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Established 1882

Vol. X.—No. 4. 1891—OTTAWA, APRIL—1891. Vol. X.—No. 4.

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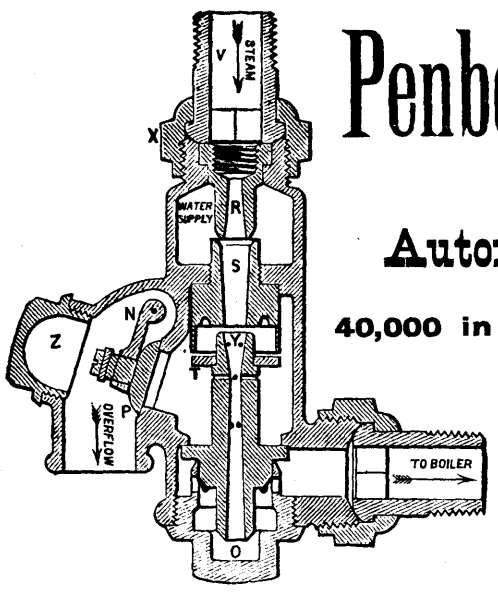

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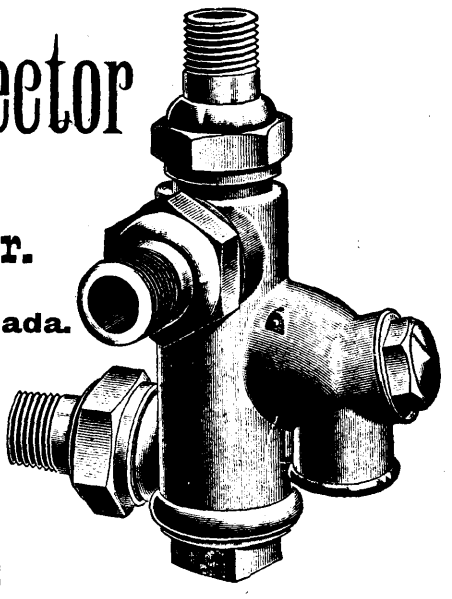

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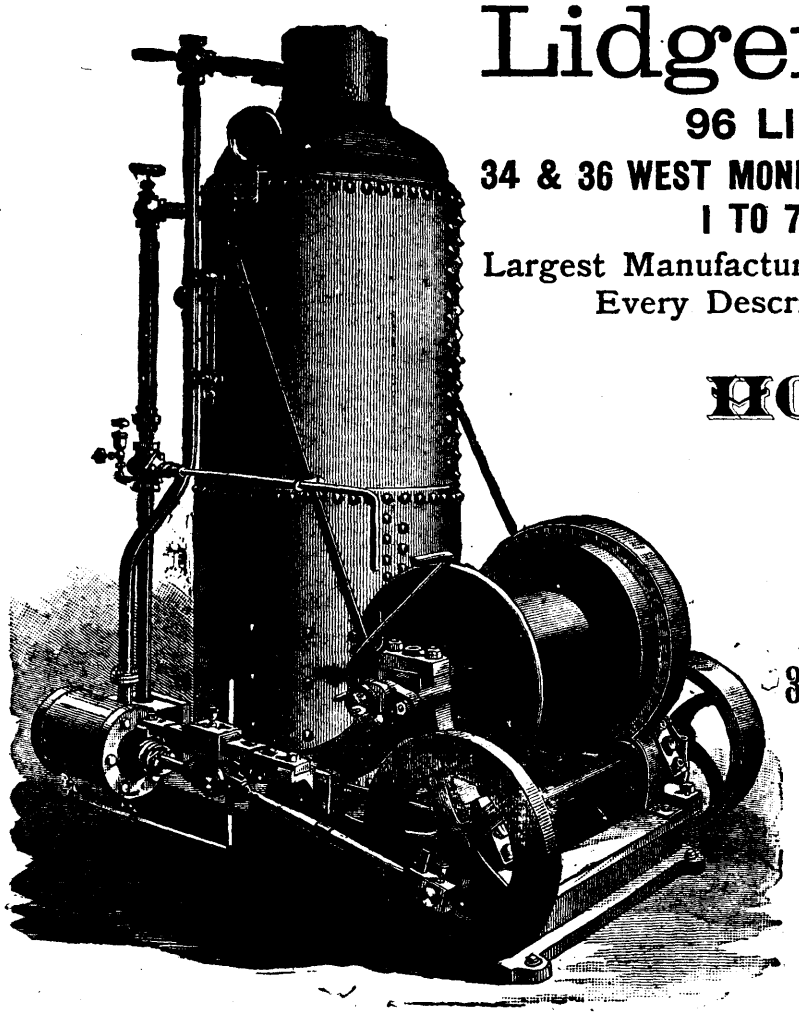

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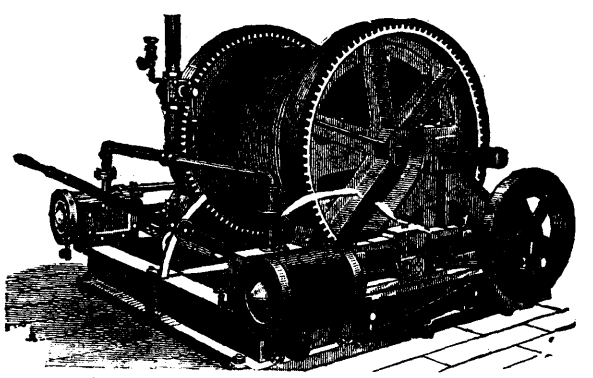

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Vol. X. APRIL, 1891. No. 4.

The Ontario Government's Mining Policy.

The deliberations of the recent Mining Convention at Toronto, and the legislation on mining matters announced by the Ontario Government, indicate the growth in the popular consciousness of the idea that the provincial mineral wealth is not merely length and breadth without depth, and therefore need no longer be given, granted, and sold forever in terms of superficial acres for 100 cents each. In the absence of that knowledge of our mineral resources and the best means of exploiting them, which we should have begun to acquire nearly a quarter of a century ago, the Government policy is cause for thankfulness. It was urged in some quarters that nothing short of a Department of Mines, with a responsible Commissioner as a member of the administration at its head, are necessary to further the mineral interests of Ontario, but the Government have done well to recognize that the country lacks education more than a policy. The promise of a Mining Bureau recognizes that the educational necessity transcends the political. The Government and the country will do well to understand just what the educational necessity is. The list of disastrous enterprises in mining and metal manufacture is a long one, and the cause of their disaster, beyond all doubt, is mainly due to the lack of skilled industry and scientific direction. For remedy of the latter, how are we equipped? Vainly shall one look through the "course of study" in the Ontario School of Practical Science for mention of a working laboratory for students of mining engineering and metallurgy. In the "practical course," under the head of "mineralogy and geology," one finds: "Use of blowpipe, fee $10;" "blowpipe analysis, fee $15;" "assaying, fee $50." The first two subjects should be within the function of a science master in a country grammar school,—so called before pretentiousness substituted the title of Collegiate Institute. Compare the tariff of fees with the announcement of the "Michigan Mining School" at Houghton, Mich.: "A State school of Surveying, Mining, Electrical and Mechanical Engineering, Physics, Chemistry, Assaying, Ore Dressing, Mineralogy, Drafting, Machine Design, etc. Tuition free."

The area of the State of Massachusetts is 7,250 square miles, and her only mineral wealth some scanty deposits of bog iron ore; our Algoma District as originally constituted, between the mouth of French River and the western provincial boundary, comprises 200,000 square miles. But though we could supply territory in that district alone, for 27 States like Massachusetts, our little cousin found, some years ago, among her youth one whose priceless wit uttered a proverb worth many miles of dollar-an-acre mines. "What on earth can you raise in such a country as this anyway?" asked a wayfarer of an urchin he met in a rock-walled field in Massachusetts. "Why, we build school houses and raise men," was the noble answer. And so we find the equipment of the mining and metallurgical laboratories of the Massachusetts Institute of Technology, founded some 25 years ago, are fitted to "raise men" to a far higher attainment of useful knowledge and practical skill than anything this vast Ontario can offer. The Institute announces that these laboratories have been fitted with a view to "furnish students means for studying experimentally various processes of ore-dressing and smelting, and what is required of a miner or metallurgist. The metallurgy of lead, copper, gold, and silver has been chosen as best suited for laboratory illustration; production of iron and steel in quantity is prohibited by the size of plant requisite, and by the large amount of ores and fluxes necessary to put this into operation The experimental work of the laboratory is carried on by students under charge of an instructor. A sufficient quantity of ore is assigned to each student, who first examines it for its component minerals, sorts and samples it, and determines its character and value by analysis and assays, and makes such other preliminary examinations as serve to indicate the proper treatment. He then treats the given quantity, makes an examintion of the products at each step of the process, ascertains, where practicable, the amount of power, water, chemicals, fuel and labor expended, and thus learns approximately the effectiveness and economy of the method adopted. He learns the value of chemistry as a check upon metallurgical work. Each student is assisted in working by his classmates, each of whom has an opportunity in turn to manage the machines and furnaces.

The Institute does not claim that the laboratory is in any sense of the word a substitute for Works. What is claimed is, that it prepares students to go into Works, and to profit by them.

"The mining laboratory consists of three parts —milling room, furnace room, and assay room —with ample storage vaults, supply room, and toilet room attached.

"The milling room is supplied with four suites of milling apparatus: 1. A three-stamp battery, set of amalgamating plates, mercury-saver, Frue-vanner for concentrating tailings, settling-tank, and centrifugal pump. 2. A Blake challenge crusher, crushing-rolls with automatic sizing screens, Richards-Coggin separator, spitzkasten, two Harz-Mountain jigs, Evans table or rotary-buddle, settling tank, and centrifugal pump. 3. A set of four amalgamating-pans, 30, 18, 12 and 8 inches in diameter respectively, also 36-inch settler, and little automatic sieve for separating mercury from pulp. 4. A set of three 40-gallon leaching vessels, set of four 8-gallon leaching vessels, and two dynamos for deposition of metals. The laboratory contains the following auxiliary apparatus: A steam engine, Bogardus mill, Root blower, Sturtevant dust-fan and blower, drying tables, and four Morrell agate mortars.

"The furnace room contains a water-jacket blast furnace, a copper refining furnace, reverberatory lead-smelting or agglomerating furnace, two roasting furnaces, furnaces for cupellation, furnaces for fusion, blacksmith's forge, melting kettle, retorts, etc. The assay room contains ten crucible furnaces, 12 x 12, all of which are jacketed with iron shells to ensure good draught, stability, and durability; two muffles 4 x 7, one muffle 3 x 6, four muffles 7 x 12, one muffle 8 x 15. These furnaces are provided with ample flue capacity and abundant draught. This room contains six pulp balances, six flux balances, five button balances, and desks for fifty students.

"The Institute is from time to time receiving ores of gold, silver, lead, copper, nickel, antimony, etc., from various localities. These ores are worked, and reports sent to those who contribute them; and it is expected, that, by the co-operation of those who wish to have examinations made, the laboratory will continue to receive the necessary amount and variety of ores.

"To bring the mining students into closer acquaintance with their profession, excursions are organized for visiting mines, mills, smelting works, and geological fields. These excursions take place as often as once in two years; and, since the year 1870, excursions have been made to Colorado, Lake Superior, Virginia, Vermont, Pennsylvania, Lake Champlain, New Brunswick, and Nova Scotia. Shorter excursions of a day or two at a time are made while the school is in session."

Now it is safe to say that in view of our present need, laboratories such as above described are not only required, but inasmuch as they are confessedly "not a substitute for Works," it would redound very much to the benefit of the Province to have them extended at least to the attainment of practical work in the metallurgy of iron and steel. For the science of metallurgy reveals. Its growth is something like an organism whose function is aiding the expansion of national intelligence and advance in civilisation. It is of all modern sciences, a living thing; a daily revelation of Him who is "great in counsel and mighty in doing." We shall do well to haste to a knowledge of its operations. The industrial forces surrounding this country are moving with a stride our sparse population and commercial by-laws can do little to influence one way or other. The future of the farm and the railway, the frontier city and the manufacturing town, may depend more largely than we can see upon what we do in the next decade for the development of our mineral resources.

The operations of a Bureau of Mines are plainly necessary in the Thunder Bay and Algoma districts, and most useful surveys should here be undertaken on a scale of sufficient magnitude. Where surface indications are not sufficiently

expressive, some application of the diamond drill will impart profundity to our knowledge. As the work progresses, maps should be published and the information obtained spread far and wide, so that the Province may get the benefit of the largest possible competition for leases. An assaying and milling laboratory should be established at Port Arthur, or some other central point. The Swedish Export Association, chiefly a government affair, sends its drummers to India, Spain and South America to compete with British exporters in the quest for orders for special lines of iron and steel. Can common sense find any reason against the provincial importation of a few Swedish iron-makers and charcoal-burners, for instituting here the manufacture of high class charcoal iron, a production saleable in various parts of the world in spite of hostile tariffs. The importation of Mr. Cockerill, a British iron master, by the King of Belgium, and the supply of money for his enterprise, established in that country an iron manufacturing business second to none in the world in its influence upon the industry of a nation.

Of what complexion will the Province make the Bureau of Mines? Will there be appointed to its duties, men who can give you the analysis of the bronze of Achilles' shield, an epigram on the brass in a lawyer's cheek, names for metals and alloys in every dead language, accurate delineations of the furnaces and mining tools of the mound builders and the pre-historic metallurgy of Atlantis? Or shall we have some well posted in metal tariffs and glib to point out what "We would, and if we could," if anything were otherwise than it is. Shall the annual report be a yearly contribution to provincial party politics and a factor in promoting a reputation for provincial stupidity, or shall its pages record the triumphs of science under difficulties and the progress of the people in useful arts which it is some measure of disgrace are now unknown to them? Shall we pursue a system of wrecking, and liberate to periodical attacks on capital, schemes which find no small degree of sanction in the ignorance which it is the duty of a wise Government to remove? Is it not possible to make the report of a Bureau of Mines—equipped and controlled by competent, well trained and experienced metalliferous engineers, as assuredly it should be—a guarantee upon which the enterprising miner may with reasonable certainty base his calculations? Beyond question it is, if the Government will but awake to the possibilities before them in this direction and to the need for immediate, liberally-devised measures for the development of the mineral wealth of Ontario.

The land policy of the Government is well within its own control and no doubt such should be the case for a time. There are constitutional objections to making the head of a Department the arbiter in a matter of right of purchase or lease. While our mining law is in a transition state this cannot well be otherwise. If the Government will but follow out not so much what the Mining Commission recommend as what their report suggests, we will have no cause to complain of a land policy framed to protect public interests.

The royalty proposed on ores, and the advanced price of mining lands, will hardly add anything to the revenue. A score of companies might be named who could part with 40 out of every 50 acres of their territories and still retain their mines intact. The royalty from many mines will hardly pay the cost of collection. In the case of shafts going down at great expense on lean ore, the payment of royalty will seem a hardship, and the mining director should have certain discretionary powers in the premises. In the case of iron mines, two per cent. on the value of ore at the pit's mouth will yield a return of $600 from a mine giving an output of 30,000 tons a year. It will be difficult to find a case where the best magnetic ore in Ontario is worth over $1 a ton when brought to ground. But, in fine, we are convinced that good will come out of the proposed legislation, though it may be but little; that progress will be made, though we shall hasten but slowly; and that there is much to be thankful for in the recognition given by Mr. Hardy's bill, to the fact that length and breadth, without depth—in other words, superficial area—should not furnish any longer the basis on which our mineral territory shall be sold. There is profundity in the conception which cannot but have its influence abroad for good.

The Ontario Mining Act.

We are indebted to the courtesy of the Hon. E. H. Bronson for an advance copy of the Bill to amend the General Mining Act, introduced the other day into the Ontario Legislature, a summary of the leading features of which is presented below. The changes in the law are important. The price of mining lands to the north and west of Lake Nipissing is to be raised from $2 to $5 an acre, and those to the south and east, heretofore sold at $1, will in the future be sold at $3 an acre. Power, moreover, is given to the Lieut. Governor-in-Council to set apart by regulation any territory shown to be particularly rich in minerals, and to fix the price of such lands at any greater price than those above mentioned, or they may be temporarily withdrawn from sale altogether. Purchasers of mining lands are compelled to develope their properties by a clause requiring that within ten years of the date of patent, they shall expend in actual mining operations, the equivalent of at least $3 per acre in the case of lots of 160 acres, or of $5 per acre in smaller lots, in default of which the mineral rights revert to the Crown, but the land remains the property of the purchaser. Under section seven, it is provided that instead of selling the land in fee simple, it may be leased by the Crown for ten years, with the right to renew for a further term of ten years, and thereafter for terms of twenty years on a rearrangement of the rent. If default is made by non-payment of the rent, or the breaking of any of the covenants in the lease, it is to be forfeited. All ores and minerals mined after the passing of this Act are to be subject to a royalty for the use of the Province, whether such royalty be reserved in the grant, patent, or lease, or not. Silver, nickel, or nickel and copper, are taxed 3 per cent., iron 2 per cent., and all other ores such percentages as may from time to time be imposed by Order-in-Council, in no case to exceed 3 per cent. Ores taken out by way of experiment may be made free of royalty on the recommendation of the Director of Mines. The bill provides for the appointment of a Director of Mines, who is to be under the direction of the Commissioner of Crown Lands, and who is to have charge of the mining matters of the Province, with such other powers as may be assigned to him by regulation. The Act does not apply to lands already sold, but only to those which may be disposed of hereafter.

We hope to make a more extended comment on the Bill in our next issue, but we cannot refrain from pointing out the injury that such a royalty must work to the mining interests of the Province. It is unjust inasmuch as it singles out for taxation a particular industry, and the most precarious and laborious of all productive industries. Of course, mining under skilful management is often very profitable, but at the same time it must be remembered that the list of failures is very large, and outweighs these remunerative enterprises in a general consideration. Yet the Bill practically discriminates against the unfortunate by taxing the gross product instead of profits or dividends. Such ill-considered legislation as this clause would enact, will, it is to be hoped, be withdrawn or amended before the Bill is passed.

The "gift of tongues" is, unfortunately, not one of the most prominent accomplishments of the office, as was felt the other day when a handsome card with a, to us, enigmatical inscription, came from the post. The deliberations of our large staff were immediately called into requisition, and after much debate, it was discovered—that the language was German. It might as well have been Greek, nay better, for some of the staff had had that tongue instilled into them by the gentle birch, but, with the exception of the office boy, who could swear a little in it, the Teutonic "sprache" was an unknown quantity. Sundry wild conjectures were ventured on. After numerous consultations of "Ollendorf," it was announced that the mysterious missive was nothing less than the wedding card of our friend Dr. C. Killing, of Amsterdam. It was at once unanimously voted: that the REVIEW extends its heartiest congratulations, and wishes the happy pair every good fortune. In which, we are sure, all who have had the pleasure of meeting Dr. Killing will join.

