a rotating wheel, or were separate and were pushed into position through a slot cut in the side of the lens mount. Within the last few years the iris diaphragm has come largely into use, thus allowing the opening to be contracted or enlarged by simply moving a pointer. Every lens for underground work should have an iris diaphragm as the number of things to be carried about is thereby reduced, and the operation of altering the stop is made easy and comfortable; the risk of fogging the plate is also done away with. When the lens mount has a slot in it, and plates of extreme sensitiveness are used, sufficient light may pass in through the slot to spoil the plate.

It may be thought that what are known as wide angle lenses which are of short focal length, and include a large angle of view on the plates they are made to cover, would be best for work in mines, but although they sometimes have to be employed, yet they do not give satisfactory results. They often exaggerate the perspective to such an extent as to make the resulting negative look very unlike the original, and owing to the principles on which they are constructed have to be used with a comparatively small aperture; as a rule the largest stop they are supplied with is *f*. 16, but the majority do not work satisfactorily above *f*. 22.

Mr. Burrow first tried a portrait lens, but as the only advantage this form possesses is speed, he abandoned it for others on the introduction of the rapid plates now to be obtained. The writer's first experiments were made with a Ross rapid symmetrical lens having *f*. 8 for its largest aperture. At that date such types were perhaps the best, for although they are slow compared to portrait lenses working at *f*. 4, yet they cover the plate better at the margins, and naturally have more depth of focus, but they include a narrow angle, and as the elements are rather widely separated in order to obtain flatness of field, the plate is not so evenly illuminated as is desirable.

The introduction of several new varieties of glass made at the Jena factory has put

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* *Transactions Federated Institute of Mining Engineers.*
† "Photography in Coal Mines." *Journal of the Photographic Society of Great Britain*, vol. xviii., page 93.
‡ *Trans. American Inst. of Min. Eng.*, vol. xvi., page 307.
§ *Der Bergmann in seinem Berufe*, Freiberg, 1891.
‖ *Mongst Mines and Miners*, London, 1893.

into the hands of opticians a power which they did not previously possess. At one time lenses were made achromatic by cementing crown and flint glass together to form the separate elements, but as the glass which possessed the higher refractive power also had a higher relative dispersive power, a certain amount of astigmatism remained uncorrected, and the lens defined indistinctly in the marginal portions of the field. In the Zeiss lens designed by Dr. Rudolph,* achromatism is obtained by employing two elements, in which the one having the higher index of refraction has the smaller relative dispersive power, while the astigmatism of one combination neutralizes that of the other. The field is flattened by the combinations themselves, and consequently they can be placed near together, thus increasing the angle of view and giving more even illumination. Practically, owing to the greater covering power, the lenses are more rapid than those we have been previously accustomed to, as they do not require to be stopped down to such an extent.

Both Mr. Burrow and the writer have used the series III. lens, having an aperture of *f.* 7.2, with much success, but Ross & Co. have recently taken up the manufacture of another type which promises better results, viz., the Goerz† lens, which has two symmetrical combinations. The double anastigmat, series III., *f.* 7.7, permits the use of the largest stop without diminishing the sharpness of the image at the margins of the plate up to an angle of 70 degs., while definition and flatness of field are uniform all over the picture.

The writer need only mention another construction of lens which has been found invaluable under certain circumstances. The Ross concentric lens is constructed on a different formula from that of all other lenses, as the two exterior surfaces of each combination are concentric, while the cemented surfaces are flat. Without a special kind of glass made at Jena such construction would be impossible. The field is quite flat, evenly illuminated, and definition is equal over the whole of it. Unfortunately the largest stop that gives sharp definition is *f.* 22, but in situations requiring a wide angle lens none better can be employed. It is claimed that the concentric more nearly yields the theoretical amount of depth of definition than any other lens, and may consequently be said to possess greater depth of focus over the whole field.

As lenses for different purposes vary considerably in diameter, it is usual, if several are to be used with the same camera, to attach to each an adapter: this is a ring of metal exactly filling in the space between the screw of the smaller lens and the flange of the largest one, which is firmly screwed to the front board of the camera. The writer has lenses of 5 inches, 7 inches, 8¼ inches, 9 inches, and 12½ inches focus, and the four first named are each fitted with its own adapter, which is kept permanently screwed on to the lens. Underground the camera can often be erected in one spot only, and as soon as this is done, by the assistance of the adapters all the lenses in succession can be tried in a few minutes to determine which includes the best view.

Plates—Photography is based on the sensitiveness of certain silver salts to the action of light, and the modern dry plate consists of a thin film of gelatine in which the sensitive silver salts are held in suspension in a fine state of division.

The method of preparation is to first soak suitable gelatine in water until it becomes soft, and at the same time to add the requisite quantity of an haloid salt, either either ammonium or potassium bromide, or both. A solution of nitrate of silver in water is prepared and added to the first solution in such quantity as will be completely decomposed by the haloid salts therein. The silver salts thus formed do not possess their maximum sensitiveness, and for that reason the mixture is subsequently heated for one or two hours to a temperature near that of boiling water.

If the gelatine solution on cooling is of the proper consistency, it is thoroughly washed by squeezing it with cold water through canvas, this being necessary in order to remove the excess of haloid salts which remain in the solution. If such were not done the surface of the film, on drying, would be destroyed by the crystallization of these salts; and in addition, the potassium or ammonium bromide left in the emulsion would act as a restrainer on development, thereby practically diminishing the sensitiveness of the plate.