As hinted in a previous issue, the gold yield in Nova Scotia for 1890 was somewhat smaller than in 1889, a close estimate from official sources placing the quantity in the neighborhood of 23,000 ounces. During the previous year the yield amounted to 26,155 oz. 6 dwts. 13 grs, from 39,160 tons of rock crushed.

EN PASSANT.

Some time ago mention was made in these columns of the discovery of vast deposits of tar sands in the valley of the Athabaska. In his report to the Geological Survey, Mr. R. G. McConnel states that the eastern boundary of these deposits has not been precisely defined, but their outcrop is estimated to have a minimum distribution of fully 1,000 square miles. In thickness they vary from 150 to 225 feet. The tar is unequally distributed through the sands, in some places merely staining the grains, but in most of the sections examined it is present in sufficient quantity to render the whole mass more or less plastic.

The commercial value of the tar-sands themselves, as exposed at the surface, Mr. McConnel thinks is at present uncertain. But the abundance of the material, and the high percentage of bitumen which it contains, makes it probable that in the future it might be utilized for various purposes. "It proves a flow of petroleum to the surface unequalled in the world." The question of the continuity of the tar sands, and their petroliferous character under cover, can only be settled in a decided manner by boring, and Mr. McConnel is strongly of opinion that drilling operations should be undertaken for this purpose. He recommends that two bore holes, one at the mouth of the Lac la Biche River, and the other at the mouth of the Pelican, would add largely to our knowledge of the underground geology of this region, and would settle positively the question as to the presence or absence of petroleum in paying quantities. At the mouth of the Pelican River, a bore hole, in order to reach the tar sands, would require to be sunk 700 feet, and at the mouth of the Lac la Biche River about 1,200. The former locality is 50 miles distant in a straight line from the outcrop of tar sands at Boiler Rapid. The latter is 106 miles from the same point, and is only 110 miles from Edmonton.

In view of these recommendations, it is not unlikely that the Dominion Government will make some tests during the coming summer. The indications seem amply sufficient to warrant the small expenditure involved, and the advantages that would accrue to the North-West are almost incalculable.

A very interesting paper on the Florida phosphate industry, was read a short time ago by Mr. W. M. Fuller, of Wolverhampton, Eng., under the auspices of the Chemical Manure Manufacturers' Association, from which we excerpt the following pertinent paragraphs:—

"I have been applied to by various friends for an opinion as to the safety of investing in Florida phosphate property; my advice is, be cautious what you are about, for it is not all gold that glitters. Properties have been sold at many times their value, and in some cases claims have been sold and put forward as phosphate lands upon which no phosphate exists; in other cases uninitiated persons have been misled by small pieces found on the surface, forgetting that a few swallows do not make a summer.

"There have been certain parties in London, from the States, doing their best to swindle John Bull, and unless you have reliable means of ascertaining the real facts—if you are out, *keep out;* if you are *in, get out.*"

According to a return kindly furnished us by the United States Consul at Port Arthur, the Beaver Mining and Milling Company exported $30,000 of silver ore, crushed and concentrates, and the Badger Silver Mining Company, $24,000, all to the Balbach Smelting and Refining Company of Newark, N.J. These exports were for the quarter ended 31st ulto.

For the first time in the history of Canadian mining, electricity is about to be used as a motive power. The company introducing it is the New Vancouver Coal Company, at Nanaimo, B. C., who have ordered a plant, costing considerably over $50,000, for use in their mines. It will include an underground tramway with power sufficient to maintain a uniform speed of eight or nine miles an hour, with 150 loaded cars continually moving. The mines will be lighted by six hundred incandescent lights, and the drills and cutters will be operated by the same current. The necessary materials will be in place in a few weeks and will at once be put in operation. Electricity for lighting purposes is also used at the mines of the Dominion Mineral Company at Sudbury, and will shortly be introduced in the phosphate district by one of our operators.

Apropos of our comment last month on the reported sale of the Badger, Porcupine and other mines, to an Anglo-American syndicate, the following letter has been received from Mr. Walter Read, Secretary of the Badger Silver Mining Company:—

"Our company has sold the Badger and the Porcupine mines to a syndicate, of which Mr. Herbert N. Nichols, of Denver, Col., is the representative. The amount received for the two properties was a satisfactory one—at least to a majority of the stockholders. Our company did not own the West End mine."

At last some one who has had sense enough to discern the true inwardness, and courage to speak his opinion of that ridiculous document, the "Report of the Experts to the United States Government on the Sudbury Nickel Deposits," has come forward. Dr. A. S. Thompson has, in a letter to the press, scored it most severely, and has exposed its utter absurdity, but an explanatory word as to its authenticity will be of interest. When first the nickel-crazy press in Toronto began quoting copious extracts from this new gospel of the Sudbury district, we wrote to the Superintendent of Naval Construction at Washington asking if such a report had been issued, and if so to furnish us with a copy *verbatim*. In reply we were assured that the Government had made *no such report*, and we were referred to the Canadian Copper Company at Cleveland, to whom our readers are indebted for the document. We did not comment on the report at the time other than to point out its flagrant unfairness to the other companies, for we thought that most of our readers had enough sense to appreciate at their true value the statements of a number of gentlemen who might be authorities on the construction or navigation of a ship, but who had no claim to be considered experts on the value or extent of mineral deposits.

A suggestion worth consideration was contained in a paper on "The Education of Engineers," read before the Yorkshire (Eng.) College Engineering Society. Referring to the old method of education, the putting of a quantity of practical work upon good material, and the newer system, of preliminary theoretical training followed by the practical one, it was held that the latter proves anything but satisfactory. Although it might produce some better engineers than the old plan, the average quality of the result was diminished by the number of students who were put through an entire college course, regardless of the fact that they were not of the material required to make engineers. Would it not be better, it was asked, to reverse the operation? First, to send young men to the works, where those quite unsuited to engineering would be discovered very quickly; then hand those who, so to speak, had been through the furnace, over to the college, where they would have every chance of being made creditable engineers.

While in New York the other day, we learned from a conversation with Dr. Rossiter W. Raymond, the Secretary, that the American Institute of Mining Engineers was at present looking about for a suitable meeting place for its next session in June. Dr. Raymond thought well of a suggestion to pay another visit to Canada, with Toronto as a possible rendezvous from which visits could be made to the mining districts of Algoma, Sudbury, Hastings Co. and elsewhere in the Province of Ontario. We immediately placed this suggestion in the hands of Mr. Hamilton Merritt, Chairman of the recent Toronto Convention, and he writes to say that an endeavor is being made to carry the arrangement into effect. In view of the immense practical benefits to the Province that would surely ensue from a visit of such an eminent body of trained engineers, there should be no difficulty in raising a sum sufficiently large to make this meeting a success. In 1889, the Ontario Government voted $1,000 to the Ottawa meeting, but owing to the inclemency of the weather, which limited the excursions in Ontario to a hasty run to Sudbury, only a small portion of the amount was utilized, and nearly $700 were returned. The Ottawa meeting of the Institute did much to stimulate mineral development in the Province of Quebec, and in one instance, at least, we can point to the establishment of a large factory for the manufacture of mining machinery, created directly and entirely through the knowledge of our resources gained by the visit. We hope to be able to record in our next issue that the Toronto meeting of the American Institute of Mining Engineers has been definitely settled. The Institute have held meetings in Halifax in 1885, and in Ottawa in 1889.

The mineral exports to the United States from the Ottawa Valley, for Quarter ended 31st ult., have been as follows:—

Phosphates....	300 tons, to Chicago.
Mica.....	$2,000, to Lynn, Mass.
Mica.....	$2,570.60, to Schenectady, N.Y.
Iron Ore.....	1,626 11/12 tons, to Catasaqua, Pa.

Dr. A. R. C. Selwyn, Director of the Geological Survey of Canada, has gone to Southern Manitoba to report on the boring operations for a good supply of artesian water at Deloraine. The total expenditure on this work has been $8,648.62. This has been derived and paid to the Deloraine Well Finance Committee, who had charge of the boring, as follows:—

Raised by Municipal loan, grant from the Local Government, and by subscription.	$4,482.78
From Geological Survey appropriation, 1889-90.....	500.00
From special appropriation of $2,000 voted by Parliament in 1890.....	1,997.54
From special appropriation of $10,000 voted by Parliament in 1891.....	1,668.30
	$8,648.62

Although a supply of water of fair quality was struck at a depth of 1,570 feet, the well is still incomplete, and it is impossible to state what further amount will be required to complete it, but Dr. Selwyn hopes that the cost in 1891 will not exceed an additional sum of $2,000.

The Nickel Steel Syndicate, about which there was some talk during the visit of the Iron and Steel Institute to this country, has materialized, with Sir James Kitson, President of the Institute, as chairman, and Mr. F. Rey, 147 Leadenhall street, as managing director. Among the other English directors are Mr. Percy Gilchrist, well known in the metallurgical world as the co-inventor of the Thomas-Gilchrist basic process, and Sir Lowthian Bell, Bart. All the French, American and English patents, says the *Ironmonger*, have been acquired by the syndicate, the principal patentee being Mr. J. F. Hall, Sheffield. It is contemplated to reduce the cost of nickel very considerably in a form suitable to apply to steel making without in any way interfering with the ordinary nickel of commerce as now used for plating and other manufactures. It is expected that before very long works will be opened by the syndicate in the neighborhood of Sheffield, for the manufacture of ferro-nickel. This should be good news to our nickel miners, for whom there is unquestionably, in the near future, an era of great industrial activity in the production of their ores for the manufacture of nickel-steel.

The *Mining Journal* is authority for an amusing story of the late P. T. Barnum, in which he figures as a mine exploiter of the wiliest type. It was in 1849, the year of the California gold excitement that the incident occurred. Mr. Barnum arrived in New York with the first specimens of Californian gold. The gold-fever was at its height; thousands were preparing to leave for the new Eldorado, and he cast about him to turn it to some account. Going to Mr. Gillman, of Boston, Mr. Barnum proposed that he should give a series of lectures on the subject in great public halls. Of course a fine nugget would be needed by way of illustration. Mr. Barnum had, as he said "a specimen lump" already prepared and weighing 25 ounces; but unfortunately, Mr. Gillman had never seen or heard of a "lump" that weighed more than seven ounces, but seven ounces would never do. "Why sir!" exclaimed Mr. Barnum, "every man who is going out expects to pick up rocks of it." A compromise, however, soon suggested itself. "Well, sir, said the resourceful showman, "I tell you what we can do. You prepare a short lecture on the subject, to be delivered in my lecture room—not over fifteen minutes long, better ten—and then be prepared to answer questions (they'll be sure to come thick and fast) about the different routes, the mining, means, and cost of living; just how to do it you understand. We will have a small table on the stage, with my twenty-five ounce lump of gold on it. As you are talking, you can handle it; just pass your hand over it now and then—and—and—I wouldn't have you tell a lie about it for anything, Mr. Gillman—but if—you see—they get the idea that that's the kind of lump they *may* find, a fortune's made and we'll share it." We cannot help thinking what a noble partner the late Mr. Barnum would have made for that disinterested patriot on both sides of the line, Mr S. J. Ritchie, in the Sudbury boom business.

The Springhill Relief Fund has been steadily growing until now it is very little short of $75,000. From every part of the Dominion large contributions have been received, and considerable sums have also been raised in England and the United States. There has been some little trouble over the administration of the fund. Certain citizens of Springhill, conceiving that it was not being devoted altogether to its proper purposes, held a meeting a short time ago, and in round terms, denounced the conduct of the Committee. Their action seems to have been entirely uncalled for; the money has been lodged in the Bank of Montreal in the name of four trustees whose probity does not admit of doubt, Hon. George Drummond, Sir Donald A. Smith, E. S. Clouston and Robert Cowans, and Hon. James McDonald, Chief Justice of Nova Scotia, has been asked to become a fifth. This alone should guarantee the proper administration of the fund, while at the same time every confidence is to be placed in the Committee. The mayor of Springhill immediately called a meeting of the Council, at which the following resolution was passed:—

"Whereas, it has come to the knowledge of this Council that rumors are abroad reflecting on the honesty, integrity and judgment of the Committee having control of the Springhill Relief Fund, that may tend to awaken in the minds of people who have generously contributed a feeling of regret in fear lest the persons for whom their sympathies were awakened should not receive the full benefit of their gifts. Therefore, resolved:—

"1st. That we place on record a motion of confidence in the persons comprising the Relief Committee, viz.: Alexander McInnes, mine manager; William Conway, underground manager; Andrew Scott, underground manager; Abner McLean, miner; Robert O'Rourke, miner; J. G. Aikma, Superintendent of the S. H. & P. Ry., and A. E. Fraser, late mayor, as an assurance to a generous public of the honesty and ability of these gentlemen to manage the relief fund in the best interests of the bereaved by the late mining accident.

"2nd. That we approve of their action in having placed a portion of the funds in the Bank of Montreal in the names of the Hon. G. Drummond, Sir D. A. Smith, E. S. Clouston and Robt. Cowans, as trustees, men of national reputation.

"3rd. That in the name of the citizens of Springhill, we tender our sincere thanks to the people throughout the length and breadth of Canada, the United States and Great Britain, who have so nobly responded to our appeal for assistance, in our sore calamity.

"4th. That the clerk at once communicate a copy of these resolutions to the Halifax and St. John papers.—Passed. "WM. HALL, Mayor."

"SPRINGHILL, April 3, 1891."

In the light of last summer's excitement over reported rich finds of gold in the conglomerates at Gay's River and elsewhere, the following remarks by Mr. Hugh Fletcher, of the Geological Survey, will be of interest to the gold miners of Nova Scotia: "The region was proclaimed a gold district and rights of search taken out covering many miles. The attention of prospectors was, moreover, directed to all the conglomerates in the province. That the conglomerate of Gay's River is auriferous has long been well known, and Professor Hind has proved the existence of gold, silver and copper in certain beds of that nature near Baddeck. The Brookfield conglomerate was said to have given rich returns by milling, although a somewhat close examination by panning the dirt in the beds of the streams flowing over it failed to indicate the presence of gold in appreciable quantity. Two samples were sent to Mr. Hoffmann, one from the neighborhood of the barytes mine, the other from the brook three hundred yards above the Glenbervie mills; but neither of them yielded, on assay, a trace of either silver or gold. Tests subsequently made on a large scale at the mill of one of the gold mines emphatically confirmed the accuracy of Mr. Hoffmann's assays."

The arrangements for the First Quarterly General Meeting of the General Mining Association of the Province of Quebec being now complete, we are able to give our readers the programme of the proceedings. Two sessions for the reading and discussion of papers will be held, in the Windsor Hotel, Montreal, commencing at 10 a.m. and two in the afternoon. The following subjects will be taken up:—

(*a*)—REPORT OF THE COUNCIL ON THE NEW QUEBEC MINING ACT.

By the President.

(*b*)—NOTE ON THE QUEBEC MINING ACT.

By Dr. Rossiter W. Raymond, M.E., New York.

(*c*)—NOTE ON THE LAW RESPECTING POWDER MAGAZINES IN THE PROVINCE OF QUEBEC.

By Hon. George Irvine, Q.C., Quebec.

(*d*)—MINE INSPECTION.

By J. Burley Smith, M.E., Glenalmond, Que.

(*e*)—THE RESPONSIBILITIES OF THE MINE MANAGER.

By A. M. Evans, M.E., Black Lake, Que.

(*f*)—SCIENTIFIC ENQUIRY IN ITS RELATION TO MINING.

By R. W. Ells, Ottawa, Ont.

(*g*)—THE CHEMICAL ANALYSES OF ASBESTOS.

By Dr. J. T. Donald, Montreal.

(*h*)—THE APPLICATION OF ELECTRICITY TO MINING.

This paper will be demonstrated by representatives of the Edison Co., New York, and the Thomson-Houston Electric Co., of Boston.

The meetings and all discussions are open to the public. In the evening of the same day (the 29th April), the members and their friends will dine at the Windsor. We understand that a number of prominent speakers have promised to be present and will take part in the proceedings.

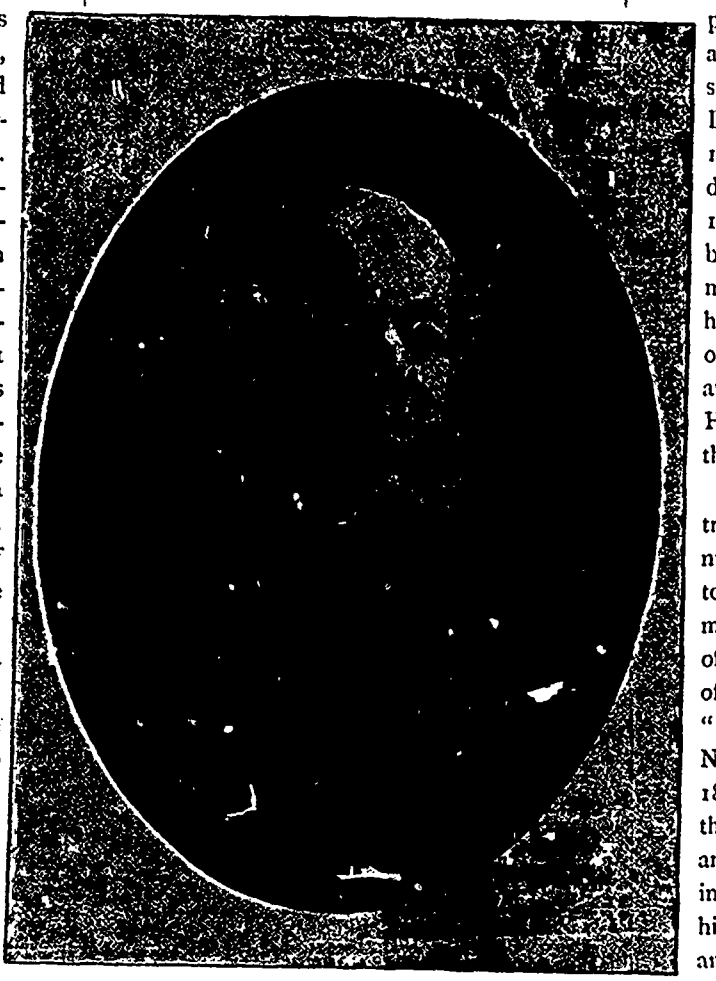
Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 11.

Alfred Richard Cecil Selwyn, C. M. G., L L. D., F. R. S.

Alfred Richard Cecil Selwyn, C.M.G., LL.D., Director of the Geological and Natural History Survey of Canada, was born in Somersetshire, England, in 1824. He is the youngest son of the Reverend Townshend Selwyn, Canon of Gloucester Cathedral. His mother was the daughter of Lord George Murray, Bishop of St. Davids, and grand-daughter of John, fourth Duke of Athol. His early education was received from a tutor, at home, but later he was sent to Switzerland, where he completed his studies. After leaving school, some years were spent, partly in travel in Belgium, France, Switzerland and the Tyrol, and partly in the position of a clerk in mercantile houses in London and Liverpool. This latter occupation, however, was distasteful, and having already acquired considerable knowledge of geology as an amateur, Mr. Selwyn gladly availed himself of an appointment as Assistant Geologist on the Geological Survey of Great Britain The ability he displayed in this position soon attracted the notice of distinguished geologists, and in 1852, on the recommendation of Sir H. T. De La Beche, the Director of the Survey, Mr. Selwyn was appointed by the Secretary of State for the Colonies to undertake the geological survey of the colony of Victoria, Australia. About this time, much interest had been aroused respecting the gold fields and coal beds in Tasmania, and the Government of that colony decided to obtain the services of a practical geologist to decide the question. Mr. Selwyn was asked to undertake the work, and consenting, at once began a thorough and systematic examination of Tasmania, his report on which was highly satisfactory. In 1859 he undertook with equal success, a similar service for the Government of South Australia. Previous to this, in 1856, he was appointed one of the commissioners of mines for Victoria; in 1858 he was made a member of the Science and Prospecting Board, and in 1861 appointed a commissioner for the Victoria International Exhibition. The esteem in which Dr. Selwyn was held by the Government and people of the colony is best shown by these and other distinctions accorded him. He was a member of the Government Tender Board, and of the councils of the Board of Agriculture, of the Royal Society, and of the Acclimatization Society. In 1869, Sir William Logan having resigned, the position of Director of the Geological Survey of Canada was offered to Dr. Selwyn, and he accepted. His work since then is well known; the lines laid down by his predecessor have been carried out to a large extent, but the field has so greatly enlarged that the present system may fairly be said to have originated with Dr. Selwyn. The responsibilities of such a position are very great, and his task has been rendered more arduous by the small sums for a long time appropriated by Parliament for the purposes of the Survey. A regrettable dissension also at one time greatly added to the difficulties of his position; and this, together with certain ill-advised criticisms made either in malice or ignorance, which had appeared, caused the appointment of a Royal Commission in 1884 to enquire into the system and work of the Survey, the report of which silenced these complaints. Very mistaken ideas as to the objects and functions of the Institution had been, and are still held. The Geological Survey is carried on in the interests of science more than of commerce. It never was intended that it should be a sort of National Prospecting Agency, for the purpose of discovering and appraising mineral deposits, and collecting commercial statistics, though this latter feature has been introduced and is carried out to a certain extent, but rather that by it the geological structure of the country should be mapped out, thus indicating to the prospector the general areas in which he might reasonably expect to find the mineral he sought.



Alfred R. C. Selwyn

Whilst administering the details of the Survey and Museum, Dr. Selwyn has taken an active part in the work of exploration. Amongst the most important of his expeditions have been:—in 1871, from Victoria, B.C., to the Rocky Mountains by the North Thompson and Frazer Rivers; in 1872, a canoe voyage from Port Arthur to Winnipeg; in 1873, from Winnipeg across the plains to the Rocky Mountains, returning by the Saskatchewan River and Lake Winnipeg; in 1875, from Victoria, B.C., to Peace River and return; in 1882, a boat voyage from Port Arthur around the whole northern shores of Lake Superior to Sault Ste. Marie. Besides these long and arduous explorations, Dr. Selwyn has made many journeys and geological observations over large portions of every province of the Dominion, and as the foregoing record shows, he has been actively and continuously engaged in geological work for forty-seven years.

Dr. Selwyn has, as Director of Geological Surveys on behalf of the Government of Victoria, Australia, and later of the Dominion, taken a prominent and active part in the collection and preparation of the mineral exhibits at six International Exhibitions: Melbourne-Dublin, 1854-5; Melbourne-London, 1861-2; Melbourne-Paris, 1866-7; Philadelphia, 1876; Paris, 1878; London, 1886. From all these exhibitions he has been awarded gold, silver and bronze medals and diplomas. At the Paris Exhibition in 1878 he was elected Chairman of the Jury on Cartography, and was awarded the Cross of the Legion of Honor, and in London in 1886, that of the Order of St. Michael and St. George.

Since 1869 he has edited and contributed to sixteen volumes of reports with numerous maps and illustrations relating to the structural geology and to the mineral, vegetable and animal resources of the Dominion. He is also the author of the Canadian part of Stamford's "Compendium of Geology and Travel—North America," London, 1883. In 1881-2 he superintended the removal of the Geological Museum from Montreal, and its reorganization on a broader basis in Ottawa, where it now embraces natural history as well as mineralogy and geology, and has become the most complete existing collection illustrating the natural resources of Canada.

Nor is it only on the other side of the Atlantic that Dr. Selwyn's abilities have met their just appreciation. Both in the United States and Canada his work is held in high esteem. A leading scientist in New York has said of the maps published by the Director, that they are "truly magnificent; my highest expectations are more than realized in them; they are, indeed, models of method and precision, and the most noble monuments to their originator." Another gentleman in a high position in the Lower Provinces, says:—

"It is my unbounded appreciation of what has hitherto been done by the corps of the Geological Survey, under the directorship of an able and eminent chief, of whom Canada may well feel proud, which prompts me to suggest, and impels me to advocate the expenditure of a few

tenths of a cent more apiece, to enable the Survey to continue recording and establishing in the most satisfactory manner, work that is being well done, and which ensures the industrial development of the country, while it will be at the same time a source of honest national pride when we compare our record with that of other countries." Many other encomiums might be cited, did space permit, but sufficient has been said to show that Dr. Selwyn's worth is widely known and honoured in the scientific world.

CORRESPONDENCE.

An Ontario Department of Mines.

SIR: One of the most imperative needs of the Province of Ontario at the present time is for the establishment of a Department of Mines and Minerals, with a responsible head as Minister of Mines, to which the technicalities of their working could be at all times referred. James Conmee, Esq., the energetic and pushing member for Algoma, has for some time past given the subject his serious consideration, and is now actively engaged in calling the attention of the Government, through a circular, to the necessity of a technical education for explorers, prospectors, and miners generally, defining the policy to be pursued, and urging the establishment of a Department of Mines at as early a period as practicable.

At present, the limits are purchased from the Crown Lands Department, but as the timber is removed and the mines developed or worked, they are changed and put under the supervision of the Minister of Agriculture, the head of a department whose interests and practices are entirely foreign to the demand of the miners, and who personally, or his staff, are unacquainted with either the technical or practical working of the mines or the development and determination as to values of the minerals discovered.

A period in the history of the mining industry has been reached which demands a more active course and better means of advancing this important branch of the public service, whilst the immense interests involved, and the growing importance of the industry, make it imperative that a well defined policy should be adopted at the earliest period to encourage the prospecting, locating, and the various methods pursued in advancing the interests of the mining industry.

From the report of the Mining Commission lately circulated, it can readily be seen what a great future there is for Ontario as a mining district if the vast extent and variety of her minerals are developed as they should be. It is the prevailing opinion that by the establishment of a Department of Mines, presided over by a responsible Minister of Mines, the requirements of the public will be fully met and their interest properly served. Each year that action is delayed in the matter, the mining interests suffer a set back of at least ten years, and in the meantime the schools for the propagation of mining knowledge are on the increase in the United States, and are turning out pupils who readily take advantage of the apathy or ignorance displayed by those who advocate the development of the mines of our Province, and whose products must compete with those of other countries in the markets of the world.

A Bureau of Mines will in the end undoubtedly cost as much as a properly organized Department, and for the first few years of development will not render the amount one-tenth of the service, but will certainly in time become one of the best paying Departments in the province, for nearly 100,000,000 acres are mineral lands, which equal in area the agricultural lands, and exceed the mineral lands of England, Germany, France and Austria, four of the greatest nations of Europe; therefore, this, the greatest of our natural sources of wealth, deserves the prominence and attention its importance demands. Before we may count on prosperity in mining in this province, the industry must be placed upon as sound and as safe a basis for the investment of capital as that afforded by other operations of a developing character. The experience of other countries show that this can be accomplished without difficulty under judicious and proper guidance. With us the practice is at present to regard mining as a mere matter of speculation, and this opinion so retards the progress of mining interests that it has become injurious to the development of the province as a mining section. The regulating of the industry and putting it upon a basis of permanency and stability, would be one of the duties and functions of the Department; and further, to secure to those who labor and invest their capital, facilities for the redress of their grievances, and afford means of reaching the ear of the Government through a representative in the Cabinet familiar with their needs and in sympathy with their aspirations. No one acquainted with mining operations as they are carried on in this country, can for a moment doubt but that many of the failures that have occurred have been occasioned from the want of skilled knowledge on the part of those having charge of the undertakings. Both skill and experience are necessary to carry on successfully the mining industry; and in the methods of extracting minerals from their ores a technical knowledge of much higher order is required than is necessary to succeed in some of the other branches of industry. The means of acquainting our young men and our mining communities with the latest results of scientific research that would be beneficial to the industry, should be afforded, through a thorough course of instruction in mining, engineering and metallurgy, and the policy should be to reach the mining community and the young men of the Province, by affording them an elementary and practical acquaintance with a few of the branches relating to minerals and mines that will be of use to them in their daily occupations, and through them to the country at large. Two conditions are absolutely necessary, if we design to advance as a mineral producing country. First, we must increase the number of our citizens who can become practical managers and operators of mines, as well as practical miners and metallurgists; and secondly, to induce both home and foreign capital to invest more freely in mining in our Province. In order to bring about this most desirable result, the first and more important step is the establishment of a Department of Mines, and the appointment of an energetic Minister of Mines, in touch with such service. Were this accomplished, the machinery necessary to secure the end would doubtless be speedily set in motion and a great field for future attainment opened up to our young men. The question of technical education and practical training of students in the various branches of mining and metallurgy cannot long be overlooked, and shortly must be dealt with by the Legislature. The suggestion is made that a feasible plan would be to increase the facilities of the school of practical science at Toronto in order to afford a thorough course of instruction in mining engineering and metallurgy. It should be carried out, but the knowledge imparted by a single institution remote from the mining districts will not answer the requirements or properly serve the exigencies of the mining interests. The practical training would be missing, and of a necessity the studies would be confined to theory and laboratory work, whilst the course would occupy from three to five years, and would not afford the observation and exercise in the field and in the mine so necessary to success, whilst but few in number could even take advantage of such a course. Something more practical and speedy in its results is required which can be taken advantage of by the mining communities and students generally throughout the Province.

The mining schools of New Zealand seem well adapted to our wants. In that country a school is established in each range or mining district and visited by a university professor and a qualified staff of assistants, who not only deliver lectures on such topics, but also conduct the practical training of classes in the various scientific courses that are of the most practical utility to those engaged in mining. In such schools the miner and the student, having the advantage of being surrounded by practical mining operations, and daily brought into contact with them, acquire in a few months a sufficient knowledge of the most essential branches of science relating to minerals such as are most calculated to assist them in their daily work, and thus a great mass of people are enlightened as to methods to be pursued that never would be reached by a central institution only; and unless some such opportunities as these are afforded our young men, they will go elsewhere to attain them, and few, if any, will return. It is as necessary to train the mining student in the vicinity of the mines as it is to train the medical student in the vicinity of large hospitals, or the law student in the atmosphere of the courts. The great advantages of the system just referred to, where the schools are dispersed through the mining districts, are that they afford facilities for experiments. Each mining range carries with it local conditions peculiar to itself, and the miner who depends upon theoretical knowledge only may, and often does, find himself confronted with a state of things for which he is not provided, and which may be the very reverse of all the theory that he has taken so much pains to acquire. A man well qualified to deal with a certain mining range may find himself at a loss with another not more than ten miles away. General principles may apply in all cases, but local conditions must also be considered and provided for. Schools on the New Zealand plan would afford practical experiments in each locality where mining is at all advanced. The aim of these schools would be to train the hand to execute as well as the mind to discover and design. As to the utility of the system quoted, Professor Black reports the following to the Minister of Mines for that colony. With reference to the facility with which the miners master the subjects, and the short space of time in which skilled operations are overcome and acquired by those whose hands have been practically trained in mechanical work, the professor says: "I was never so impressed as I was one night at Karangahake with the intelligence, perseverance and energy which the miners can bring to bear upon any subject in which they are intensely interested. Here we had many of them analyzing and assaying silver ore with quite sufficient accuracy by the usual laboratory and furnace process, while three days before very few of them could identify silver ore when they saw it, much less could they form an idea of the portion of silver which it contained." One of the chief functions of the School of Mines would be to investigate the character and composition of gold and silver-bearing quartz and other valuable minerals, to procure the most recent information concerning their treatment elsewhere, and to guide the miner in the application of sound and scientific principles in both mining and metallurgy. Thus there would be practical experiments directed by skill and experience carried on in each mining locality, whilst the useless expenditure of capital and energy in hopeless directions, now so frequent and so injurious to the mining development of the province, would be obviated, and the country would be in a better position to profit by whatever mineral wealth our lands contain. In Europe scientific attention, directed by government authority and supported by the public purse, has long been engaged with improvements for raising and the treatment of ores, and it is by such aids that the mining industries of the European powers have been built up.

"MAC."

TORONTO, April 1, 1891.

Gold on Cayoosh Creek.

BY DR. G. M. DAWSON, OTTAWA.

Cayoosh Creek rises among the high and rugged mountains of the eastern border of the Coast Ranges of British Columbia, and flows into the Fraser near the town of Lillooet. Rich gold placers were worked along this part of the Fraser more than thirty years ago and still continue to produce some gold, but singularly enough, though thousands of experienced miners have passed Cayoosh Creek on their way to Cariboo and other inland points, it was not known to afford payable ground till 1886. The discovery was then made by Chinese, and these people, almost exclusively, have since worked the Creek for a length of two or three miles, extracting therefrom several hundred thousand dollars worth of gold. Subsequent to this discovery auriferous quartz veins were found on the upper part of the Creek, about seven miles from its mouth, and a number of claims were taken up by white men, of which the first and best known was named "The Bonanza." The occurrence of visible and free gold in these quartz veins, at once gave a clue to the origin of the placer gold of the creek bed and its adjacent terraces. Assays of the quartz made in the laboratory of the Survey, showed gold varying in amount 0·722 oz. to 0·992 oz. to the ton, the gold being very minutely and uniformly distributed through the rock. Prospecting has since been carried on upon these veins but no persistent attempt has been made to work them, but the discovery within the last few weeks of an exceedingly rich, though small body of quartz on the Bonanza claim, will no doubt lead to the business-like opening up of these promising deposits. I am indebted to Mr. F. Soues, Gold Commissioner, and Messrs. Bell and Harvey for a specimen of the quartz lately found, which is said to assay at the rate of 9,000 ounces to the ton. Conformably with the character of the quartz previously known here, the gold, though forming so considerable a part of the whole of this specimen, is thickly spangled through the rock in separate granules, such as to produce "scale gold" if the whole were comminuted and carried into the gravels of a stream.

In 1889 I visited and examined the places in which prospecting was in progress on the "Bonanza," but understand that the present find has been made at a greater height above the stream, on the mountain side, than that to which the veins had then been followed. None of the quartz veins when I saw them were large, most of them being about six inches only in thickness, and the largest not exceeding a width of 2 feet 6 inches. The veins and stringers were, however, rather numerous, characterizing a belt of some width and running for the most part parallel to the bedding of the dark argillaceous shales or schists in which they are contained. The steep character of the mountain slopes in which the veins occur in this locality appear to afford facilities for obtaining considerable quantities of quartz from these small veins at a moderate expense, and if seams or kernels of the character of that just discovered should be found to occur even at considerable intervals, the profitable working of the whole belt of veins and stringers may be assured. The rocks containing these veins form a zone included between the grey granitic and gneissic rocks characteristic of the Coast Ranges and belong to the series seen along the line of the Canadian Pacific Railway near North Bend and elsewhere on the Fraser River. The present discovery thus goes far to prove the accuracy of the suggestions made in my "Mineral Wealth of British Columbia," with reference to the connection of the placer gold of this part of the Fraser with the run of these rocks. It should also afford encouragement to the further prospecting of rocks of this age and character in the various parts of the Coast Range region in which they occur.

In conclusion the statement just alluded to may be quoted as follows: "On comparing the portions of the Fraser River thus found to yield 'coarse' gold with the rock formations of the country, it is found that the first described run of 'coarse' gold corresponds almost exactly with that portion of the valley which is excavated in certain schistose argillites and micaceous and other schists of dark colour, to which the name Anderson River Series has been provisionally assigned. It must, however, further be remarked that a series of Cretaceous argillites, conglomerates and sandstones which have probably been deposited in a still earlier hollow excavated along the outcrop of the soft rocks of the Anderson River Series, also runs parallel to this part of the river, on its east side; and that while it is probable that the gold has originally been derived from the Anderson River series, a portion of that now found in the river may have been obtained by the robbing of Cretaceous placers contained in these later rocks."

For further particulars bearing on the general question, I may refer to the work already named, particularly to pages 28 R., 47 R. and 118 R.

The Ontario Mining Laws.—Important Recommendations by the Port Arthur Board of Trade.

To the Members of the Board of Trade of the Town of Port Arthur:

GENTLEMEN,—In pursuance of a resolution of the Council of your Board, passed on 24th ult., appointing a Special Committee, composed of the officers and thirteen members of the Board, to investigate and report upon the necessary or proposed changes in the Provincial Mining Laws, the committee begs to report as follows:—

WORK OF COMMITTEE.

1. That the meeting of the Committee was called for Monday, the 26th ult., at the Secretary's office, at which there was a large attendance of the members. The Committee was then organized by the appointment of a permanent chairman, held daily meetings up to Feb. 4th, and discussed at length the proposals made. The Committee had not only the benefit of the advice of the practical mining men who were of their number, but also were able to profit by the suggestions of several well known explorers and others interested in the district, who were good enough to attend many of the meetings, and the conclusions arrived at may be taken as the unanimous wish of those interested in both exploring and mining in this district.

The Committee deemed it advisable that the recommendations made should be followed by brief statements giving the reasons for the conclusions arrived at in order that other representative bodies, when discussing the subject, might the more readily understand the position taken by your Board.

A DEPARTMENT OF MINES FOR ONTARIO.

2. That it is of the utmost importance that there should be established a Provincial Department of Mines, to be presided over by a responsible Minister of the Crown, similar to the present Department of Crown Lands.

It was the unanimous decision of the Committee that such an important industry as mining deserved more care and attention than it was possible to get from the Government when it was not under the charge of a Minister and Deputy, whose business it would be to promote by every legitimate means the development of the mineral resources of this great province. With the creation of a Department, problems that are now difficult of solution would be easily solved, and there would be some incentive to the building up in Ontario of a mining industry which would furnish profitable employment for thousands of men and comfortable homes for their families.

TOWNSHIP SURVEYS.

3. That the Government be recommended to proceed as rapidly as possible with the completion of the system of Township Surveys in what is now the unsurveyed territory of the province; said surveys to accurately describe the topography of each particular township, and, if possible, the geological formation to be added, the stakes to be of a permanent character, the townships first surveyed being those which are most likely to attract explorers and purchasers.

In different portions of the province, particularly in the District of Algoma, there are large areas of mining lands about which absolutely nothing is known, the lakes and streams not even being noted on the Government maps. Explorers are consequently deterred from prospecting in such territory owing to the great expense of making surveys. Complaint is made that some of the townships already surveyed have been done in such a manner that the work has almost to be done over again in order to be of service.