The preparation of the exceedingly sensitive plates which have been placed on the market within the past eighteen months is a trade secret, and a valuable one. The method of obtaining this extra sensitiveness cannot therefore be described in this paper. It is, however, known that in order to obtain the maximum amount of photo-chemical decomposition from the minimum exposure, the film must contain some halogen absorbent. By photo-chemical decomposition is meant the invisible change undergone by the salts of silver contained in the film when it is exposed to light and it is generally admitted that one of the results of this decomposition is the liberation of the halogen element previously combined with the silver. Now, gelatine possesses the power of absorbing with ease large quantities of liberated halogen, but slow gelatine plates are common articles of manufacture, hence the mere presence of gelatine is not sufficient. As may be expected, almost every imaginable salt or material has been tried as an absorbent, even the nitrates, which are extremely powerful, but without obtaining any results of practical value. The writer is informed by a firm of leading plate manufacturers that as far as their present knowledge goes, no better halogen absorbent than gelatine is to be found, and that the method of cooking the emulsion is the main factor for obtaining extreme sensitiveness,

Since the writer commenced underground photography the sensitiveness of plates has been enormously increased; indeed the most rapid now on the market are nearly three times as quick as those obtainable two years ago. Mere speed is, however, not the only point to which attention has to be paid, as the quality of the film is of equal importance. Good, rapid plates are an essential where artificial illumination has to be employed, more especially in mining, where any figures in the view necessarily occupy somewhat strained positions. The writer's first satisfactory results were obtained on the Mawson plate, which then had a speed of about 80 on the Watkins scale, but the introduction of the Cadett lightning plate proved a perfect boon, as it allowed the exposure to be reduced one half. Most manufacturers have quickened up their plates during the past year, but from the last table published by Mr. Alfred Watkins of the trials which he has made, it appears that the Cadett plate still holds its own as the fastest on the market. The average speed issued is from 160 to 180 on the Watkins scale, and the numbers, which are marked on each box, may run in rare cases to as high as 228. All the writer's latest results, and also those of Mr. Burrow, have been obtained on such plates, and both can bear witness, not only to the great speed but the good quality of the film.

Methods of Illumination—The incandescent electric light is practically useless. The writer has exposed a plate for 30 minutes at the bottom of a shaft which seemed brilliantly illuminated, using stop *f* 16, and only succeeded in obtaining an impression of the incandescent lamps themselves and of their surroundings to a distance of not more than 6 feet.

The arc electric light gives far different results, and is somewhat largely employed in obtaining portraits on the surface. Underground, the conditions are different. Portrait lenses do not give good results, and if the next best lens is employed, it means four times the exposure necessary on the surface; it is also practically impossible to arrange reflecting surfaces in the happy manner that can be carried out in the studio. The inconvenience of carrying the electric cables into the working places is left out of consideration.

Messrs. Dewey & Bretz obtained a series of views in the mammoth seam at Kohinoor colliery, Shenandoah, Pennsylvania, with the aid of the arc electric light specially erected in the mine for such purposes. They used five lamps, each giving 1,600 candle power, but even with a diaphragm of *f* 16, exposures of from 10 to 30 minutes had to be given. At the Chicago Exhibition the South Duffryn Colliery company exhibited two underground photographs taken by the Photophane Company of London, at the Abercanaid colliery, which were obtained with the aid of the arc electric light. The plates had an exposure of from 15 to 20 minutes, using stop *f.* 16. Anyone who is acquainted with the working of mines, need not be told that this is too long for a person to remain perfectly steady if he is to be shown in the act of performing any operation connected with getting coal, and no man can stand still for such a length of time, even when placed in a lounging attitude and supported. Putting aside the inconvenience, even with moderate lenses and rapid plates, the electric light seems quite inapplicable to photography in mines.

When artificial illumination is employed, the light must not only have a high degree of intensity, but be rich in rays which are chemically active, viz., green, blue and violet. The metal magnesium, when burnt in air, gives a powerful light rich in actinic rays, and as early as 1863 it was used for obtaining photographs by artificial light. Messrs. Debenham and Sopwith both employed it in the form of ribbon. The former cut a number of lengths of the ribbon, tied them together at one end, and thrust the other end into a lump of clay stuck against a sheet of tin, which was used as a reflector, and held in the hand. Mr. Sopwith's lighting arrangements consisted of a number of tin reflectors, usually from three to five, shaped into parabolic curves, to concentrate the light, before each of which was burnt from 6 to 10 inches of magnesium ribbon. The art of lighting consisted in using the lamps at suitable distances, and frequently the foreground was made up by secondary lighting after the holder of a lamp had withdrawn from his position. At the time when these photographs were taken the ordinary flash lamp was unknown.

The writer first used two regulating magnesium lamps, the ribbon being wound out as fast as it was consumed in the burner in front of the reflectors. An exposure of from 2 to 4 minutes was given, using stop *f.* 16 and a Mawson plate. It became at once apparent that while similar illumination had been successful in Mr. Sopwith's case in the comparatively thin seams of his district, it was useless in the 30 feet seam and its large working places. Only one of the numerous attempts made in the ten yard coal was successful; but fairly good results were obtained in the Silurian limestone mines, where the working places are similar in size and arrangement.

What is required is a very brilliant light for a short period, and to produce it a large quantity of magnesium must be rapidly burnt. Flash lamps, in which magnesium in the form of fine powder is blown through a flame, usually burning alcohol, satisfy these requirements, and provided a sufficient number be used, any desired illuminating power may be obtained, and if these be distributed softer effects in the lighting result. Often, however, the space in which the camera has to be operated is so confined that it is impossible to properly use one lamp; and in some cases it cannot be fixed on a stand, but has to be held in the hands of an assistant. Mr. Burrow found the smaller flash lamps ordinarily purchasable to be useless for the principal lighting, and designed two powerful ones, each having three orifices, and consuming ¾ ounce of magnesium powder for each flash. The two were supplemented in large areas by a few smaller lamps, and sometimes by one or two oxy-hydrogen limelights.

Anything burnt in oxygen gives a far more brilliant light than when burnt in air, and it is stated that magnesium gives twelve times its ordinary illuminating power when so consumed. All the writer's best results have been obtained by employing the lamp designed by the Platinotype Company, in which magnesium powder is burnt in the oxy-hydrogen blowpipe.