REGULATIONS AS TO THE PURCHASE OUTRIGHT OF MINING LANDS.

4. (*a*) That all applications for the purchase of mining lands in unsurveyed territory shall be made upon the following basis: The party so applying shall have caused the land so applied for to be staked out and bounded by blazed compass lines to conform as nearly as possible with proposed surveys; the application shall be accompanied by a sketch showing its position and area, and a fee of $5.00 for every forty acres or fraction thereof so applied for within 90 days from the staking out; the party so applying shall complete at his own expense the surveys of as much of the land so applied for as he shall elect to purchase and pay the purchase money, $2.00 per acre, to the proper authorities. Failure to either complete the surveys or pay the purchase money to be a forfeiture of all rights under said application, which shall not be renewable, and to entitle any other person to survey and purchase any or all of the lands included in such application.

(*b*) That in surveyed territory no application shall be received or entertained for the purchase of mining lands unless it be accompanied by a deposit of one dollar per acre on the lands so applied for, the balance of the purchase money to be paid within sixty days from date of said application; default in payment on said balance to constitute a forfeiture of the deposit, and to entitle any other person to purchase said lands.

It is believed by your Committee that the present custom of allowing blanket applications, covering immense tracts in unsurveyed territory, and the surveying of not only single locations, but large numbers of locations, and filing the surveys in the Department with no deposit in either case, or a nominal one, is most prejudicial to the best interests of the province, as it allows speculators to tie up large tracts of country which it is not their intention to purchase. In surveyed townships the custom of making applications with either no deposit or a nominal one, has the same bad effect, and the suggestions made in Clauses A and B are intended to prevent the tying up of land in this manner, but not to interfere in any way with *bona fide* investors who are prepared to pay for their purchases.

EXPLORERS' RIGHTS.

5. (*a*) That in unsurveyed territory explorers be allowed to stake out and apply for claims in a similar manner to that provided in Section 4, Sub-section A, of not less than 40, nor aggregating more than 160 acres, to be accompanied by a fee of $5.00 for each 40 acres so applied for, a certificate to be issued allowing the completion of a survey, and filing the same within ninety days of the date of staking the claim or claims. A new certificate shall then be issued entitling each applicant upon the expenditure of fifty dollars per annum in development work on each forty acres for two years, or $100 at any time within one year, to a patent upon payment of a sum of $1.00 per acre.

(*b*). That in surveyed territory explorers be allowed to apply for a claim or claims of not less than 40, nor aggregating more than 160 acres, the application to be accompanied by a fee of $5.00 for each 40 acres, a certificate to be issued allowing the applicant within ninety days of filing such applications, upon payment of one dollar per acre, to take out a new certificate, which, upon the expenditure of $50 per annum in development work on each forty acres for two years, or one hundred dollars at any time within one year, entitle the applicant to a patent without any further payment or fee.

(*c*). Non-fulfilment of any of the conditions of Clauses A and B entitles any other person to make such application.

It was considered by the Committee that every inducement should be offered to legitimate explorers to prospect Crown Lands as much as possible. The fact that in unsurveyed territory the cost of the surveys which he has to make will about equal the $1.00 per acre which has to be paid in the surveyed territory within about the same time, will show the *bona fides* of the applicant, and prevent the locking up of any large tract of land with no intention of completing the conditions. With the immense tracts of land still owned by the province, it was not considered advisable to limit either the purchaser, without conditions, or the explorers in the area to be taken up. It is an undisputed fact that the men who were practical in either case, only take such lands as they may consider of value, and the chances are that the bulk of the tracts taken up by those who do not understand the situation are worthless, and well sold at the Government price. It is believed by the Committee that offering liberal inducements to explorers to spend money on actual development of their properties, will tend more to advance legitimate mining in Ontario than any other possible method. Such has been the history of mining all over the United States, and while the recommendations here made are not as onerous as the American, they are sufficiently so to prove within a very short time whether they are of value or not.

EXEMPTING APPLICATIONS FOR LAND.

6. That all applications for the purchase of lands, when not surveyed, or completed surveys now lodged in the Crown Lands Department, where the purchase money is not paid, under the existing regulations, be treated as follows: When the application is not accompanied by a survey, the surveys shall be filed for same before July 1st, and the purchase money paid on these as well as in surveys not accompanied by purchase money before Sept. 1st, all new transactions to come under the new regulations after the passing of the Act, and on old transactions, failure to comply with these conditions to entitle any person to make application under the new regulations.

It is believed by your Committee that unless this be done, much hardship would ensue, not only to the explorer, but to the men who have in good faith applied to purchase mineral lands.

MINING OFFICES AND AGENTS.

7. That mining offices should be established at the most convenient centre for each mining district. That these offices should be presided over by a reliable and responsible agent, to whom all applications for the purchase of, and all business connected with the purchase of mineral lands shall be transacted; this office to contain a record of the patented lands, and of all applications for lands in that particular district; those records to be open for inspection by the public upon payment of a nominal fee, as in Registry Offices, maps of the different townships, etc., to be furnished free or at a nominal price.

Your Committee finds that the present system of conducting this business through the Crown Lands Department is not only slow and laborious, but inconvenient and expensive to the prospector. Much delay and expense, and the clashing of applications would be avoided if made only through the office for each particular district. The furnishing of maps and information, as suggested, would be not only a great boon to the explorer, but would lessen the labor, trouble and complications in the Department, and at the same time the application and other fees would more than pay for the administration of such offices. These should be established at such places as Rainy River, Rat Portage, Port Arthur, Sudbury, North Bay, Sault Ste. Marie, and as many others as the business would warrant.

TAXES ON MINING LANDS.

8. That the present system of taxing mining lands in districts without municipal organization be continued: but the system of selling for arrears of taxes be discontinued, and instead, that when the lands are two years in arrears, they be advertised, and if the taxes and advertising costs be not paid within one year from the date of such advertisement, that these lands revert to the Crown and come under the then existing regulations as if they never had been sold.

Your Committee find that the amount realized by the Government for unpaid taxes, while not large at any time, is in many cases sufficient to cover many thousands of acres of land, which is then bought at the sale for a comparative trifle by speculators, who will neither sell nor improve the property. Thus the re-selling at the Government price of even a portion of these lands would more than cover any loss of revenue that might ensue.

FREE GRANT PATENTS.

9. That all patents for lands under the Free Grant or similar acts should not contain a reservation of the minerals to the Crown.

The hardships and trials of a settler in a new district are sufficient as it is, to make him entitled to any value that there may be in his land for minerals after he has done the settlement duty and received his patent, and there certainly should be no reservation of the minerals.

ROADS AND RAILWAYS.

10. That liberal grants should be made for the building not only of highways but railways throughout the mining districts.

There are millions of acres of Provincial lands which are wholly inaccessible by any other than a canoe route, and cannot be mined without roads. The judicious and liberal expenditure of money in roads, and in some cases, where experience has proven the value of the district, in railways, would tend not only to promote actual mining, but the additional sales caused by such expenditures would more than reimburse the province for its outlay, besides adding largely to its population and wealth.

MINING SCHOOLS.

11. That Mining Schools should be established throughout the province at the most convenient points for the practical education of mining men.

These schools should not only be capable of educating the youth of Canada as mining engineers, geologists, metallurgists and practical mining men, but every convenience should be given so that miners and prospectors who have not the technical education, might at least learn sufficient of the rudiments of geology, mineralogy and metallurgy, to enable them to work more intelligently and with better results in exploring the great unknown lands of the province.

DIAMOND DRILLS.

12. That the province should purchase and own a diamond drill at each mining centre, these drills to be rented to prospectors at actual cost of wear and tear and operating expenses.

Your Committee finds that the cost of a diamond drill is such that none but wealthy land owners can buy them, and it believes that diamond drilling done judiciously is the most successful method of testing and exploring such ore deposits as iron, copper, nickel, etc., and that the purchase and leasing thereof by the Government would tend to develop such ore bodies much more rapidly than at present.

SUGGESTED ACTION.

13. Your Committee recommends that united action be taken, particularly by the Boards of Trade and other representative bodies of Algoma, in impressing upon the Government the necessity for amending the laws with regard to the sale of mining lands, and the adoption of such a mining policy as is in accordance with the suggestions herein set forth.

PROPOSED REGULATIONS.

14. That the Government of the Province of Ontario be requested to furnish this Board with a copy of any proposed regulations or amendments at as early a date as is possible.

The Committee desires to thank those gentlemen, not members of it, who were good enough to aid the Committee's researches in every possible way.

All of which is respectfully submitted.

GEORGE T. MARKS,
Chairman.

PORT ARTHUR, ONT., February 4th, 1891.

Iron and Steel Wire Ropes.—Mr. A. H. Stokes, one of Her Majesty's Inspectors of Mines, recently read before the Derby Society of Engineers an interesting paper on "Iron and Steel Wire Ropes, Chemically, Microscopically, and Mechanically Considered." The importance of the subject was shown by pointing out that in the United Kingdom alone upwards of 500,000 lives were daily trusted to the efficiency of these appliances. The tensile resistance of the wires is readily ascertained by taking out a few feet of wire from one end of the rope. Suspending the wire from some convenient attachment, it is made to hold up an empty tub at the lower end. Water is then carefully poured into the tub until when the tensile limit of the wire is reached it breaks. Afterwards the water in the tub can be measured and the breaking strain calculated. For testing resistance to torsion, a piece of the wire, 8 inches long, might be screwed up tight at one end in an ordinary smith's vice, and the other be held fast between the plain faces of a pair of dies in stocks, which have only to be rotated, and the number of whole turns before the wire breaks carefully counted, to ascertain the torsional limit. Steel wire should stand 28 twists.

Notes on Coal Mining.*

By Mr. J. S. Burrows, F.G.S.

My immediate predecessors in this Chair having given our Society valuable addresses on prices of coal, wages paid, and the duration of our coal supply, it is to be hoped that a few remarks on the early history of the coal trade, and the conditions under which coal mining will probably be carried on in the future, may be of interest. For the following historical details I am indebted to Mr. Boyd's book on "Coal Mines Inspection," a work which will well repay perusal.

Coal was dug on the Castle field, at Newcastle on Tyne, in the year 1239, and 70 years later we find a Royal Proclamation forbidding the burning of "sea cole" in London. Curiously enough, monks and abbots figure amongst the earliest colliery proprietors, both in England and Scotland.

Early in the 14th century, coal was worked to such an extent as to become a source of revenue from taxation. There are accounts in existence of serious explosions of fire damp, which occurred in North Wales, the Midlands, and Durham about the close of the 17th and commencement of the 18th centuries; that near Chester le street, in Durham, causing the death of 69 persons, including at least one woman. The winding shaft of the colliery where this last named explosion occurred, was 114 yards deep, showing that coal mining was being carried on under conditions approaching our own as to depth. The miners worked long hours in a foul atmosphere, and numerous accidents occurred upon which no inquests were held till about 1814. Progress in coal mining, and efforts to improve the lot of the miner, may be said to date from the commencement of this century. In the year 1800, the total amount of coal raised was estimated to be 10 millions of tons, which amount had increased to 27 millions 16 years later.

Candles were ordinarily used for giving light underground, and the flint and steel was for years the only substitute where candles could not be used, owing to the presence of explosive gas. About 1815, Sir Humphrey Davy and George Stephenson introduced the so called safety lamps, bearing their respective names. Dr. Clanny had also brought out a cumbrous form of his lamp two years before this. At this time, according to Mr. Buddle, the furnace, waterfall, steam ventilator, the air pump, and the heated air pipe or cylinder, were known, and he stated that "the standard air course or current of atmospheric air which I employ in the ventilation of the collieries under my care, abounding in inflammable gas, moves through an aperture from 30 to 40 feet in area, with a velocity of 3 feet per second, which equals 5,400 to 7,200 cubic feet." This he thought sufficient, and as the next step he looked for the discovery of some chemical process for rendering explosive carburetted hydrogen harmless.

His experience was "that the ordinary and unavoidable casualties in collieries occasion more calamity than explosions of inflammable air." From this time, for many years, the Davy, Stephenson and Clanny were the only safety lamps used in this country; but, during the past ten years, these lamps have been largely superseded by the Mueseler and Marsaut types of lamp, which, though far from perfect, are a great improvement on their predecessors.

During the past sixty years a marked improvement has taken place in the condition of our underground workers, partly owing to increased knowledge on the part of employers and workmen, and partly to Acts of Parliament. In 1831, the first Truck Act became law; in 1842, Lord Ashley's Act was passed forbidding the employment of women and girls underground, and providing that boys under ten should not be employed except such as were already at work in the pits; that wages should not be paid at or near a public house, and empowering the Secretary of State to appoint inspectors, the first being Mr. Tremenhure. In 1847, Mr. Duncombe, the then member for Finsbury, introduced a bill providing for the appointment of three inspectors, for payment by weight, and for weekly pays, but had to withdraw the measure The same gentleman introduced a second bill later in the same year, to prohibit the use of naked lights and gunpowder in fiery mines, but this bill was rejected.

The Act of 1850 established the principle of underground inspection, Messrs. Blackwell, Dunn, our present inspector, Mr. Dickinson, and Mr. Morton, being those appointed The next Act, passed in 1855, set forth seven general rules, and provided that special rules should be drawn up for every colliery. Some of these proposed special rules are worth noting. One rule sought to make it an offence for a collier "not to attend Divine Service at least once on the Lord's Day;" and the object of another was to prevent a workman coming to his work "on a Monday morning dirty, or with an old beard." These last two Acts had each been limited in operation to a period of five years, but the next Act of 1860 was to be perpetual, and it provided, amongst other things, for the education of boys, and for the inclusion of certain ironstone mines worked in connection with coal. In 1862, after the terrible accident at Hartley Colliery, a short Act was passed requiring two means of exit for the workmen at each colliery.

The next Act, of 1872, introduced a new feature; from this time managers of mines were required to hold certificates of service or competency. The Home Secretary received 3,596 applications for certificates of service, which, it is needless to say, were not all granted. One sub-inspector was also appointed in each district to assist the inspector. With the provisions of this Act, and of the later one of 1887, most of us are, or ought to be, well acquainted. One clause of this Act, General Rule 9, requires that "safety lamps, wherever used, shall be so constructed that they may be safely carried against the air current ordinarily prevailing in that part of the mine in which the lamps are for the time being in use, even though such current should be inflammable." This is a very severe test to apply to any lamp which requires oxygen to support combustion, or, in other words, which cannot be hermetically sealed from contact with the surrounding atmosphere; and, though the Mueseler, Marsaut, and other lamps in careful hands, and after careful examination, may stand the test, every manager of a mine must have constantly in his mind the serious consequences of an oversight in the putting together of the lamp. Instances have been known where shielded lamps have been taken down the pit without gauzes, and often with the glasses so slack that not only could the glass be moved round with the fingers, but the flame could be blown about by the breath. In my opinion a lamp cannot truly be called a safety lamp which depends for its safety on the most unremitting personal care and attention, and which in the absence of such care is simply a naked light. A few years back great hopes were raised that portable electric lamps were so perfected as to be able to displace oil lamps, but I regret to say that this expectation has not yet been fulfilled. The advantages of such a lamp are too obvious to need comment—the beautiful light, hermetically sealed from contact with the surrounding atmosphere, seemed the very thing required for our coal mines. There are two forms of this lamp, one with a secondary battery, requiring to be charged from a dynamo, and the other with a primary battery, where the waste of the elements is replaced by refilling like an oil lamp. I have not been able to secure one of this latter type. Lamps of the former or secondary battery type, in my opinion, only require to be a success that the arrangements should be so altered as to prevent the charging solution (1 part of sulphuric acid to 9 parts of water), from getting to the metallic connections and so destroying them.

The charging is simple, a current strength of 7-10ths of an ampère at a potential of 10 volts for 10 hours, is all that is required, and I trust the makers of the lamp will persevere till they have overcome what is the only drawback. Being somewhat disappointed with the portable electric lamp, I intended ere this to continue the electric cables into a few working places and light them by the ordinary incandescent lamps as an experiment, but have not yet found an opportunity. The lighting up of surface works and pit bottoms of collieries is pretty common now, still a few suggestions based on experience as to the best means of fitting up an electrical plant may be of interest to some who have not yet tried this system of lighting. The first requisite is a good pair of coupled engines, well up to their work, and used solely for driving the dynamos. Most of us begin by trying to make use of some engine already at work, such as a fan engine, and end by getting special engines for the purpose. A good governor to the engines is an absolute necessity; there are several to select from, but many electricians recommend Pickering's governor as being the most sensitive. It is well to have two dynamos (one working and one in reserve) of a good substantial pattern, compound wound, with the commutator of large diameter and plenty of copper in it to wear at. I fancy that there is less sparking at the brushes with a commutator of large diameter than with one of less diameter, but would not like to say that this is the only reason for the evident superiority of one machine over another in this respect—there may be other causes. A short time back I used to be very much puzzled with the terms volt, ampère, etc., when reading or hearing a description of electrical apparatus, and as there may be others present to whom the terms are unfamiliar, I venture to transcribe the following text book definitions:—

"The Volt is the measurement of pressure."

"The Ampère is the measurement of the rate of flow."

Dynamos for lighting are usually made for an e. m. f. of 100 or 110 volts, the number of current ampères depending on the size of the machine, or in other words the number of lamps it is intended to supply. A 16 c. p. incandescent lamp requires $\frac{1}{10}$ ampère at 100 volts, so that a 100 light machine would supply 60 ampères of current and so on. A copper wire of No. 16 Birmingham wire gauge will convey a current of 3⅔ amperes without heating, and serve six 16 c. p. lamps. Each dynamo should be supplied with a series of resistance coils, say 10 in number, giving a range of about 40 volts by moving the switch across the 10 steps without altering the steam throttle valve. For instance, if 20 lamps are switched off, the engine, having less work to do, quickens its speed, drives the dynamo faster, increasing the volts, and wearing out the lamps.

With resistance coils the small handle is simply moved back a sufficient number of steps till the volt meter again shows 100 volts. Large magnetic cut-outs should be placed near each dynamo to cut off the current when excessive, owing to the engine running away, or a short circuit. With a table showing the quantity of current wires and cables of various sizes will safely pass, and the Phœnix Fire Office rules as a guide in fixing, an intelligent workman, who has previously assisted a professional electrician in fixing an installation, can himself erect a satisfactory and workable plant. There are various plans of securing the cables in the shaft, wooden or vitreous cleats being the most common. I have on the table a glass insulator and bracket supplied by the Manchester Edison Swan Co. Ld., for securing the leads. The idea is to run the cable through the round glass insulators which, by a projection on the glass, are held securely in the brackets which have been already screwed or driven into the wooden bearers, or brickwork. The cable is then fastened in the glass insulator by the vulcanized conical wedge piece, and in shafts the glass should be filled in with composition applied hot, and rounded off at the top, to prevent water lodging round the cable in the glass insulator. Wooden insulators (not oak), boiled in paraffin wax are also supplied instead of glass ones, the mode of fixing being exactly the same in both cases. Latterly we have put our cables in the shaft 4 feet apart to avoid the risk of short circuiting, though a few inches of space between the leads is sufficient for all practical purposes. The loss in transmission is 2 volts at a point 330 yards from the dynamo when a number of lights are taken off, and 6 volts at 450 yards from the machine.