The impossibility of properly composing the picture on the ground glass screen adds a considerable amount of doubt to the uncertainty of obtaining any desired view. What is generally done is to arrange a series of lamps or candles about the main objects, and endeavor to get all these on the screen. After this has been done, it is sometimes possible to burn a short length of magnesium ribbon and examine the view thus revealed, but in many cases that procedure is impracticable, as the smoke produced will not clear away in reasonable time. Focussing is equally uncertain. What is done is to place a light somewhere in the middle distance and get that point sharp. Now, if the view could be seen on the screen as it is when working on the surface, it is often possible to sacrifice sharpness in an unimportant part, and thereby obtain a a clearer representation of several other points of importance. It sometimes happens below ground that the uninteresting points are in focus while the important points are indistinct.

Development—Having made the exposure, the subsequent treatment of the plate may be considered. The action of the light does not produce any visible effect, and the plate has to be treated with a chemical solution known as a developer to bring out the latent image. Developers act by reducing those portions of the silver bromide which have been exposed to light in proportion to the amount of light action, leaving unchanged those portions that have not been altered. In this way a negative is obtained which is the reverse of the original as regards light and shade, for the greatest deposit of silver is found where the image was brightest, and the smallest deposit where the object was in shadow.

Some developing agents act by themselves, but the greater number ordinarily employed require the addition of an alkali before they commence working. The quantity of alkali depends on what plate is being worked with; if an excessive quantity be used, general fog is apt to be produced, that is to say, a deposit of silver is formed all over the plate, even on those portions which have been unacted upon by light. To prevent either general or chemical fog, a soluble bromide is almost invariably added to the reducing and accelerating agents, so that the normal developer consists of three solutions.

The writer has obtained the best results with pyrogallic acid and ammonia in 10-per cent. solutions as follows:—

1

	Ounces.
Pyrogallic acid	1
Sodium sulphite	3
Citric acid	¼
Distilled water to	10

2

Liquid ammonia 0·880	1
Distilled water to	10

3

Potassium bromide	1
Distilled water to	10

With a correct exposure 1 ounce of developer is best formed by taking 10 minims of each solution Nos. 1, 2 and 3, and diluting to 1 ounce, but in order that develop-

*English Patent No. 6,028, 1890.

†"A New Astigmatic Lens," C. P. Goerz. *Jour. Phot. Soc. Great Britain*, vol. xvii., page 253.

ment may be well under control, it is better to commence with half the quantity of alkali. Indeed, as the great majority of the writer's plates have been considerably under-exposed, he usually takes 40 minims of No. 1, 40 minims of No. 2, and 20 minims of No. 3, and dilutes the mixture with from 4 to 6 ounces of water (for the whole plate size). At intervals of about 10 to 15 minutes a further quantity of 10 minims of the ammonia solution is added. Development is slow, but usually all the details can be coaxed out and sufficient density obtained. When development is complete, the plate is fixed by immersing it in a solution of hyposulphite of soda, which dissolves out the unaltered silver bromide. Intensification of the image is, however, often necessary. This is generally done by first bleaching the negative with a solution of bichloride of mercury, and after washing for at least an hour in running water, treating it with a dilute solution of ammonia. If all the hyposulphite of soda has been eliminated from the negative by washing before placing the negative in the mercury solution, and if the washing be complete after bleaching, the writer's experience is that the image is practically permanent.

With very thin negatives, the writer prefers to use the ferrous oxalate developer in place of the ammonia solution, as the bleaching process and treatment with oxalate can be repeated over again, if sufficient density be not obtained with the first application. If this process be used it is of the greatest importance that the washing water shall not contain a trace of lime. Indeed with a valuable negative, it is best to soak the plate in distilled water, after the preliminary washing and before applying the ferrous oxalate solution.

Many persons prefer the pyro-soda developer where sodium carbonate in its impure form (commercial "washing soda") is used as the accelerator. This rarely produces green fog, and if the proper proportion of bromide is employed is less liable to produce general fog. The writer has not been so successful with this mixture as with pyro-ammonia, probably because of his greater familiarity with the use of the latter. There is, however, little doubt in his mind that success in underground photography depends largely on efficient development, and as Mr. Burrow uses pyro-ammonia developer and is a photographer of long and varied experience, his opinions and practice are alike valuable. It is in development and the subsequent treatment of the negative that the professional excels the great majority of amateurs.

General Remarks—The difficulties to be overcome are not many, but are hard to surmount. In all classes of mines the smoke resulting from blasting, the moisture-laden and misty atmosphere, and the dripping of water from the roof are customary drawbacks supplemented in coal mines by the presence of coal dust, which not only thickens the atmosphere, but deposits particles on the lens and plate. The condensation of water on the lens and plate is perhaps the most difficult matter to avoid. So far as the plate is concerned, one has to trust to luck; but with the lens, the best preventive is to carry it in the trousers pocket, and so warm it up to the temperature of the body. Even with all precautions, and after an examination has been made to see if the lens is clear immediately before exposure, the opening of some door in one of the airways may momentarily divert the regular current, and cause some cooler air to enter the place which is being photographed, with the result that the glass is chilled, and as soon as the ordinary warm air again comes into contact with it, the lens fogs and the plate is spoiled.

The difficulties of focussing and composing the picture have already been alluded to. Often on development it is found that the figures are very badly situated, or that some desired point is not included, or even that an important part is out of focus, and consequently the plate is spoiled. None of these things should happen if it were possible to examine the view on the focussing screen.

The smoke produced by burning magnesium is very dense, and if it gets in front of the lens it will spoil the plate. For this reason it is best that the current of air should be from the object to the lens, or the clearness of the picture will be sadly interfered with, even if not completely spoilt. Mr. Burrow has found on several occasions that where he could only get dull pictures looking, say, from east to west, he got clear ones of the same spot looking from west to east, and this was apparently not due to a change in the direction of the air current. He cannot explain the matter, but mentions it as a curious and oft-repeated experience.

The writer is of opinion that only one half the illumination is required in a metalliferous mine to obtain the same result as compared with a similar view in a coal mine. Rocks in metal mines such as fluorspar, quartz, etc., have a more or less metallic lustre, especially when wet, and, reflect a considerable amount of light, while dull, black coal has rather a tendency to absorb it. Comparisons of the amount of light required in the limestone workings, and that necessary for similar views in the thick coal, support the above view. The only satisfactory instantaneous view that the writer has ever obtained, was in a gate road passing through a basaltic dyke, an excavation similar in all respects to those made in metal mines.