As to the future of coal mining, when coal will have to be won at great depths, and at a correspondingly high temperature, experts seem unanimous in thinking that the winding arrangements will prove no obstacle, but that the temperature probably will. Our late President, Mr. Hall, in his interesting address, concluded "that with our present knowledge and appliances (which, however, must by no means be considered finite), where temperature due to depth reaches 100°, coal cannot be worked except at very great expense, if at all." As the temperature at 4,000 feet in depth would be 116° or more, it would indeed be a very serious outlook if high temperatures should seal to us the 29,000 millions of tons estimated to lie between the depths of 4,000 and 6,000 feet.

The temperature of the spinning rooms in a cotton mill is never allowed to fall below 84° F. if it can be avoided, and in summer I have found the thermometer standing at 90° and up to 96°. What the temperature is in front of the puddling furnaces, rolling mills, Bessemer pits, or hammers in a large iron or steel works, I am unable to say, but it is certainly very high. In some of the large Atlantic passenger steamers the temperature in the stoke holds is often 160° F., and I have been told that when repairing a boiler, buckets of iced water are used to cool down the tools so that the men can handle them, yet Europeans work in this temperature four hours at a stretch, with an interval of eight hours before the next turn. In passenger steamers coming up the Red Sea, the stokers face a temperature of 180° F.; I believe these men are mostly natives of warm countries, but whether they are employed because Europeans cannot stand the heat, or from motives of economy, I do not know. Mr. Merivale says that in some of the Comstock Lode silver mines, Nevada, work was in 1877 carried on at a temperature up to 123°, the rock having a pretty uniform temperature of 130°, this great heat being due to the hot springs, some of which have a temperature of 158°. Undoubtedly when we have to deal with temperatures of this magnitude, nay, long before, the ventilation will have first of all to be very largely increased, and at the same time the work to be done by the colliers made very much lighter.

Without pretending to any gift of prophecy, I can conceive of a time when electricity will be carried throughout the workings of a colliery, both to give light and supply power. Though much must be done before electricity can be applied in this wholesale manner, enough has already been done to show that, if certain difficulties can be overcome, such as sparking at the brushes, the use of electricity in coal mines is quite feasible, and, I think, economical. When necessity compels its use, wonderful progress will soon be made. A locomotive of 100 horse power, driven by electricity is now at work in the new underground railway in London and I am proud to think that our fellow townsmen, Messrs. Mather and Platt, have been so successful in their enterprise. I have cut the accompanying sheet from the advertising pages of the *Iron and Coal Trades Review* to show that machines for coal cutting and drilling, driven by electricity, are in the market, though I have not seen any at work.

Pumping by electricity is, and has been, an accomplished fact for some time in the Forest of Dean, Yorkshire, and elsewhere. A 40 horse power electric locomotive, weighing 5½ tons, is now at work at an American colliery hauling tubs on a level underground, and the lighting is done by the same cables, apparently with success. If, then, we can reduce the labor of the collier to supervision of his coal-cutting machines, spragging and propping and filling coal into tubs, all of which operations can be performed in the full current of air, we shall have done a great deal towards making the higher temperature bearable.

We have now working at Atherton collieries a small experimental plant for winding coal tubs up a down brow, the motive power being electricity. The generator dynamo on the surface is driven at a speed of 1,230 revolutions by the engine which drives the lighting machines. It is series wound, and was constructed to work at a potential of 300 volts, and to give out 6 horse power on the shaft of the motor below ground. Two insulated cables, each of $\frac{7}{16}$ s. copper wire, are led down the winding pit to the motor at the top of the down brow, a total distance of 448 yards. The motor below is a fac-simile of the generator on the surface, and makes 1,000 revolutions per minute. From the pulley, 8 inches diameter on the motor shaft, a belt drives either a fast or loose pulley, each 54 inches diameter, on the worm shaft. The worm gears into a worm wheel of 40 teeth on the drum shaft; the drum, which can be put in and out of gear by a clutch, is 2 feet 6 inches diameter, is fitted with a powerful brake, and makes about 8 revolutions per minute. It must not be supposed that this is put forward as a good arrangement; the worm is a very wasteful contrivance for transmitting power, and was adopted, firstly, to prevent any risk of

* Paper read before the Manchester Geological Society.

the full tubs running back should the motor break down; and secondly, to reduce the speed of the drum without having recourse to counter shafts or toothed wheels. As at first arranged, the motor shaft was coupled direct to the worm shaft, and an ordinary switch was employed, but this plan failed completely. When the current was switched on the inertia of the motor, worm, and drum was so great that the main driving belt was thrown off the fly wheel of the steam engine. The present arrangement of fast and loose pulleys was then substituted, along with a new switch having six steps, five with resistance coils and the last one open, so as to pass the current gradually The motor is kept constantly running with the belt on the loose pulley of the worm shaft, and the switch on the first step. When it is desired to wind up the tubs the belt is moved on to the fast pulley, and the switch handle is moved step by step till the full current is on This arrangement works continuously, and has never failed except when the break down could be clearly traced to some defect in construction of the generator on the surface; in fact, with first-rate appliances, there seems no reason to fear a break down any more than with a steam engine, and, if you keep a spare armature in reserve, the faulty armature of either machine can be replaced in 30 or 40 minutes. As the worm probably loses 50 per cent. through friction, and is not necessary with a good brake to the drum, in putting up another plant I should use ropes, belts or toothed wheels, or possibly a combination of these. The length of the brow is at present 220 yards, the gradient is 1 in 5 till near the top, where it is 1 in 4 for the last 20 yards. A full tub of coal weighs 13½ cwts., and the motor can bring up four full tubs at a time, though two are sufficient for ordinary requirements. The time occupied in winding is about seven minutes, and the amount of work performed by the motor when winding four full tubs, assuming 50% to be lost by friction of worm, etc., is:—

	H. P.
Where the brow is 1 in 5.....	6·6
" " 1 in 4.....	8·2

We have made some experiments to determine the loss in transmission between the surface generator and the underground motor with varying loads, the result showing an average loss of 10·12%. A large dynamo has been proved to give out 93% of the power applied to the driving pulley on its shaft, so that so far as the dynamo or generator goes, considerable efficiency has been attained; and, taking all into account, electricity seems to be more profitable than compressed air as a motive power. Experiments made at Powell Duffryn Colliery showed that the indicated horse power in the cylinder of an engine worked by compressed air was only 30·8% of the indicated horse power in the steam cylinder used for compressing the air.

Now if we take two steam engines, one used for generating electricity for driving an underground hauling engine, and the other compressing air to be used in a like manner, and assume that 100 horse power is shown by the indicator diagram taken from each steam engine, the useful effect would be for electricity:—

	H. P.
Indicated horse power of steam engine..	100
Efficiency of steam engine say 60%	60
Friction and slip of belts, say 10% of this leaves	54
Efficiency of generator, say 93% this leaves	50·2
Loss in transmission through cables, say 10%, this leaves.....	45·2
Efficiency of motor, say 93%, this leaves.	42
As against efficiency of air engine cylinder	30·8
A difference in favor of electricity of....	11·2

Or 36% over compressed air.

In putting up a large electro-motive plant the first cost would probably be less than for a similarly powerful plant for compressed air. Assuming the steam engines to be the same, the generator, belts, and counter shaft would not cost as much as the air compressing cylinders and receivers, the air pipes, bearers, and cost of fixing the pipes would well cover the cost of the cables, and the motor and shafting underground would cost no more than the air eng , and the drum or other hauling gear would be the same in both cases. Against all this there is one great drawback, namely, sparking at the brushes; in a main road this would not perhaps matter much, but it would prevent the application of electricity as a motive force in the workings unless some means be found to obviate the danger.

In conclusion, it seems to me that very little progress has been made in the 600 years of coal mining, especially in the lighting of mines and in appliances for saving manual labor, but in time, electricity will revolutionise both our defective means of lighting, and our old fashioned plan of getting coal by hand labor. I know that coal cutting machines have been tried from time to time during the past thirty years, but (apart from any imperfections in the machines themselves, the hitherto abundant supply of labor, and the great cost of air-compressing plant), I believe that the difficulty of maintaining rigid iron pipes in mines, where the floor lifts, and where the roof falls or has to be taken down, has deterred many from giving machinery a trial. The laying and maintenance of flexible electric cables would be a much simpler matter, and they could easily be removed when desired Certainly, electricity is yet in its infancy, but it is a promising infant, and is likely to develop into a giant some day. Let me, then, earnestly recommend our younger members to avail themselves of the many opportunities of acquiring some knowledge of electrical science before the responsibility and work, inseparable from the management of large concerns, leaves them little leisure, and often less inclination, to take up more brain work. To our older members I venture to suggest that it is worth while encouraging, so far as may be, the efforts of those who are seeking to provide us with a servant so powerful and efficient as electricity.

Mica Mining in the United States.

As to the origin of the mica veins no definite opinion can now be offered. They can hardly be regarded as essential members of the strata in which they occur. They are of later origin than either their hanging or foot wall, and their contents reveal an igneous or aqueo-igneous origin. While, indeed, they for the most part, have the strike and dip of the inclosing rocks, as at the Balsam Gap mine, Buncombe County, and the Westall mine, Yancey County.

In the efforts of the vein matter to insert itself, the inclosing rocks have been twisted and contorted in many directions and in various degrees; in one instance, according to Professor Kerr, (*a*) forcing the rocks into opposite dips at the surface.

The New Hampshire deposits, according to Professor Slater, (*b*) "Appear to be obscure beds, closely following the general run of the apparent bedding that characterizes the granites in this part of the country."

The North Carolina deposits, on the contrary, appear to have arisen through the injection of material from below, the fissures following indeed the general run of the bedding of the inclosing rocks, but cutting across this when the line of least resistance did not coincide with a plane of stratification. That the vein material in filling the fissure met with great resistance on the part of the contiguous rocks is shown by the contortions, foldings and disruptions which they exhibit. It might well have happened that at times there was less resistance transverse to the bedding than parallel to it, and at such times the fissure would partake of the nature of a true lode.

The crystallized quartz would seem to indicate a crystallization from an aqueo-igneous solution. This is rendered the more probable by the occurrence of thin sheets of quartz between sheets of mica and by the impression of the edges of mica sheets on fragments of well crystallized quartz, forming a sort of pyramid with microscopic steps. So far as known this latter phenomenon has not been observed on the feldspar, though thin sheets of this also have been found between sheets of mica. The impression of the edges of mica sheets upon the quartz would seem to indicate that the mica crystallized first, and in so doing inclosed at times some quartz between the layers, and at other times some feldspar. It is not here discussed whether in the aqueo-igneous magma filling the fissure, the mica, quartz, and feldspar were present as such, but bearing in mind what has been said as to the impressions on quartz, and the inclosures of quartz and feldspar, it would appear that in the order of crystallization we have mica, feldspar, quartz. Although the inclosing rocks offered considerable resistance to the fissuring force, still after the entrance of the vein matter, it was free to crystallize in large, nearly pure masses.

Some blocks of mica are curiously bent and twisted, as if resistance had been offered to the free extension of the crystal, either by the wall or the matrix. From this or similarly acting forces comes the "A" mica, a striated mica with the strix forming the letter A, or rather a V, as there are seldom any cross lines. These striations are from 2 to 12 inches long, and inclose angles of 30° to 45°.

The curvature of mica blocks amounts at times to 10° to 15°. "A" mica is not saleable, as the striations interfere with its transparency.

In addition to these phenomena a shearing force would seem to have acted at times. Some blocks of mica are cut through and thin filaments of mica left adhering to the edges. This may have been caused by a slow slipping along the middle leg of a fold, as the edges do not exhibit the appearance usually caused by cutting or shearing with heavy instruments.

ASSOCIATED MINERALS.—The minerals associated with mica are numerous and interesting. From a list prepared by the late Prof. W C. Kerr, and now published for the first time, they are as follows:—

List of Minerals Associated with Mica in North Carolina.

Albite,	Glassy feldspar,	Rogersite,
Allamite,	(sanidin),	Samarskite,
Amazonstone,	Garnet; red & black,	Thulite,
Apatite,	Gummite,	Torbernite,
Arethunite (? P),	Hatchettolite,	Tourmaline,
Autunite,	Limonite,	Uraninite,
Beryl,	Magnetite,	Uranocher,
Biotite,	Menaccanite,	Uranotil,
Columbite,	Muscovite,	Yttrogummite.
Euxenite,	Phosphuranylite,	

Dr. F. A. Genth, for some time chemist and mineralogist to the North Carolina Geological Survey, has had the kindness to correct and supplement this list. He writes:

Amazonstone, perhaps.—Doubtful.

Autunite (Torbernite?).—All autunite.

Biotite, probably; but I have not seen it from mica veins, as far as I remember.

Euxenite.—Does not contain Ti O^2. Is not true euxenite.

Glassy feldspar (san. lin).—Very doubtful.

Pyrochlore.—In minute octahedrons at the Ray mine with black tourmalines.

Yttrogummite.—I do not know of any analysis having been made. Very doubtful.

Fluorite.—In pseudomorphous granular patches after apatite.

Apatite seems to be fluorapatite.

Orthoclase.—Often completely altered to kaolinite.

It is not known what Professor Kerr meant by arethunite, as the list was not found until after his death.

The Flat Rock, Deake and Mart Wiseman mines, in Mitchell County, and the Ray Mine, in Yancey County, are famous localities for nearly all these minerals. At the Wiseman mine there has been found a block of "A" mica, weighing nearly 200 pounds, and a piece of samarskite of 94 pounds. This latter mineral is worth about $1.50 per pound.

DRESSING MICA.—The blocks of mica hoisted from the mine are sent to the stripping room, where extraneous matter, as pieces of quartz, feldspar, wall rock, and fragments of mica, are removed. The blocks are then split by means of wedges or heavy knives, and are sent to be "scribed." This scribing is an operation demanding considerable skill and experience, the purpose being to get from a given rough sheet the largest number of valuable sheets. The patterns by which the mica is scribed are pieces of tin, sheet iron, etc., of different sizes and shapes, as determined by the order from the manufacturers of stoves. By far the greater part of cut mica is used for stove windows and peep holes, and the size and shape of the pieces are determined by the special order, just as in special orders for firebrick. Formerly the size of the cut sheets largely influenced the price of clear mica, but now, although, of course, the quality is still regarded as of prime importance, the size beyond certain dimensions, say 6 by 8 inches, is not. The number of patterns varies from time to time. In Mitchell County, about one hundred different patterns are used, the sizes running in inches from 1 by 1 to 6 by 8, or as large as the stock will allow, increasing by one-fourth inch. The cut mica varies in value from 10 cents to $6 per pound, the average being not far from $1.75. One hundred pounds of good block mica may yield 33⅓ pounds cut mica; an inferior block may yield only 5 pounds; the average is 10 to 12 pounds. The writer is informed that a 100-pound block from the Flat Rock Mine gave 75 pounds of cut mica. This is the highest yield he has ever heard of, and is very far above the average. It will at once appear that upon the skill of the scriber depends, to a great extent, the yield of the cut mica. An unskilled scriber may get from a given block only one-half as much cut mica as one experienced in the art. After the blocks have been split and scribed they are sent to the cutters. These are workman provided with heavy shears, and they cut through the sheets along the scribing. The different sizes are then wrapped in paper, generally in 1-pound packages, packed closely in a strong box, and sent to market. As most of the mines lie remote from rail, 25 miles or more, the transportation is a considerable item of expense.

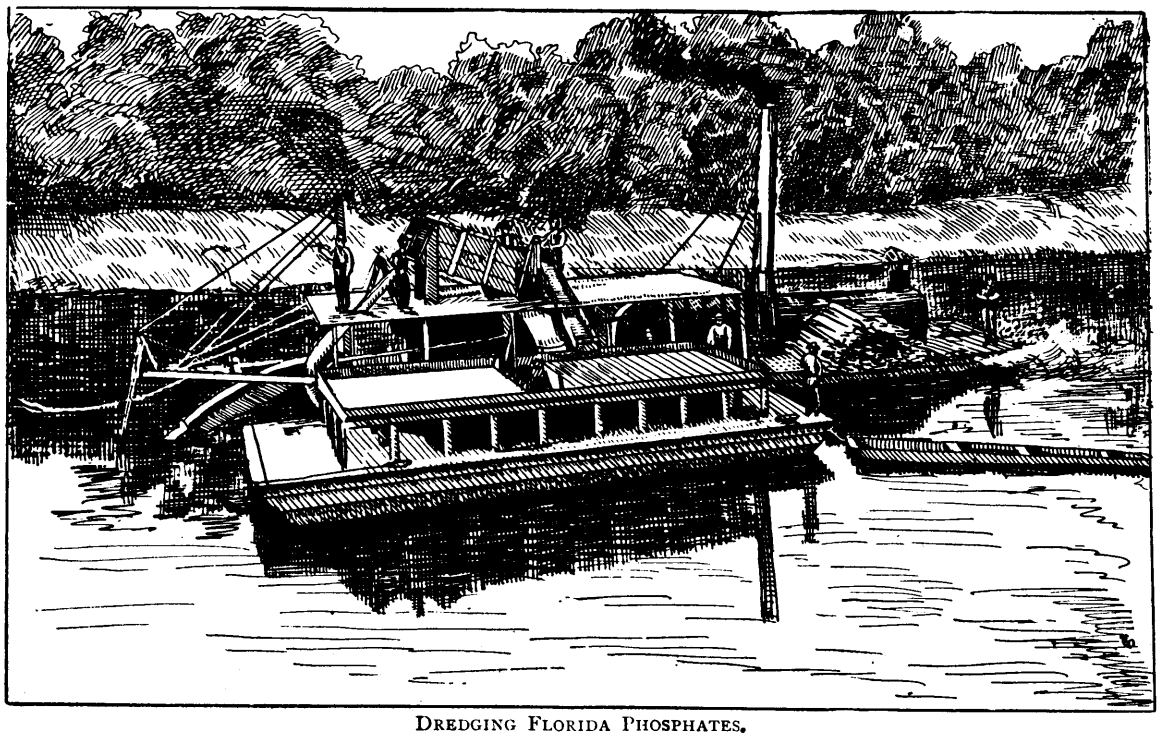
MICA WASTE.—In mica mining there is a great deal of waste. Not only must the blocks be freed from adhering quartz, feldspar, etc., but the mica itself is subjected to close scrutiny, and all pieces unavailable for good sheets are rejected. Great heaps of quartz and feldspar accumulate about the mines, and great heaps of waste mica about the dressing house. None of these materials have as yet been much utilized. Prof. W. C. Kerr stated (*a*) that in the seventeenth century the Indians packed kaolin (resulting from the decomposition of feldspar) from the mountains of western North Carolina to the seaboard for exportation. The Indian name for the Smoky Mountains (Unaka), may thus have been derived from the Indian name for kaolin (unaketh, white). It has been proposed to utilize the feldspar (orthoclase), for the manufacture of potash salts, but the present large deposits of potash minerals, already soluble in water, at Stassfurt, etc., would perhaps prevent a successful business of this kind, even should the method be applicable. The waste mica might perhaps be used as an absorbent for nitro-glycerine in the manufacture of mica powder. It is sometimes used, finely pulverized and mixed with graphite or grease, as a lubricant. A little is used also for silvering wall papers and other decorative purposes. The ancients used it for adorning the interior of their palaces. If an economic use could be found for it, it could be had in large quantities, and at a cost of 10 cents a pound.

It has been stated (*b*) that the Carolina micas are much more extensively impregnated with foreign substances in dendritic and other forms, than the New Hampshire mica, and also that the twisted structure is more common in southern than in northern (New Hampshire), mica. If this is true, there is more waste from North Carolina mines than from those of New Hampshire, and the business must be more precarious in the former place. As regards the first two points the writer is not yet in a position to give an opinion. It may be true that North Carolina mica mines yield more off-color and "A" mica than the New Hampshire mines. We may even go so far as to agree that the geological differences between the two sections could account for it. Such general statements, however, unsupported by the facts upon which they may be based, should be received cautiously. In the North Carolina mines no very close watch is kept over the yield of clouded or "A" mica; it is extremely doubtful if any mine keeps any account of it. The proportion between the cut

(*a*). Eng. and Min. Journ., vol. xxxi., No. 13, p. 212.
(*b*). Tenth U.S. Census, vol. xv., p. 833.

(*a*). Eng. and Min. Journ., vol. xxxi, No. 13, p. 212.
(*b*). N. S. Shaler, Tenth U.S. Census, vol. xv., p. 834.

mica and the waste mica affords no indication of the yield of clouded or "A" mica. It often happens that the waste mica contains no clouded and but little "A" mica. Some mines are famous for their clouded mica, while others have very little. The same is true of "A" mica. It is not known to the writer how strict and detailed a watch is kept in New Hampshire over all the products of the various mines, and therefore he cannot speak of them. But it is known that any assertions as to the yield of the North Carolina mines in clouded, twisted, or "A" mica rest upon very insecure data. The statistics as to the yield of cut mica are not satisfactory, and this is the only matter of much consequence. According to the United States Tenth Census there were in the United States in 1880, 78 mica mines, 71 of these being in North Carolina; of these 78, 22 were worked, 17 of them in North Carolina. The capital invested in the United States was $337,900, $6,900 being in North Carolina; total number of hands employed 272, in North Carolina, 177; total paid in wages $65,600, $29,650 in North Carolina; total production 81,669 pounds, valued at $127,825; North Carolina producing 42,669 pounds, valued at $61,675. Thus North Carolina had invested 2.42 per cent. of the total capital, employed 65.4 per cent. of the total labor, yielded 52 per cent. of the total product, and 48.3 per cent. of the total value. Based on the value of the product $1 capital in North Carolina in 1880 was equal to $44.65 in New Hampshire, her sole important competitor. This latter State had invested as real and personal property, $314,000, and the value of her product was $62,900. North Carolina had invested $6,900, and the value of her product was $61,675. It would certainly be a most remarkable business that yielded $8.93 per dollar invested, particularly so when it is remembered that of the stuff hoisted only from 10 to 12 per cent is utilized. If the twelve or fifteen mines operated in North Carolina in 1887 can show anything like such a profit as this, they can hold their output for several years yet. It is feared that such profits are forever past.



DREDGING FLORIDA PHOSPHATES.

Coal Mining in British Columbia, 1890.

We quote the following excerpts from the Annual Report to the Minister of Mines, by Mr. Archibald Dick, Chief Inspector for the Province of British Columbia:

"While all the mines are being worked with vigour and unprecedented energy, and with an immense investment of capital, for which there is the best prospect of a safe and profitable return to the lucky proprietors, I sincerely trust that the unhappy differences which have existed lately in this district will be adjusted, and harmonious relations be restored between differing employers and employed, as such a consummation would tend greatly to advance the coal industry and the prosperity of the community, as well as to place this Province in a proud position as commanding the market of the Pacific Slope, whether as to quality, quantity or price of the great staple article of necessary utility—coal.

"The outlook for the year we have now entered upon (1891) is the most promising that it has been my good fortune to experience for the coal industry; the harbors of the port of Nanaimo are replete with shipping of every possible size, from the largest ocean ships and steam vessels to the small towing craft and capacious barges, and the powers of the Collieries have been strained to the utmost to fill orders to the many comers. I need hardly say that the City of Nanaimo has been a large participant in this stream of prosperity that has visited the district, and I trust that it may long continue and increase.

NANAIMO COLLIERY.

"The coal from this colliery was in good demand during the past year.

"**No. 1 Pit, Esplanade, in Nanaimo.**—This mine, forming part of the Nanaimo Colliery, belongs to the New Vancouver Coal Mining and Land Company (Limited). As in the previous year, the workings in this pit have been from what is known as No. 1 and No. 3 North Levels. All the workings from these levels are under the water of the Nanaimo Harbor, and are getting to be very extensive. The No. 1 Level with its windings is in about 2,800 yards from the shaft in a north and westerly direction. In this division of the mine they have taken much coal during the past year, the coal being of a first-class quality, hard, and will average about seven feet thick. They have drifted or run the level in about 800 yards, without a fault or hitch of the smallest kind. Here they have as many employed, considering the distance, as they can take coal away from; and at present they have coal won where they could employ 100 more men than what are now employed in this district of the mine. At the back of the level they are only a few yards from working under Protection Island, under all of which, I have reason to believe, lies this famous and valuable coal. In No. 3 level there has been much prospecting and exploring done. They are now getting out a considerable quantity of good coal, but they do not seem to have got into the extensive field where No. 1 is, although they are working towards it and expect to get in soon.

"Ventilation is good. Motive power, two fans, both on the Murphy principle, worked by two steam engines. The fan machinery is erected near the top of the up-cast shaft. The last time that I was down (in December) I found that there were 60,000 cubic feet of air passing per minute for the use of 90 men and 15 mules. The air is well conducted into the face by brattice or otherwise.

"This mine is ventilated on the separate split system, the main division being near to the bottom of the shaft; the part or current going to the No. 1 level, and the other down the slope for the No. 3 level workings. Here they are extensively using brick to build stoppings to conduct the air in the main airways. There is very little gas now found.

"In this mine, as in all other mines of the colliery, a deputation of men is sent once in each month to examine the mine, under Section 79, General Rule 31. The finding of the condition of the mine is recorded in a book kept for that purpose; and a notice is put up where all may see it.

"**No. 3 Pit (Chase River), Nanaimo Colliery.**—This is mentioned in a previous report as being near to the mouth of Chase River. With the exception of a short stoppage in the early part of the summer this mine has been worked steadily. The coal from here is of a very good quality, and hard. As it is worked on the pillar and stall system and that by a slope, and having got as far as it is intended to go at present, all the mining is at the pillars (coal), which were left behind to support the roof, those pillars being fully one half of the coal that was in the mine at the start, so that there is yet a large output to be got here.

"Ventilation is good. Motive power, a fan on the surface near the top of the up-cast shaft. The last time I was down I found that there were 50,400 cubic feet of air passing per minute for 69 men and 9 mules.

"This mine has been free from gas since the start, and it is also free from dust.

"**South Field Mine, No. 1 and No. 2.**—These mines are now what are known as the South Field Mine.

"This mine is worked by a slope from the surface, and is now down about 800 yards, but at present it is not worked in the bottom, and nearly all the coal came out from the south side. It has been the greatest producing mine of the colliery. This coal is of a very good quality, and in some parts is about 18 feet thick, but as in the other mines it had faults now and again to contend with. The coal is mined on the pillar and stall system.

"Ventilation is very good. Motive power, a large fan, on the up-cast shaft. This is also ventilated on the separate split system. The air is taken in by both No. 1 and No. 2 slopes, the up-cast shaft being put down between them, and is found to work well in ventilating the mine. The last time I was down, in December, there were 40,000 cubic feet going down the No. 1 slope, and 80,000 going down the No. 2. slope, total 128,000 per minute for the use of 149 men and 18 mules. There is now very little gas found in this mine, which is also free from dust.

"**No. 4, South Field Mine.**—This is the slope mentioned in a former report, and about half a mile from No. 3 pit. It is down about 1,000 yards with a long level to the south side. The company have been to a great expense here, and at times prospects looked favorable, and it was reasonably expected that good coal would be early found here, as they have good coal coming this way from No. 3, and also from bores they put down away to the dip only a few hundred yards ahead; yet, with all those encouragements, the prospects are not looking very favorable; but it is to be hoped that there will before long be a profitable mine here, the location being good, and well situated for other works.

"**No. 5, South Field Mine.**—This is a new shaft which the company are putting down to the dip and north of the working of No. 2 slope, after having put down a series of bore holes. The prospects from those holes gave them encouragement to start the above shaft, which is now down 100 feet: and they expect to reach the coal a little over 500 feet from the surface. As the company have got machinery and head gear up, to be used in the sinking, it may be expected that, in the absence of unforeseen accident, the company will get to the coal early in the summer, and this will be quite an acquisition to the proprietors.

"**North Field Mine, Nanaimo Colliery.**—This mine is mentioned in a previous report as being in the northern part of the New Vancouver Coal Company's extensive estate. The mine has been worked continuously during the past year, the coal varying in thickness from three to six feet, and is very hard and of a very good quality. It is in good demand both in the Victoria and California markets, and commands the highest price.

"The coal is worked on the long wall system, by a level, and slopes from the bottom of the shaft. This is the only coal mined upon that system in this colliery, and on account of the thinness of the vein the system works well.

"Ventilation is good. When I was down in December I found there were 23,400 cubic feet of air passing per minute for the use of 56 men and 3 mules. This is conducted on the separate split system, the intake being the east level and slope; this comes back by the returns, and eventually rises up and out of one apartment of the shaft walled off. Close to the top on the surface is erected a fan.

"During the past year the company have been sinking another shaft, which is about 70 yards west of the hoisting shaft, and had got down to the coal and connected with the works at the end of December, so that once they get these works arranged this second shaft will be their return or up-cast shaft, and will also form a second connection or outlet with the surface.

"Little or no gas has ever been seen in this mine.

"Two years ago there were nothing but woods here, but now that the New Vancouver Coal Mining and Land Company have extended their works, and the Hamilton Powder Company have also started their works in this neighborhood, there is quite a town springing up, which is likely to grow, and flourish correspondingly with the progress of the coal and powder works, of which progress there can be no doubt.

WELLINGTON COLLIERY.

"**No. 3 Pit, Wellington Colliery.**—This pit, as has been mentioned in a previous report, is in the valley of the Millstone River. The workings are all by way of a slope from the south side of the shaft.

"In this pit much of the work is under the valley, which is sometimes overflowed at very high stages of the river. As well as mining underneath the valley, a great deal of work has been done below the high bluff overlooking the valley. The workings here have only been at pillars (coal), and that under the bluff, as it is not the intention of the manager to take any of the pillars from under the valley, until every other part is worked out; this is done as a safeguard against an inflow of water from the surface. They were working at the pillars up to the 16th May, when there was a strike, and up to the present time there has not been any coal taken out of this mine. Water was being pumped out as usual up to the 26th August, when I was there and went down the mine with Mr. Bryden, the manager. We were satisfied that the gob was heating from the steam and smoke that travelled along the return airway. Since that date no water has been taken out, and during the same time the old ventilating fan has been removed and a new one put in its place.

"Ventilation was good. I never found less than 39,000 cubic feet, and at the time of the stoppage there were 35 men and six mules.

"**No. 4 Pit, Wellington Colliery.**—This pit is about 1,000 yards east of No. 3, but on the top of the bluff, overlooking the Millstone Valley.

"Here, as in all the mines of this colliery, the men worked regularly on to 16th May, when they came out on strike, and little or no coal came out of the mine till August. At this time a few men started to work, and they kept gradually increasing. When I was down in December there were 120 men working.

"This pit is worked on the pillar and stall system, and is a very extensive mine. The coal is generally good, yet it is not without some faults. Here there is a connection with No. 3 pit, as well as the fan shaft.

"Ventilation is very good; motive power, a large fan on the up-cast shaft, worked by a large steam engine. This mine is ventilated on the separate split system; two main divisions at the bottom of the shaft, and this is again split further in in the workings, when, after going round all the works they meet again near the bottom of the up-cast shaft. The last time I was down, in December, I found that there were 108,000 cubic feet of air passing per minute for the use of 120 men and 20 mules. The mine is free from dust, having a regular system of pipes for watering where required.

"In addition to the overman and fireman, there is a staff, called the shot lighters, to examine and see that everything is safe before a shot can be fired. This staff use only safety lamps.

"**No. 5 Pit, Wellington Colliery.**—This is as yet the only pit of the Wellington Colliery that has railway connection with the Esquimalt and Nanaimo Railway, and also with the company's own system of railway to Departure Bay.

"In this mine, as in all the other mines of this colliery, the men worked steadily up to the 16th May, when the strike started, and this mine was also at a stand until August, when a start was made by a few, who have been followed by others, until, when I was there in December, there were 111 men at work.

"This is about the most extensive mine in this colliery. The coal is worked here from the east and west sides, also from an incline on the south, and a slope to the north. As this has been on the pillar and stall system (with the exception of part of the slope that is long wall), there has been much good coal worked here. Now at the south incline and west side, all the mining is at the pillars, which contained about two-thirds of the entire coal; but of course there are many of them by this time taken out. On the east side they are working in the solid coal, and also at the pillars. Down the slope to the north the long wall system works well, but it has to be closely attended to.

"In this slope there is also a considerable amount of work done on the pillar and stall system. Down this slope, and also in the east level, there is the prospect of having a very extensive mine for many years to come.

"Ventilation is very good. Motive power, a fan driven by a steam engine. When I was down in December I found that there were 116,560 cubic feet of air passing per minute; that is to say, to the west and south incline, 51,460; to the east side, 28,090; and to the slope, 37,010 cubic feet of air per minute; total as above, for the use of 111 men and 14 mules; this after being conducted well into the face and around the pillars, by brattice or otherwise. As all the above splits are within a few feet of the bottom of the down-cast, they do not get together again until they are close to the up-cast shaft.

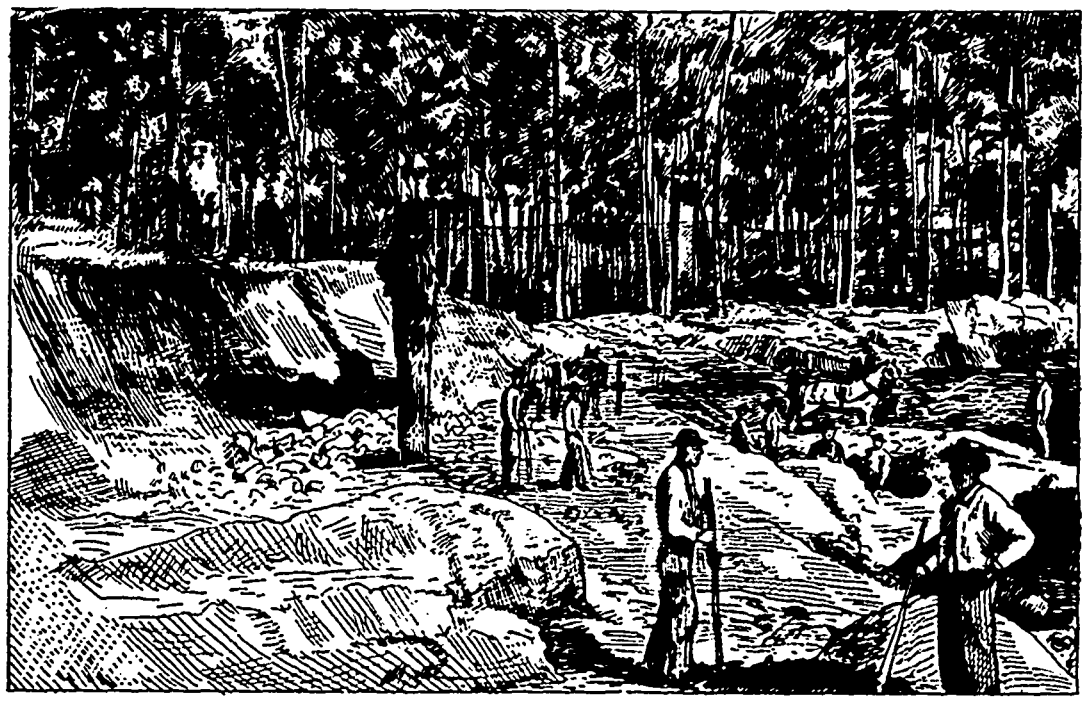
"This mine is also free from dust, and everything is arranged to keep it so, as there is a regular system of pipes for taking water along wherever it is likely to be required, with the mains along the levels and main roads, and smaller pipes leading therefrom to the stalls. In addition to the pipes there are sprayers connected to them at different places in the mine; the water coming out of them is so fine that the air carries the moisture along, so that there is no place it cannot reach—in the roof as well as the floor and sides. The pipes are connected with a large reservoir on the surface; the pressure being the depth of the shaft, 260 feet. Here they have also got their staff of shot lighters and examiners.

"**No. 6 Pit, Wellington Colliery.**—This is the same mine as mentioned in a former report, and about 900 yards east of the No. 4 Pit. Although working, the two shafts are only a short distance from each other; but that small piece is to remain, as it is not the manager's intention to connect those works for some time. This is going to be a very extensive mine, the coal almost lying flat, so that the working is all around the shaft, with a great extent to spread out. The coal is very good and hard, from six to eight feet thick, and worked on the pillar and stall system, which seems to be the best way of mining in this colliery, all things being considered.

"In this pit there has been the same drawback during the past year as has been in all the mines in this colliery, namely a strike, starting on the 16th May; and, as in the other mines, a few men went to work in August, who have been gradually added to, so that when I was down in December there were 55 men at work, with 20 men working in the afternoon.

"Ventilation is good; motive power, a fan on the Murphy principle, and when I was last down I found that there were 36,000 cubic feet of air passing per minute for the use of 55 men and 10 mules.

"This mine is ventilated on the separate split system, the two main divisions being at the bottom of the shaft, and conducted well into the face by brattice or otherwise. In this mine the company are at present restricted to a certain number of men, but they are trying with all haste to get connection with No. 5 Pit, in what is known as the East Level. The coal is good in both sides, and that may almost be counted on all through. It is expected to accomplish this in about a month or two. Then we may anticipate that the output of coal from No. 6 will exceed that of any of the other mines in this colliery.



EXCAVATING LAND PHOSPHATES, FLORIDA.

"**No. 2 Slope, Wellington Colliery**—There has been little or no coal mined or work done here during the past year, but the Company intend to resume work early in the spring.

EAST WELLINGTON COLLIERY.

"This property of the East Wellington Coal Company comprises two shafts, known as No. 1 and No. 2, which are in the valley of the Millstream. The shafts are about half a mile apart by a direct course, and are worked as one mine.