The invariable practice of the writer has been to burn weighed quantities of magnesium powder, for with the comparisons thus obtained, some guide can be formed or future occasions. If two platinotype lamps are employed, burning 60 grains of magnesium in each, supplemented by 20 grains in an ordinary flash lamp, and using the lens with stop *f.* 16, sufficient light should be obtained to illuminate the largest areas met with underground. The writer does not wish it to be inferred from the remarks made as to the smaller amount of light required, that photographs in metal mines are easier to obtain than they are in coal mines, indeed statistics of the Cornish and the writer's exposures seem to show that both are equally difficult. Mr. Thomas states that the average in the Cornish experiments has been about 17 per cent. of good negatives; 70 per cent. of the writer's exposures have been complete failures, and out of the remaining 30 per cent. only about one half are good.

The Sultana Gold Mine.

A correspondent writes as follows regarding the operations at the Sultana mine: "The Main Shaft is down now 150 feet below deck. It is well timbered with a separate ladder-way and a good ventilation shaft. Two drifts have been started from this shaft, one at 60 feet level and another at 120 feet. The drifts running north have not been pushed far. The 60 ft. level running south had to be stopped on account of a large open cut along the outcrop which averages about 30 ft. deep. The vein in the shaft has varied from 3 ft. up to 8 ft. in thickness of solid quartz. The 120 ft. level going south was in 35 ft. when I was there on the 10th inst. and they were pushing it ahead with power drills at the rate of 56 ft. per week. In the breast of this drift the vein was fully 3 ft. 6 in. thick of solid quartz. In the open cut to the south of the shaft house the quartz has ranged from 3 ft. to 8 feet thick. All the quartz that has come from these drifts, cuts and shaft has yielded an average of nearly one ounce bullion to the ton of 2000 lbs. Mr. Weir, manager of the Imperial Bank told me that the bullion from this mine sells far $16.00 per oz. Mr. Caldwell, the owner, claims that all the quartz crushed in his mill has yielded an average of fully fifteen dollars per ton from the battery and plates. But the concentrates do not add very much to this value. They amount to less than one per cent. of the ore and are valued at less than $1.00 per ton. Immediately behind the mill there is a second shaft down only 45 ft. so far. It is on another vein, which apparently merges into the main vein somewhere near the Main Shaft. During my visit orders were given to resume sinking in this shaft with the intention to cross-cut under the mill and connect with the 120 ft. level from the main shaft. This second vein averages about 27 inches of quartz in this shaft. All the quartz formerly taken from it yielded an average of over $20.00 per ton in the mill.

When the site for the mill was being graded on the edge of the lake, they uncovered a great body of quartz on the edge of the water, which measured twenty feet across and from a careful average sample assayed over $14.00 per ton. Caldwell is eager to undercut this great vein of rich quartz just as soon as possible with this 120 ft. level. But he has still almost 200 ft. to drive. However, he is sinking No. 2 shaft now as fast as possible with the intention of crosscutting into this mass of quartz as soon as they reach the same level. There is no chance of opening this great mass of ore from its surface, because it lies on the very brink of the Lake of the Woods and is only a few inches above water level. The main vein here is a renticular contact vein between schists and granite. It varies greatly in thickness and richness both horizontally and vertically. But every ton of quartz that has ever been crushed has yielded *at least* four dollars per ton. It ranges from this to upwards of fifty dollars per ton. Samples frequently assay up to $150.00 or $200.00. The shaft house is a very large substantial wooden building covered with steel shingles. It contains a 60 h. p. boiler, a Rand air compressor and receiver for 4 of their No. 3 drills and a steam hoist. Close alongside is the forge, which is well stocked with tools and with steel and iron. The mill stands about 235 ft. south of this shaft house. It is a solid substantial frame building 45 x 50 ft. covered with steel shingles. In the top story there is a feeding floor and grizzly, with a friction hoist to haul the cars over the tram from the shaft-house (and also to hoist the ore from shaft No. 2). Just under this floor is a Blake crusher set just above two strong ore bins. From these bins the ore is fed by automatic feeders to the two batteries of five stamps each. These weigh 850 lbs. and drop 90 per minute. Shoes and dies are chrome steel. Most of the amalgam is collected in the batteries. But there are large amalgamated copper plates in front (which are kept in fine order). The pulp flows from these plates into two Frue vanners and then runs to waste.

Close alongside of the mill is a very snug frame house used as an office and for sleeping quarters for the staff. I should mention that the mill is run by a 60 h. p. Waterous engine and a 75 h. p. Waterous steel tubular boiler. In the engine room there is also a small engine to run a dynamo supplying 52 incandescent lights for the mill, shaft house, assay office, house, etc. Alongside the mill is a large shed covered by steel shingles and heated with a large quantity of steam coils, which was built for a costly cyanide plant. Most of the plant has been torn out and cut up for other things, as this ore is not at all suited for the cyanide process. Some distance to the north-west of the shaft-house a well defined quartz vein averaging fully ten feet wide crops out in the ridge of some rising ground. This vein shows very distinctly . waters edge. I have always been surprised that the owner has never tested it in any way. He has not even taken samples for assay. I estimate that ten thousand tons of quartz could be quarried here and delivered to the mill at a cost of one dollar per ton without stoping below lake level. I had no opportunity to break out any fair samples of this quartz, but I see no reason why it should be any poorer than the average of the Main Vein where so much work has been done. There are about 30 hands employed altogether. Mr. Caldwell has a first-class Swedish mine foreman there who has got some very good sober Swedish miners under him. The engineer and amalgamator in the mill are very good men. Mr. Bell, the assayer and mill superintendent, is a well educated and competent official. You never hear any noise or rowdy conduct of any kind from the men's quarters. They are charged $4.00 per week for board. There is a capital wharf directly in front of the mill, where the largest steamers on the Lake of the Woods can discharge. An excellant steam launch capable of steaming about 10 miles an hour is part of the outfit.