"In No. 1 Pit, coal only comes from a few men, and that from the west level, towards the No. 2. The coal is of the usual good quality, and hard, but the Company are much troubled with faults of one kind and another. On the east side they are now in a long distance which has proved one continuous fault, with a little black dirt here and there; but as this side is the greater part of their estate, they are determined to find out what is in it, and it is to be hoped that they will yet find a good piece of valuable coal as they have incurred a large outlay. I might say it has been up-hill work all the way.

"**No. 2 Pit, East Wellington Colliery.**—In this pit the Company have been working steadily all the year, except for a day now and then. The coal has kept good, and is in good demand in San Francisco, where most of it goes.

"This pit is worked on the long wall system, as has been the general way of working here. The roof is not quite so strong as it was some time ago, yet the mine works well, and the prospects for coal look good for the year we have now entered on, and I hope that expectations will not be disappointed, as the company are persevering and highly deserving of success.

"Ventilation, good; motive power, a fan on the Murphy principle. The fan is erected at the top of the No. 1 Shaft, and worked by a steam engine. When I was down in December I found that there were 23,000 cubic feet of air per minute for the use of 50 men and 7 mules, the air going down No. 2 Shaft, along the faces, except what escapes at different roads, but it is always caught up again at the face when it winds its way along the airway and out of No. 1 Shaft. There is very little gas given given off in this mine, and there is not much chance for it to collect, the old works being well filled up in every particular, and due precaution is used to prevent accidents.

UNION COLLIERY, COMOX.

"This colliery belongs to the Union Colliery Company. The mines are only a few miles from Comox. This Company are working two veins of coal, two mines known as No. 1 and No. 2 Tunnels, or Adit Levels, going in on the hill side on the south side of the railway, and high above its level. Both of these levels are in about 600 feet, in good hard coal, and from two to three feet thick, overlaid by a strong sandstone. The mines here are on the pillar and stall system, and are very safe workings.

"Ventilation, good; motive power, a furnace, the air going in the travelling and hauling road, and returning by way of the face. There is no gas found in here, and it is free from dust, the mine being wet throughout.

"**No. 1 Slope, Union Colliery.**—This slope, which is now down about 2,000 feet, has not been extended any distance during the past year, but the levels from it to the north side have been working steadily the most of the year, that is by three levels with the stalls therefrom. The coal has kept good and very hard, and improving a little in thickness, being from three to five feet thick, with a strong roof. There are good indications to show that this seam of coal will improve in thickness, going to the north.

"Ventilation, good; the motive power, a fan on the Murphy principle, driven by a steam engine. This mine is also ventilated on the separate split system, going down the slope, and then going in the levels, coming around to the up-cast shaft by way of the stalls, so that the air goes down the slope to the lowest place there, then ascends until it again comes out at the top. The last time I was down I found that there were 24,000 cubic feet of air passing per minute for the use of 36 men. The mine gives off some gas, but not so much as to trouble the working of the mine when attended to. There is no dust in this mine, which is wet throughout.

"**No. 1 Shaft Union Colliery.**—This is the shaft mentioned in a former report. There has been much prospecting done here during the past two years, but there has been very little coal taken out. Now it is looking better, and the Company have the prospect of yet getting good workable coal, and it is hoped that they will do so after going to so much expense.

"**No. 2 Slope, Union Colliery.**—This is a new mine, started during the past summer, and about one mile north of No. 1 Slope. Here the coal was easy to get at, and now the Company have put a slope down 260 yards. The coal will average six feet thick. This coal is very hard, of good quality, and resembles the Wellington coal, and I may say that it is the most valuable strike of coal that has been made here by this Company, and is a good thing for them, also for the settlers of the extensive district of Comox, as well as for the Province in general. The Company have put down a series of bore-holes away ahead of this slope, which have proved the coal for a long distance.

PROSPECTING.

"**New Vancouver Coal Mining and Land Company, Limited.**—The workings from the No. 1 Shaft have now got through under the harbor, with one and three-quarters of a mile to haul the coal, this being about under Protection Island. There was a bore-hole started in this island about three months ago, and pushed with all haste. When at the depth of 588 feet coal was struck, and as it was gone through it proved to be a good workable seam. After going through this the bore-hole was continued, and at the depth of 650 feet from the surface another seam of coal was struck, which was thought to be a continuation of the first seam of coal that was worked on Newcastle Island, and also in the old No. 3 Pit, Front Street, Nanaimo. As the coal from both those places was of a good quality, there is no reason to think that it is not as good under Protection Island and the waters of Nanaimo Harbor. Near to this bore-hole the Company is preparing to sink a shaft, making every preparation to start, so as to lose no time, in order that they may be able to ship coal from this island at as early a date as possible. There is now a wharf built on the island for landing the machinery and materials.

"This Company put down a bore on Mrs. Frew's estate, which is the delta of Nanaimo River. Six feet of coal was passed through at a depth of 910 feet from the surface. They did not find the lower seam here.

"The bore-hole mentioned in a previous report as being down 1,460 feet was continued until they reached the depth of 2,220 feet, making the deepest hole in this district. No coal of any apparent value was struck, except that stated in my last report, namely, twelve feet of coal.

"**Comox.**—The New Vancouver Coal Mining and Land Company, Limited, have also been making some extensive researches in the Comox Valley. A powerful drilling machine was imported, and taken to Comox about mid-summer last It was got to work as soon as possible, and continued drilling until a depth of over 2,000 feet was reached, and this was accomplished in less than six months. The results cannot be published at present, but it is sufficient to state that the coal measures undoubtedly extend into the north-westerly portion of the Comox Valley, but at a considerable depth. It remains to be proved whether the measures contain workable coal seams at a depth that will lead to their being worked. This Company are proceeding with other bores, and it would be a great benefit to the settlers of the important settlement of Comox if the Company should be successful in their enterprising exploration, as a home market would be provided for the settlers' produce.

"The New Vancouver Coal Mining and Land Company, Limited, are about to bore on Texada Island, where there are indications of coal measures. They are going to prove what is in them.

"The same Company are also starting to bore No. 4 in their North Field.

"In looking over this underground prospecting, you will see that this Company are exploring over a large area of Vancouver Island, and it is to be hoped that they will be successful in their undertakings, as it requires a great outlay of capital. The Company possess both the capital and the management necessary to insure success.

"There was other boring done in Rupert District of which I cannot give the results.

"**Oyster Harbor**—The diamond boring drills were removed from Oyster Harbor after considerable expenditure and an energetic search for coal.

"Negotiations, I am informed, are in progress for a renewal of operations, and it is to be hoped, in the interest of the Oyster Harbor Coal Company, as well as of the Province at large, that further exploration will prove successful.

"According to Mr. Richardson, the geologist, the whole of this section contains coal-bearing measures, which are a continuation of, and about the same formation, as we find at Nanaimo, but the covering seems there to be somewhat greater than it is hereabout.

TUMBO ISLAND COAL MINING COMPANY.

"This island, lying at the south-east entrance of the Straits of Georgia, has been prospected for coal by the above company for the past three years. There was one hole put down two years ago; then they started a shaft having a steam engine and air compressor. They worked away at this shaft until they got down over a hundred feet, when they quit work in the shaft, and put down another bore hole near to the first one. This was put down through hard sandstone rock for about 220 feet. Here a bituminous shale was struck. This continued most of the distance, up to 325 feet, when coal was struck. I was at the bore-hole, saw and helped to bore and take out a considerable amount of coal, as well as some of the shale referred to. The coal that I saw taken out, the coal which I saw that had come out before I got there, and what was got out after I left, is enough to satisfy the Company that there is a large seam of coal under all this island, which the above Company owns. The above mentioned shale, when burned in a retort, was found to contain much gas, which burned with a clear white light. This may be very valuable for illuminating purposes. Altogether this Company has got a valuable property, and we hope, that when once it is opened out that it may be profitable for the Company, as well as beneficial to the Province at large. I am indebted to Mr. Charles Gabriel, who has charge of the works, for such of the above facts as are not within my personal knowledge."

Noah's Ark as a Precedent in Mine Timbering—The timbering of a mine, necessarily a costly operation, is regarded as of very great importance; but sometimes the expense of this operation reaches a very large figure. In the Levant Mine, St. Just, the workings are very extensive, but for some reason the timbers only last a very short time, and their renewal keeps a force of men constantly employed. This gave rise to an amusing conversation at a recent meeting.—Dr. Searle enquired why did they not put in timber that would last until the Day of Judgment? "Have we" he added, "any man of sense connected with this mine?"—Captain Newton: Can you recommend any timber that will stand that?—Dr. Searle: Under chemical influence it will; would I be on the committee of this mine and not make it pay?—Dr. Quick: You are quite right; she will never pay any more.—Dr. Searle: You can sink timber under the sea and it will last for ever, and why not in Levant mine?—Mr. R. P. Couch: You recommend the process; don't speak generally like that.—Dr. Searle: What did Noah do with his ark? He pitched within and pitched without and kept the antiseptic influence out and all the people in the ark were dying from the same complaint as we have been dying of, the Russian influenza. (Laughter.)—Captain Newton: You were never in the ark. Dr. Searle: It was pitched within and pitched without.—Several in the room. Pitch him out.—Dr. Searle. I have heard of dry rot in the pulpit, but I did not expect to meet with it in Levant account house.—Mr Couch: Did Noah hand you down a receipt?—Dr. Searle: Nature furnishes the prescription, and any man is a fool who does not carry it out.—Be this as it may, it is generally thought that Levant will ultimately receive a benefit from their present outlay, and that the agents will have an opportunity of dealing with a larger quantity of stuff than now.

The Copper Deposits of the Province of Quebec.*

Dr. R. W. Ells, Ottawa.

(Continued from page 71).

In what we have styled the third area, viz., that of Ascot and Hatley, we find a great series of deposits which have of late years proved to be among the most valuable in eastern Quebec, not probably so much for the amount of copper contained as for their adaptability for the manufacture of sulphuric acid. In this respect the ores of this most easterly belt differ widely from those of the two areas already described.

The variegated and vitreous ores are, for the most part, wanting; the bulk of the ore being a chalcopyrite, with much iron pyrites. The amount of copper contained is not high, averaging, for the great bulk of production, from four to five per cent., while in most of the ore there is an appreciable quantity of silver, reaching in some portions, as much as $25 to $40 per ton of ore, but yielding, on the average, from four to five dollars. A certain amount of gold is also present, but, as no attempts have yet been made to save this, the quantity is unknown.

These mines are situated in what we now regard as the Sherbrooke and Stoke Mountain anticlinal, and the rocks are chloritic, micaceous and talcose schists, with diorites. On this belt of rocks south-west of Sherbrooke and extending to the north line of Hatley, a large number of mines have been located, some of which have been worked for many years, while others, although containing valuable bodies of ore, have been idle for some time. In the township of Hatley the deposits appear to be much less numerous; the belt of schists becomes narrower, probably in part owing to the overlap of the black slates of the Cambrian system. The most southerly deposit of copper ore in this direction is near the upper end of Massawippi Lake, on the west side, on lot nine, range six. At this place there appears to be two kinds of rock, the soft blackish and bluish and pyritous slates being in contact with the hard quartzo-felspathic rocks of the mountain series. The contact is probably along a line of fault, and the ore, which is scattered through a width of eight to ten feet, is in the form of the yellow sulphuret, but the shaft being filled with water, the quantity could not be ascertained; a large amount of iron pyrite appears to be mixed with the copper ore. This is the Parnell mine. The only other mine located in this township is that on lot twenty-eight, range one, known as the Reid Hill mine. It has an elevation of 500 to 600 feet above the Massawippi River, and presents the appearance of six beds of the yellow sulphuret, with iron pyrite, in a space of a fourth of a mile in breadth. Similar ores appear on the lots to the west, on ranges two, three and four adjoining. Considerable exploratory work was done at this place, and a level was driven in about 200 feet below the outcrop of the bed, but no details of the workings or subsequent exploration are to hand. Beginning with this mine and passing into Ascot, there appears to have been an unusual development of this variety of ore, more particularly in that portion to the south-west of the St Francis River, though large and very valuable deposits have also been discovered in the extension to the north east of this anticlinal. The ores are apparently yellow sulphurets, and no less than fifty-five localities were at one time reported as copper-producing or giving good indications of the ore. In all, up to 1865, thirteen mines were operated, of which the localities may for the sake of reference, be briefly noted as follows, but since that date several others have been opened:—

The Clark mine—Lot 11, range 7.
The Sherbrooke mine—Lot 12, range 7.
The Albert mine—Lot 3, range 8.
The Eldorado or Capel mine—S.E ¼ lot 4, range 8.
The Victoria mine—N.E ¼ lot 4, range 8.
The Ascot mine—W. ½ lot 8, range 8.
The Parks mine—W. ½ lot 12, range 8.
The Short mine—Lot 14, range 8.
The Lower Canada mine—Lot 3, range 9.
The Marrington mine—N.E. ¼ lot 6, range 9.
The Hill mine—E. ½ lot 8, range 9.
The Belvidere mine—Lot 10, range 9.
The Magog mine—Lot 11, range 9.
The Griffith mine—Lot 3, range 11.

These are the mines mentioned in the report for 1866, and in addition, several other areas, not distinguished by any particular names occur, on which a greater or less amount of development work has taken place. Several mines have also since been opened, which promise well in view of the great present demand for sulphur ores. Among these may be mentioned the Suffield mine on lot three, range eleven; the Cillis, now the "Howard," on lot five, range eleven; the Hepburn mine, on lot seven, range nine; and the Moulton Hill mine, north of the St. Francis River, on lots twenty-three and four, range three. The width of the ore lodes, or beds, in this section is very great, in places being considerably over fifty feet, and the breadth of the ore-bearing rocks south of Sherbrooke, is about three miles; while from the Parnell mine, on the south, to the Moulton Hill mine, on the north, the distance is about twenty miles. Still further to the north, again, in Garthby, large deposits of similar ore have been reported. The first reference to the copper ores of this section is found in the report of the Geological Survey for 1847, where an outcrop of a vein in the fifteenth lot of the seventh range is mentioned as worthy of trial, which was found to contain, in addition to copper, small quantities of silver and gold; the latter, however, not in quantity to be of economic importance, but of interest as showing the possible presence of the precious metal in greater quantity in other veins of the vicinity. On the thirteenth lot of the same range, the continuation of this deposit carried copper pyrites in veins distributed throughout a belt of thirty feet of chloritic slates. This lode, on lot fifteen, was at the time traced for a distance of about fifty yards, but further to the south, from half to one-third of a mile, could not be found. When first opened it had a breadth of from ten to twelve inches. Up to 1858 no further interest appears to have been taken in these deposits, only two places being referred to in the report for that year, viz., that just mentioned and on lot nineteen, same range, where a small vein of copper pyrites was seen in a railway cutting near Sherbrooke station on the Grand Trunk Railway. In 1859 the Ascot mine was discovered by Thos. McCaw of Montreal, at Haskill Hill, and found upon examination to consist of a bed of copper pyrites mixed with iron pyrites, with a thickness of five or six feet, in a matrix composed of impure limestone and chloritic schist. This mine was, in the fall of 1863, purchased by an American company who erected furnaces for smelting the copper ore at Lennoxville. In the Geology of Canada, 1863, reference is made to but three mines in this vicinity, viz.: the Ascot, or Haskill Hill, the Belvidere and that first discovered and already described. The ore was similar throughout, and the breadth in the Belvidere lode was estimated at six feet. What was afterwards the Marrington mine on lot six of the ninth range showed a vein of from two to three feet at the surface, with a large proportion of iron pyrites. During the next two years a very extensive development in mining took place; a large number of mines were opened and a very considerable quantity of ore extracted. From notes kindly furnished me by Mr. T. McFarlane and by J. S. Hunter, now of Belleville, I am able to present a few items in regard to some of these, not already generally made public. The Clark mine is situated one mile and a half from the Lennoxville station, G. T. R., on lot eleven, range seven, Ascot. This was first opened in 1863, by Mr. Wm. Clarke, and was worked with more or less vigor for several years, principally by an American company, who took out a large quantity of ore. The work was carried on for the most part by means of open cuttings upon a vein said to have a thickness of eighteen feet (?) and containing three and a half per cent. metallic copper. This estimated thickness of ore bed is, however, doubtless exaggerated, since, on the most reliable authority, the thickness never exceeded seven to eight feet, and gradually decreased to eighteen inches. In addition to surface workings, a pit was sunk to a depth of forty feet, and a shaft for seventy-three feet. Further explorations were carried on in 1866, but without success, and in that year the mine was sold at sheriff's sale. No returns as to quantity or quality of output are to hand, and the mine has apparently remained idle since the date mentioned. The Sherbrooke mine immediately adjoins that just described to the south, and is traversed by the same lodes as are found in the Clark mine. It has been quite extensively explored on the surface, though not yet opened up by underground exploration. Several valuable deposits of pyrites are reported on this property; one of which is said to have a thickness of eight feet, while another was stated to be no less than seventy feet in width.(?) Assays by several parties gave from $4 to $5 of gold, $11 per ton of silver, and from 30 to 40 per cent. of sulphur.

A group of three mines, situated on lots three and four, range eight, and lot three, range nine, are worthy of special notice, not only from their early history, but from their great and growing importance at the present time. These comprise what were formerly known as the Lower Canada, or Hartford, now the Eustis or Crown mine, the Capel or Eldorado, and the Albert; the latter being now owned by the firm of G. H. Nichols & Co.

The Capel mine was so called from the name of the original owner of the property, Mr. Geo. Capel, and in 1863, chiefly through the agency of Mr. W. S. Hunter, three men, Mr. Hunter, Mr. Pierce and Mr. Capel, formed a company to develop the property on lots three and four of range eight. These gentlemen spent from eight to ten thousand dollars in exploratory work, and, finding the results satisfactory, divided the property into two portions; the eastern area, on range nine, being styled the Prince Albert mine.

The property was soon acquired by Montreal capitalists by whom mining operations were commenced, and have been carried on to the present day though under change of ownership and management. From the Montreal firm the property passed into the hands of Taylor & Sons, of London, who adopted the Henderson process for the extraction of the metallic copper. This, however, after a thorough trial, failed to give satisfaction, and the mine was closed. The property subsequently changed hands, and was finally purchased by Messrs. G. H. Nichols & Co., an American firm of ability, by whom the ores have, for the most part, been shipped to the sulphur works at New York or vicinity, for the manufacture of acid. Within the last three years, however, a somewhat extensive plant has been erected at the mine for the manufacture of sulphuric acid on the spot, as well as for that of superphosphate. Smelting works have also been still more recently started for the production of matte. The success of the present company is no doubt largely due to the saving of the sulphur and other by-products of the ore, in which the profit consists.