Mr. Caldwell has been crushing about 80 tons of quartz per week, yielding an average of $1,200.00 worth of bullion. But during the last few weeks his small force of miners has been so busy with the re-timbering of the Main Shaft, putting in the new ladder-ways and the ventilating shaft that they have not crushed nearly as much quartz as usual. While not in a position to speak officially I am informed on good authority that the total amount of gold won to date exceeds $30.000, the whole obtained from what may fairly be called dead work.

NEW COMPANIES.

British Columbia Gold Dredging Co. Ltd., has been incorporated under the laws of British Columbia to take over and work mines in that Province. Capital, $1,500,000, in shares of $10. Head office, Vancouver, B.C. Directors: W. A. Shahan, J. E. W. Macfarlane and J. W. Campion.

Anglo-American Gold and Platinum Hydraulic Mining Company Ltd., is another British Columbia company, incorporated during the month. Capital, $250,000, in shares of $5 each. Head office, Vancouver, B.C. Directors: J. Barnet MacLaren, S. F. Scott, G. D. McKay, and R. Hughes. The secretary of the new company is Mr. A. E. Tregent, New Westminster. Operations are to be carried on in the Smilkameen country.

Slocan Milling Co. Ltd.—Registered 24th August, 1894.—Authorized capital, $100,000, in shares of $10 each. The directors are: A. E. Humphreys and John G. Williams, Duluth, Minn.; N. D. Moore, John Vallance and Howard Donnally, New Denver, B.C. Head office and works, New Denver, B.C. The company proposes to work mines and to carry on the business of milling ores in the Slocan District, B.C.

The Alamo Mining Co. Ltd., is the name of a new company registered, with headquarters at New Denver, in the Slocan District, B.C. Authorized capital, $500,000, in shares of $1. The directors are the same as those of the Slocan Milling Co. given above.

The Minnesota Silver Co. Ltd.—Registered with an authorized capital of $1,000,000, and headquarters at New Denver, B.C. Directors: G. J. Atkins, Howard Donnally, J. S. Blackaller, and Walter Marshall, of New Denver, B.C., and A. E. Humphreys, of Duluth, Minn.

Bridgeville Mining and Improvement Co. Ltd. has given notice of application for charter of incorporation under the laws of Nova Scotia. Authorized capital, $3,000, in shares of $20. The chief place of business is at Bridgeville, Pictou County,

N.S. The directors are: C. F. Ross, W. E. Young, Thos. McMillan, Wm. McPherson and Thos. Williams, all of Bridgeville.

The Oromocto Coal Mining Co., with headquarters at Fredericton Junction, New Brunswick, has been incorporated with an authorized capital of $40,000, in shares of $10. The directors are: Parker A. Nason, Gladstone; E. Moore, Fredericton; Luke E. M. Dewitt, Blissville; and Wesley D. Nason, of Gladstone.

British Columbia Stock and Mining Exchange—Messrs. F. C. Innes, J. W. McFarland, and George De Wolf, of Vancouver, have applied for charter of incorporation under this designation, with the object of buying and selling shares and dealing in mineral claims, leases of mines, and in all kinds of properties that are dealt in by the London Stock Exchange. The capital is $5,000, in shares of $25 each. Head office: Vancouver.

The Provincial Mining and Dredging Co., Ltd., is the title of a new company seeking incorporation with an authorized capital of $1,000,000, in $10 shares, for the purpose of prospecting, dredging for and mining all kinds of precious and base metals in British Columbia. The directors are: Norman McLean, Hugh McLean, and W. F. Gore, and the head office is at Vancouver, B.C.

Horsefly Gold Mining Co., Ltd.—Application under the Foreign Companies Act, B.C., is made for incorporation by this company, with headquarters in San Francisco, Cal., with the object of taking over leases and mining claims, and to carry on the business of hydraulic and other processes of mining, in the Province of British Columbia. Capital $1,000,000, in shares of $10.

Scott Mining Co.—This company has been registered under the Foreign Companies Act, B.C., with an authorised capital of $100,000, in shares of $100, and headquarters at Seattle, Wash., to carry on mining in the Province of British Columbia.

Canadian Mica Co., Ltd.—This company with a capital of £90,000, in £1 shares, was registered in London, Eng., on 24th ult., to acquire properties in counties of Frontenac, Ont., and in the counties of Saguenay and Ottawa, in the Province of Quebec. The following are the signatures to the articles of association, each for one share: G. Atkins, West Dulwich; J. Robertson, West Dulwich; R. H. Willats, Holborn Viaduct; A. G. Larker, Heine Hill; F. Spencer Hendon, W. Spencer Hendon, F. Page, Victoria Park, London.

The Marmora Mining and Milling Co., with chief place of business at Toronto, is being incorporated with a capital stock of $24,000 to take over and operate the reduction mill plant and machinery of the Hastings Mining and Reduction Company at Marmora, Ont., and for other similar purposes.

The Baltimore Coal Mining and Railway Co., is seeking incorporation in Nova Scotia. Capital stock $300,000. Head office, Hillsborough, N.S. Among the incorporators are Charles Archibald, Blowers Archibald, William F. Wortman, Frederic Steeves, Warren Taylor and Francis Ritchie. Power is asked to construct and operate a railway from near Baltimore mines to some point of shipment on the Petitcodiac river. It is asked to exempt the property from taxation for 10 years, and power is asked to issue bonds to the extent of $10,000 per mile of the railway. The object of the company is to develop the coal mines at Baltimore.

The Otterville, Ont., Brick and Tile Manufacturing Co., has been incorporated with a capital stock of $5,000, to manufacture bricks, tiles, terra cotta ware, etc.

Memramcook Gold Mining Co.—A dispatch, under date of 18th inst., says: "Another one of the many meetings of Memramcook Gold Mining Co. was held at Dorchester to-day. The following are the officers elected: J. W. G. Smith, president; E. C. Cole, Moncton, vice-president; H. J. Logan, Amherst, secretary; C. E. Freeman, Amherst, treasurer; A. C. Vanmeter, Moncton, and Dr. Gaudet, St. Joseph's, directors; and M. G. Teed, solicitor. It will be seen that Mr. Neily has vacated his seat as president and also retires from the management. The new board of directors held a meeting this evening in which they decided to pay up all the liabilities and give the property another test."

Bras d'Or Marble Co.—This company was re-organized on the 17th May with following gentlemen as directors: R. Macdonald, of Macdonald & Co., Halifax; George E. Francklyn, Halifax; R. Uniacke, president Halifax Banking Co., James B. Hattie, of Hattie & Mylius, Ald. Mosher, Henry Saunders and G. Hobrecker. At a subsequent meeting of directors the following officers were elected: President, R. Macdonald; vice-president, George E. Francklyn; secretary-treasurer, George Hattie. The capital required to develop the property and carry on the work of quarrying marble has been subscribed, and work is to be carried on under the supervision of D. MacLachlan, manager. A road is in course of construction which will bring the quarry within five miles of the railway. Some $10,000 have already been expended in testing the quarry. Samples sent to Great Britain have given great satisfaction. The property has been examined and approved by Mr. Underhill, of Vermont.

A new Form of Rail.—Mr. William T. Manning, chief engineer of the Baltimore and Ohio railroad, has recently been granted a patent on an improved form of rail. The head of this rail, instead of being symmetrical, as is customary, is made one sided. Mr. Manning claims that a large proportion of the rails on curves are thrown away before they are worn out, for the reason that the inside of the head is worn off, and that by placing this rail in the track with the wider side of the head on the inside, and after it has become pretty well worn either turning the rail end for end or placing it on the other side of the track, it will last twice as long as a rail of the usual form. It is not claimed that this rail will have any great advantage over the common form in straight track, but its great advantage will be found on roads where there is a large percentage of curvature. It is stated that on such roads the high rail on the curves is often replaced several times without disturbing the inside rail.

GOLD MINING IN BRITISH COLUMBIA.

"It would seem," says the Nakusp *Ledger* "that the excitement caused by the discovery of gold on Cariboo creek, would be the means of a rich quartz region being opened up in that section. On the 15th of August, Chas. Vader acting on a suggestion from Nelson Demers, left his placer ground and proceeded up Mineral creek to prospect for quartz. When three miles away from Cariboo creek, and about six miles in a direct line from the Columbia river, he ran across a stringer of solid mineral in a granite, slate and phorphyry formation. Tracing it up he discovered a ledge of quartz eight feet wide and traceable for 300 feet on the surface. He staked a claim and called it the Orpheno, an assay from it giving returns of $175 in gold and six ounces in silver.

The Le Roi is rapidly developing into a mine. Forty men are at work and ten tons of ore are exported daily to the Tacoma smelter via Spokane. Air compressors and other machinery are about to be put in. Col. Peyton has just bought three carloads of merchandise in Spokane for this mine.

From Forty-nine Creek we learn that J. F. Ritchie has returned from a visit to the works and reports that a want of water alone prevents them from working a good bank of gravel. One sluice box gave $18 worth of gold from old tailings. The company intend this winter to increase the size of their flume and sluice boxes so as to take full advantage of the 2,000 inches of water which flow for some ninety days every year. The flumes and boxes will be covered with loose rock to hold them in position and prevent their being disturbed by a washout. This will entail an expenditure of some four or five thousand dollars, but the ground shows up well and fully justifies the further investment of capital.

The Nakusp Mining Co. and the Goat Canyon Co. have at last bottomed on bed rock. Their prospects are good, the gravel being rich in coarse gold. But there is no disputing the fact that the boulders are large and numerous and will give a great deal of trouble.

The Cullough Creek Tunnel Co., is opening up the old works and are drifting to strike the old rim rock. The previous company spent $20,000 on this claim without striking bed rock Work will be continued all winter.

On Smith creek, Haskins & Co. are sinking a shaft on their property, and are down 20 feet. They expect to reach bed rock at a depth of 50 feet. The top gravel contains pay dirt. A wheel and hoisting gear are being brought in and this claim will work all winter.

SILVER LEAD MINING IN B. C.

[FROM OUR EXCHANGES]

The Cumberland, which immediately adjoins the Idaho and St. John, until the last few days had only been able to show 18 inches of clean ore at a depth of over 100 feet, can now lay claim to have one of the finest showings in the Slocan. The extensive ledge of clean ore recently exposed on the Idaho has now been traced and stripped for some distance on the Cumberland ground by Martin Clair, one of the owners, and so far a four foot vein of clean ore has been uncovered.—*Tribune.*

The owners of the Thompson group of claims to the south of Four-mile, have every reason to be satisfied with the result of the development work done by them on their claims. The ledge appears to be very similar to that on the Fisher Maiden. The surface showings were dry ore mixed with galena, but the greater the depth the less the galena until it can be called an entirely dry ore. With two such promising milling propositions as those referred to, both situate within a short distance from Silverton, the Alpha group shipping ore, and the Read and Robertson group employing a large force of men, we may look for considerable activity in the Four-mile camp this fall and winter.—*The Miner.*

Six men are at work on the Northern Belle No. 2, in Slocan district, on which the vein is from 8 inches to 2 feet in width. Ore has also been struck in the R. E. Lee tunnel. Both these claims are in the neighborhood of the Washington.

In sinking a shaft at the mouth of the tunnel on the Josie, in Trail creek district, a fine vein of ore was struck at a depth of 50 feet.—*The Tribune.*

Returns have just been received from the first car of Skylark ore sent out this year by the Spokane and Great Northern Mining Co. The ore yielded 199.4 ounces in silver per ton, $26.60 gold per ton and 5.6 per cent. lead. This ore will net $100 per ton even after paying for packing and waggon freight to Marcus. A second car load goes forward in a day or two.

Mr. J. A. Mara, M.P., has secured the free entry of the 100 ton concentrating plant of the Slocan Milling Co., which they intend to build between New Denver and Three Forks.

"The Silver King on Toad mountain has about 60 men working," said Mr. LeBau, of Nelson, "and has just let the contract for the hauling of 50 tons of machinery from Nelson to the mine, a part of which is now on the ground. The consulting engineer is expected out from England in September, to decide upon the nature of additional machinery needed. The mine will soon ship 400 tons of ore to Denver."—*Spokane Review.*

The following are the particulars of the Humphreys-Moore concentrating plant, now being constructed by Fraser & Chalmers, Chicago, at the mouth of Howson Creek, about one mile from Three Forks, Slocan district, to handle the output from the Idaho and Alamo mines:—

An elevated tramway running straight down the creek will discharge the ores on the upper levels of the concentrator building, and the lower level, where the finished product comes out, is only a few feet from the railroad grade. The building itself is 153 feet long by 53 feet wide with an elevation of 80 feet. It is divided into six compartments at differing elevations, and in the foundation there are four stone and mortar retaining walls. The rest on the structure is of wood. The ore enters the mill on the upper floor at an elevation of 62 feet, and on that level it is crushed. From the rock crusher it drops 18 feet to the first floor through an ore bin, from which a self-feeder passes it to the grand rolls where it is crushed again. The ore is then elevated to the first floor where it passes through a conical screen 36 x 42 inches by 6½ feet. From this screen the rock falls to the second floor again where the coarse rock goes through a set of rolls and is elevated again to the first floor, the fine rock going direct to the elevator. The ore then passes through three different screens. From these it goes to different compartment jigs. The coarse rock then goes through a Huntingdon mill and from that into three 4-compartment jigs, 12-inch mesh. Everything then goes into a settling tank and from that into four Calumet & Hecla buddlers where the final separation into waste and concentrates takes place. The plant was manufactured by Fraser & Chalmers, of Chicago, and cost $11,715, but with necessary additions will foot up to about $14,000. There are 150,000 feet of lumber in the buildings and 175 yards of stone and mortar work. The buildings will cost in the neighborhood of $30,000. The capacity of the mill will be 100 tons of ore in 24 hours. There will be extensive ore bins placed on the hillside above the mill and the company will put in an elevated tramway next spring to transport the ore from the hill. It is not the intention to do custom work unless in lots of 1,000 tons and over. The company however mean to buy ore as soon as the mill is running. The work is being held back by the delays in railroad construction.

The *Slocan Times* gives the following estimate of the shipments of ore from the Slocan district during the coming winter:—

	Tons.
Slocan Star	2,000
Noble Five	1,500
Other claims on Reucau Mountain	1,000
Wonderful	500
Idaho	1,500
Alamo and other claims in Idaho Basin	500
Grady group	1.000
Fisher Maiden	500
Mountain Chief	500
Dardanelles	500
Ruby Silver and Surprise	300
All other claims	1,000
Total	10,800

The deal has been closed which consigns to the Omaha & Grant smelter 800 tons of ore from the Alpha mine, and the shipment will begin without delay. A $3 rate from Silverton to Nakusp has been secured. This will be the largest individual shipment yet made from the Slocan country, and the largest, but one, made from West Kootenay, the exception being a shipment of 1,000 tons made from the Le Roi, at Trail Creek, last spring.

At the joint tunnel on the Black Diamond and Little Phil mines, work is still going on. It is now in 368 feet. They have cut two veins so far and are now driving for the third. The first vein cut was 75 feet from the mouth. It showed a body of galena eight feet wide. Five feet of it is quite clean, assaying 42 ozs. silver and 60 to 70 per cent lead. The other three feet is very good concentrating ore, being a three to one proposition. The second vein cut was quite 11 feet wide, but was virtually barren where they crossed it, only carrying galena in small particles. The third vein that they are now running for shows very well on the surface, the ore being of a good grade in the two shafts sunk on it, 80 ozs. and 68 per cent. lead being the average of some 20 samples taken from these shafts.

Mr. E. D. Carter, lessee of the No. 1, is now in Wisconsin getting his company in organization. They are also owners of the Comfort and Highland claims, and as two of the company are here and two in Wisconsin, Mr. Carter has gone there to fix things up. Heretofore all has been in the names of the two owners here. Mr. Carter is expected back this month to start up the mine and mill again. On their last run the mill proved adapted to the ores, and on a run of 51 days produced 69 tons of concentrates that sampled and sold at the smelter in Great Falls, Montana, 304 ozs. silver and 7 per cent. lead. The mine shows several large bodies of fine ore and as it has been practically untouched they have a great area of virgin ground known to be ore bearing.

Forty tons of Silver King ore, valued at $4,000, were, the other day, shipped to Denver, Col., from Nelson. The freight rate was $14 a ton.

It is reported that a concentrator will be built at the Silver King. The new machinery at the mine is being placed in position.

The latest shipment from the Skylark gave, for the carload lot, 215 ounces of silver and $26 gold per ton, and six per cent. lead. Another car goes forward this week that will be of the same grade.

Fifteen tons of ore from the Alpha mine was brought in on Monday and 60 tons the following day. This is the first ore shipped over the Nakusp and Slocan railway, and will be followed by 700 tons from the same mine. The ore goes out of the district via Revelstoke.

The *Mining Journal* (London) for August 25th, gives lengthy extracts from the report of the British Columbia Board of Trade on mining matters. In an editorial on the subject, after detailing the wonderful richness of specimens from the Slocan, Toad Mountain and West Kootenay generally, it says: "Taking these samples to be fair average specimens of the products of these districts, as certainly they may be presumed to be, a happy history of successful working would seem to be awaiting British Columbia. Nothing but financial depression is responsible for the fact that the day of great things has not yet arrived."

Manager Hendryx is reported as saying that the smelter company at Pilot Bay will be ready within two months to purchase all ore offering. If so, and the price is equal to that paid by outside smelters, there is no reason why every ton of ore mined in Kootenay should not be treated at Pilot Bay. The operation of that smelter means employment to quite a number of men, and every man drawing pay regularly in Kootenay is a factor in the development of the mineral resources of the district.

MISCELLANEOUS ITEMS.

On 22nd inst., while a number of men were loading ore on the 7th level of the Copper Cliff mine, a mass of rock, estimated to weigh seven or eight tons, fell from the roof, crushing two men under it, one being killed almost instantly, and the other living about one hour in an unconscious condition. The names of the unfortunate men were Thos. Lintley and Samuel Mattson, both Finlanders. A companion, who was close beside them, escaped with a slight bruise on one leg. One piece of the rock which fell was six feet long, three feet wide, and over two feet in thickness. An inquest is being held.

From the new chrome iron deposits being worked at Black Lake, Que., we learn that the Lambly-Nadeau Co. has taken out over 180 tons first grade ore, containing over 50 per cent. sesquioxide of chromium. Mr. Joseph Lemelin has mined over 140 tons from the property of Dr. Reed. The other operations are reported to be meeting with encouraging results. Shipments have been made to the Baltimore chrome works, the Tyson's, Baltimore, the Kalvin Chemical Co., Philadelphia, and to the Carnegie Iron and Steel Co., at Pittsburg.

Wellington Coal Co., Nanaimo, B.C., have ordered an electric mining locomotive for their mines, from the Royal Electric Co., Montreal.

The output of coal from the Joggins mines of the Canada Coals and Railway Co. is now close upon 450 tons per day. A correspondent writes: We have three slopes working, but I might state that No. 1 is presently lying under water, but is being rapidly unwatered with a view to extending our workings in this direction. It is intended to fit up a winding engine and boilers at the slope, and in due course an extensive output of good clean coal is expected. At No. 2, two new double-flued boilers have been placed down, and the output from this slope is in consequence steadily increasing. At No. 3, two new, seven feet diameter, double-flued Lancashire boilers have been put in and one large coupled horizontal winding engine. This work has just been completed, and in course of time the output from this slope will be more than the other two combined, in fact, within a year from now it is certain the output will exceed 1,000 tons daily. A haulage engine on the tail rope system has also been erected at No. 3 to draw the coal to No. 2, where it is prepared for the market. This work has all along been done by horse. The engine has been built by the Ingersoll Rock Drill Co., Montreal, and has the appearance of being a first-class piece of workmanship. The Lancashire boilers, fitted with Galloway tubes, were built by the the Robb Engineering Co., Amherst, N.S. The winding engine is second hand, and was bought from the proprietors of the Chignecto colliery, Maccan. A great many other improvements are going on, including arrangements for shipping slack etc., by water, and improvements at the wharf, which has been entirely re-modelled.

A flow of natural gas, capable of supplying a town the size of Edmonton has been struck at Athabasca Landing by the petroleum boring party under the supervision of Dr. Selwyn, of Ottawa, and the direction of the Dominion government. Farther down the Athabasca river, natural gas has come up from fissures in the rock for years, and the bubbles that rise to its surface are easily ignited. At low water, these fissures being exposed, can be lit, and the weary traveller is often spared the necessity of cutting wood to boil his kettle, by merely putting a match to them. They are easily put out, but more often they are left until the river rises and extinguishes them. The fact of such a flow of gas being struck at a depth of 400 feet, shows the amount of pressure existing in the overlying strata, and will assist the party in making calculations on the distance yet to go before oil is reached. As sand, suitable for making plate glass can be extracted from the tar sands along the river, this discovery of natural gas may, in future years, prove a boon to glass manufacturing industries.

MINING REGULATIONS

TO GOVERN THE DISPOSAL OF

Dominion Lands Containing Minerals other than Coal.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands, not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same, but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 feet in length and 500 feet in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fradulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The Regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as: "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interor

PROVINCE OF NOVA SCOTIA.

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

—AND—

PRECIOUS STONES.

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

GOLD AND SILVER.

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

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted gold valued at $18 an ounce.

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

MINES OTHER THAN GOLD AND SILVER.

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

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

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

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

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

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

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

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

ONTARIO MINING INSTITUTE.

The First Quarterly General Meeting of the Institute, for the Transaction of Business, and Reading Discussion of Papers

WILL BE HELD IN THE

PRIVATE BILLS COMMITTEE ROOM

PARLIAMENT BUILDINGS, TORONTO,

—ON—

Wednesday 12th, & Thursday 13th Sept.

Chair to be taken at two o'clock in the afternoon and at eight o'clock in the evening of both days.

All interested in Mining and the development of Ontario Mineral resources, are cordially invited to be present.

JAMES CONMEE, President. **B. T. A. BELL,** Secretary.

GENERAL MINING ASSOCIATION

—OF THE—

PROVINCE OF QUEBEC.

THE AUTUMN MEETING of this Association will be held at Sherbrooke, Que., on WEDNESDA and THURSDAY, 26th and 27th September, next.

JOHN BLUE, President. **B. T. A. BELL,** Secretary.

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

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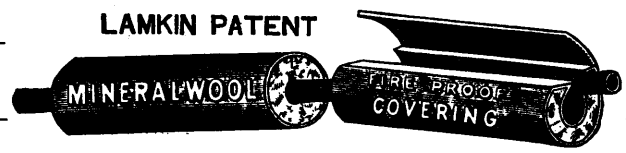

STEAM PACKINGS.

ASBESTOS GOODS OF EVERY DESCRIPTION.

MINING LAWS OF ONTARIO.

ANY person may explore Crown Lands for minerals.

Mining lands may be taken up as surveyed locations or staked claims.

Locations range from 40 to 320 acres.

Claims range from 10 to 20 acres on vein or lode.

Locations may be acquired in fee or under leasehold.

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

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

Rent of claims, $1 per acre each year.

Claims must be worked continuously.

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

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

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

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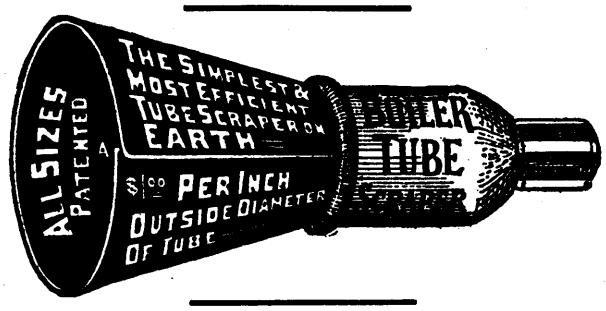

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