The depreciation of the copper market at the time of the former management, combined with the loss of the

* Mineral Resources of the Province of Quebec, 1870.

sulphur, was such that expenses apparently could not be met. The deposits at the Albert and Capel mines are doubtless a continuation of that found to the south-west at the Crown mine, formerly the Lower Canada. There the ore bed is an immense, but somewhat irregular deposit of chalcopyrite, with much iron pyrites, yielding an average of four to five per cent., some of the ore being very rich, and in addition contains an appreciable amount of silver; the lode varies in width from four to over fifty feet, and has been worked to a depth of over 1,600 feet. At the Eustis or Crown mine also, smelting works have been erected, in which a large amount of matte is made, the sulphur in this case being wasted, but a very large proportion of the ore still goes in the raw state to the sulphuric acid works in the vicinity of New York, while the residue is treated for copper at the smelting works at Bergenport, New Jersey. The owners of the latter are the Eustis Mining Co. The ore at this mine apparently occurs conformably with the bedding, the irregularities in size being due to local thickening of the ore mass. Dykes of diorite are met with in the different underground workings, and can also be seen at the surface in the immediate vicinity of the mines. The rocks containing the lode are schists, often highly micaceous and talcose, but generally chloritic, which are traversed by numerous quartz veins. The ore is delivered on the railway, about half a mile distant from the Albert mine, by an elevated cable tramway, carrying the ore buckets, and from the Eustis property by a gravity tramway to the track, where it is dumped directly into the cars. From several assays of this ore the quantity of sulphur is found to vary somewhat, but averages 38 to 40 per cent. :—

Iron	35
Copper	4 to 5
Silver, about one ounce per unit of copper, say 4 ounces per ton.	

The Lower Canada mine, or the Crown mine now so-called, was discovered in 1865. For two or three years thereafter it was worked for copper alone, but subsequently for copper and sulphur. This mine is well described in the Geological Survey Report for 1866, from which the following abbreviated extract may be made as illustrating the character of the workings and of the ore at that date. The strata for a distance of 1,600 feet dip S. 30°-40° E. <40°-60°, and in this distance five shafts have been sunk in micaceous schist, to the south-east of a dolomite band, and to all appearances in the same bed of ore. In shaft No. 1, the ore is ten feet thick, the lower four feet of which is apparently an almost compact mass of the yellow sulphuret of iron and copper, with a yield from this portion probably of eight per cent. of copper. Upon this are two feet of similar character, but yielding only about five per cent. of copper, and the upper four feet contain iron pyrites alone.

No. 2 shaft is 125 feet south-west of this, sixty feet deep, and the ore bed is four and a half feet thick; the lowest part is similar to that in the first shaft, but said to yield fifteen per cent. copper, while the remainder yields only three per cent. The ore bed, as shown in the shafts Nos. 3 and 4, sunk to a depth of 75 and 132 feet respectively, is similar to that in No. 2, but in No. 5, sunk 90 feet, the bed is six and a half feet thick and vertical for 80 feet from the surface, thence dipping S. 40° E. <40°-50°. In the vertical part it contains only iron pyrites, but below this sufficient copper pyrites becomes mixed with it to cause the bed to yield between three and four per cent. of metallic copper. Other bands of copper ore occur in this lot, on both sides of shaft No. 1.

Subsequently to the date of this report mining operations were vigorously carried on, and in addition to the copper, which was originally the sole object of the enterprise, the large amount of sulphur contained in the ore was utilized for the manufacture of sulphuric acid, both in Canada and the United States. Up to June, 1869, about 20,000 tons were smelted to 40 per cent. regulus on the spot.

A very large quantity was shipped to acid works, the amount of sulphuric acid obtained being stated at one ton of 65 per cent. acid to each ton of ore.

The yield of ore from these mines at present is very large and apparently annually increasing. The output for 1889 taken from the returns of the CANADIAN MINING AND MECHANICAL REVIEW, was, from the Eustis mine, 34,089 tons, including 1,773 tons matte, and from G. H. Nichols & Co., 36,000 tons. Of some of the other mines alluded to in the list given in a preceding page, but little can here be said. On some of these a considerable amount of exploratory work was done and the promise of good sized ore beds seemed good, but, in most cases, this exploration was not pushed to a depth sufficient to decide as to the actual value of the property. This can be easily seen by refer ence to the great mines of Capelton, and by a comparison of the enormous size of the lode in the lower levels, with the comparatively limited extent at the surface. Among others, not noticed in the list of 1866, may be mentioned the Suffield mine, on lot two, range eleven; the Hepburn mine, on lot seven, range nine, at which a large amount of exploratory work appears to have been done, and the Cillis mine, on lot five, range eleven, which has, within the last year, been re-opened to a greater depth, and the ore has been found to increase in quantity and quality so greatly that it is now considered an exceedingly valuable property. It has been purchased by an American syndicate and will be worked.

From notes obtained by Mr. Willimott in 1882,* the Hepburn mine was then being worked quite extensively. Like the Ascot and Suffield mines, it was the property of the Sherbrooke Mining and Smelting Co. A shaft was sunk to a depth of 156 feet, and at sixty feet a level had been driven for thirty feet, from which a north and south cross-cut was made. The latter was carried 110 feet, at which distance a bed of yellow sulphide twenty-four feet thick was cut, averaging about seven per cent. metallic copper. The north cross-cut was carried ten feet, where another bed of yellow ore was cut, said to be twenty-seven feet thick. No ore has been raised, the object of the company being to develop a large reserve.

About twenty men were employed at the mine. Work at this mine was shortly after abandoned. The quality of the ore in the dump, seen in 1885, looked well. Of the Suffield mine, Mr. Willimott says: "A shaft has been sunk 200 feet; at the depths of eighty-five feet and at two hundred feet, levels have been driven to the east, the former 300 feet and the latter 100 feet, connected by a ventilating winze."

The amount of exposed ore is reported at about 40,000 tons, of which 3,500 to 4,000 have been taken out with the intention of concentrating and smelting at the mine.

At this mine the drilling was done by compressed air driven by an engine of sixty horse power.

The ore resembled that from the Capelton and Hartford mine, an assay of which was made by Dr. Harrington in 1877, yielding 75.03 ounces of silver to the ton. Assays of the Suffield ore, by John Massey & Co., London, England, gave percentages of silver, varying from eight ounces to 235 ounces per ton, and from four to twenty-nine per cent. of metallic copper.

In the area north of the St. Francis, deposits of ore occur precisely similar to that of Capelton, and in similar rocks. What has proved to be a very valuable deposit was found about three years ago by Mr. Burke, the owner of the land, on lots twenty-three and twenty-four of the third range of Ascot, which has since been somewhat extensively developed, and purchased by the same syndicate which acquired the Cillis mine. The bed of ore which dips with the slate south-easterly at an angle of 45° to 50° was found to rapidly increase from four to six feet at the surface, to a reported thickness of not far from fifty feet, at a depth of seventy feet, revealing an enormous body of ore. This location was revealed by the uprooting of a tree, and is in the direct course of the Capelton deposit, which it so much resembles. In view of the fact that these several ore beds which are found over a breadth of some three to four miles, resemble each other very closely, and from the crumpled and overturned character of much of the strata in which these are contained, it seems most reasonable to suppose that the greater part of these mines are located upon different portions of the same lode, repeated by folding from place to place, and that as large and valuable deposits of the ore have been found at widely separated portions of the same vein, both in the southern and northern portions of the township, and almost equally valuable deposits are known in the more western portion of the belt, as at the Cillis mine, it may be very safely predicted that the real value of many of the mines which were opened twenty-five years ago, and speedily closed, has never been ascertained, and that other masses of ore, of equal importance to those so long worked, will at some not distant date, by careful prospecting, be found. Much of the failure of twenty-five years ago was, doubtless, due to the speculative character of the work done. Mines were bought and sold on the flimsiest sort of evidence as to their value or worthlessness; often on samples which were obtained from an entirely different location from that represented. The growing importance of these ores as a source of supply for sulphuric acid is being very fully realized by the men interested in this industry in the United States; their superiority over most of the ore there found, for this purpose, being acknowledged. There are yet, in this eastern belt, many places thickly covered by forest growth, the prospecting of which is a difficult matter, but of the many mines already opened and abandoned it is highly probable, as in the case of those now worked, that deeper and more scientific testing would change the aspect of things greatly for the better.

Further to the north, in Garthby, a considerable deposit of pyrites is found on lot twenty-two of range one. This deposit is described in the Geology of Canada 1863, p. 733, as "a large mass of iron and copper pyrites subordinate to the stratification of the enclosing rock, which is a calcareous serpentine, dipping to the south-east at an angle of 50°. The extent of the deposit has not been determined, but there appears to be a breadth of about twenty feet, in which the two ores are more or less mingled with rock. Large masses of the mineral consist of a fine-grained iron pyrites, without any copper, while in other portions the ore is such an admixture of copper pyrites as to afford eight per cent. of the metal."

The ore at this place occurs in rocks differing in age from those of the area just described, being more closely allied to the deposits of Bolton and Potton. The first opening was made by Mr. J. B. Coulombe, in 1860, and was nine feet long, five feet wide, and said to be sixty feet deep. No work was done on the property after 1861. An analysis of the iron pyrites apparently free from copper gave iron 42, sulphur 48, copper 1·1, silica 8·9. This property is about four miles from the Quebec Central Railway, and recent explorations during the past year, in the southern part of the area, are said to have developed a large body of ore, the measures being traced into South Ham for a distance of three miles, but no definite information can be obtained on this point.

In the townships of Ham and South Ham, several mines were also at one time started, but these, apparently from an insufficiency of ore, have long since been closed. Among these may be mentioned the Nicolet Branch mines on lot twenty-eight, range four, where the variegated and vitreous ores were found scattered through a band of dolomite and chloritic schists, over-laid by glossy black slates.

The ore is found in small veins only, disseminated through the rock, and by exploration over several hundred feet several tons of rich ore were obtained. On range B, lots thirty-three to thirty-six, explorations were made; on the right bank of the Nicolet River on similar ores in green rocks, like the last, but without success, only small quantities apparently being found. In South Ham, in the serpentine and diorite rock of the south and east side of Nicolet Lake, small deposits, mostly of the yellow sulphuret, occur on lot twenty-two, range one, old numbering, or lot forty-four, range one, new numbering. This was styled the Nicolet Copper Mine. A small amount of exploratory work was also done on lot fifty-two, range two, new numbering, but no returns are to hand. Further north, in the township of Thetford, copper ore has lately been reported by Dr. Jas. Reed as occurring on lots three, four, five and six of the first range, and on lot fifteen of the second range of Leeds, as well as lot nineteen of the second range of Thetford, but the quantity and character of the ore is unknown, as not yet explored.

The Asbestos Industry in 1890.

In the Summary Report of the operations of the Geological Survey, just issued, Dr. Ells reviews last year's operations in the asbestos districts as follows:—

"The asbestos industry shows also a great increase, both in the amount of the output and in the prices obtained for the raw material, and probably not less than 8,000 tons have been shipped during 1890, though the complete returns are not yet in. The price of No. 1 has risen rapidly from $100 to $125 to $200, and even $250 per ton, with a further tendency upward. Several new mines have been opened and the work at the old mines has been pushed with greater vigour. The increase in the output is largely due to the fact that improved machinery is now employed in all the pits, in some of which compressed air for the purposes of drilling and hoisting is used; others use steam direct, the former being considered the more advantageous, owing to the ease with which the drill holes can be kept clean. Preparations are now being made for removing the dumps from their present sites to the barren ground near the Thetford River, and it is estimated that the crushing and cobbing of these will amply repay the cost of removal. The necessity of employing machinery for the purposes of crushing and cobbing for the smaller veins at least is now recognized, and is being put in operation at the American and Anglo-Canadian mines at Black Lake. In addition to the mines already described in former reports, several new areas have been opened on the west side of the Quebec Central railway. While the veins at all these occasionally show good fibre, it is evident, upon examination, that the rock nearer the river and on the low ground does not yield such fine asbestos as in the mound where the mines were first opened. In Coleraine, also, several of the new companies which began operations last year at Black Lake, have abandoned their locations, owing, probably, to an unfortunate choice of ground, while some of the Thetford companies—notably King Bros., A. S. Johnston and A. H. Murphy—have opened new areas here and found good veins. Among others, Dr. James Reed, on lots 27, 28, 29, has erected a first-class mining plant, with air compressors, for carrying on work on his areas, on which considerable work has been done during the past season, mostly by the contract system. On the west side of the upper part of Black Lake, near the inland line, Messrs. Grundy, Steel & Co., of the Beaver Mining Co., have begun work in Range B, Coleraine, but the work so far has been mostly exploratory. Numerous small veins and some of fair size have been found, but their value cannot yet be definitely pronounced upon.

"Great activity on the part of prospectors is manifested throughout the whole of the Serpentine belt of Thetford, Coleraine, Broughton and Wolfestown. Several finds of valuable areas are reported, none of which, however, in so far as careful inquiry could determine, are of very great importance. An interesting point discovered during the past year is the fact that the walls of so-called barren rocks encountered in nearly all the mines, owing to the presence of faults, and formerly supposed to be worthless, are now in good ground, the barren portions extending but a short distance. This is what might have been expected in such areas, the fault being only local and merely displacing masses of presumably equally rich serpentine. The serpentine areas of the south-western portions of the province have not yet disclosed the presence of workable veins of asbestos in quantity, with the exception of the mine at Danville, owned by Mr. Jeffrey, where some fine veins have lately been discovered. The Brompton Lake mine, which is the most southerly worked to any extent, has been opened to a very considerable depth, and a large amount of money has been spent; but the prospects for workable veins in the lower workings are no better than at the surface, and no returns have yet been made. About Orford Pond on the south side of Orford Mountain, and near Long Lake, at the northern extremity of the same ridge, excavations have been made in thin and irregular seams a fourth of an inch, and in the road west from Knowlton Landing to Bolton Pass, in the serpentine band to the east of the Missisquoi River, some exploratory work has been done without finding asbestos of any economic value, and in so far as yet ascertained this portion of the province does not present favorable indications for profitable asbestos mining."

* See Geol. Sur. Rep., 1882-3-4.

Iron Ore Concentration.*

Concentrated iron ores are usually considered as those which have passed through sizing and jigging or sizing and magnetic separating processes, and the term is more commonly applied to magnetites than to hematites, but we may properly consider any method of beneficiating iron ores in this discussion.

In other words, we may refer here to any means of increasing the percentage of iron in an ore by separating from it all or a part of its gangue under the general caption of concentration, and therefore in this category, washing or jigging processes may be considered. The roasting of iron ores is to a certain extent a concentrating process, but their purpose is seldom one of separating the gangue from the ore, but rather of driving off moisture, sulphur, or carbonic acid; and this treatment is generally recognized as that of "roasting or calcination." The system of washing brown hematites approaches in results those obtained by jigging and may fairly be considered under the general head of concentration.

The use of the washer has developed more largely in Virginia, Georgia, Alabama and Tennessee, than elsewhere lately, but the forms principally employed are either the shaft or the cone washers. The shaft washers are single or double, the latter being preferred, and consist of one or two logs of wood iron bound and fitted with blades; these logs revolve in a trough in which the ore and water are placed, the revolving blades cutting up the clay lumps, and forcing the ore up the inclined bottom of the trough, the water carrying away the clay to suitable settling reservoirs or mud dams.

In some instances iron shafts have been used in place of logs, and the most approved arrangement is to have paddles which slip into sockets secured to the shaft, in place of securing the blades directly to the shaft. The accompanying illustration shows an arrangement of washer of which a number have been erected in central Pennsylvania, in Virginia, Tennessee and Alabama, by the Gaysport foundry, of Hollidaysburg, Pa. The ore as brought from the workings is discharged from mine cars on a "grizzly" through which all but the lumps pass into the trough. These lumps are fed into a crusher and from this also drop into the trough, unless it is desired to ship them without washing. As, however, considerable clay adheres to or is enclosed in the nodules of brown hematite ore, the washing of the broken lumps is advisable. As the blades cut or push the ore forward in the trough, it is met by a stream of water and the clay is washed away, the ore passing out at the upper end of the trough into a revolving screen in which a final rinsing by water takes place, and in which the finer ore or sand is separated, the coarse ore passing on to an inclined conveyor which serves as a table from which any foreign material may be hand-picked.

In some instances all the fine ore which will pass through one inch round holes is, after washing, treated in jigs, as described in the *Journal*, vol. viii., p. 42, when discussing the process used at Iron Mountain, Missouri.

An advantage claimed for this washer is, that it embraces the principal feature of the submerged log-washers, logs being placed on an incline of from two to three feet in their length, thus practically submerging the logs nearly one half their length, the back end of the washer-box being 4 feet high. The logs are 17 to 18 inches in diameter, generally 30 feet long, covered with iron their entire length. The teeth are made with detached bases, the bases being secured to the logs so that the chilled teeth may be renewed without disturbing the bases. The logs are provided with flanged gudgeons, the back or lower gudgeon being protected with a chilled thimble, which runs in a chill step or bearing.

The logs are both driven from the front or discharge end by spur and bevel gearing. Two or more washers may be set side by side, all driven by the same main line shaft, with countershafts to each washer, this countershaft beng fitted with a shifting clutch so that any one machine may be readily stopped without interfering with the operation of the others.

A circular issued by McHanahan and Stone, descriptive of jigs, makes the following statement:—

"Many furnace men have never attempted to estimate the cost of smelting the foreign material contained in their ores. It is not unusual to find furnaces using ore containing 20% of foreign matter that might be taken out by a good jig, and it will be generally found to pay to use jigs if only 5%, or less, of foreign matter can be removed. In estimating the cost of using low grade ores in a blast furnace, not only the cost of coke, time and furnace labor required to smelt this barren material must be considered; but the cost of freight, handling and storage, and taking care of increased amount of cinder. It also decreases the available capacity of the furnace.

"As the commercial value of ore becomes generally regulated by its analysis, it will be found necessary to give more thought to the proper dressing of the siliceous hematites, and it must be remembered that the value of ore depends, not only on the metallic iron, but also on the limit of silica.

"The market value of ore varies in the different parts of this country more than the price of pig iron. Formerly but little difference was made in the price of high and low grade ore, but gradually all ores are being held at more nearly their real value, and the difference in value varies with cost of coke, labor and all other expenses outside of ore, and if it is possible to increase metallic iron 5 units, and secure a corresponding decrease in silica by the use of jigs, they would prove profitable investments." The same authority suggests the following general rule for determining the value of brown hematite ores at the mine:—

"*Rule.*—For each unit of increase in metallic iron add one-twentieth of one cent. per unit to selling price; and for each unit that silica is lowered, add one-tenth of one cent to selling price Thus, if ore before jigging analyzes iron 42, silica 22, and sells for 3 cents per unit or $1.26 per ton,—if this ore is improved by the jigs to iron 50, silica 12, the increase in iron, 8 units, at one-twentieth of a cent per unit, equals four-tenths of a cent, and decreased silica 10 units at one-tenth cent per unit, equals 1 cent; making total price for jigged ore per unit 4.4 cents. Fifty per cent ore, at 4.4 cents per unit, equals $2.20 per ton, an increase of 94 cents per ton."

The following analyses of brown hematite ores before and after jigging are presented:—

Ore before jigging—metallic iron, 31.72. Insoluble residue, 48.82.

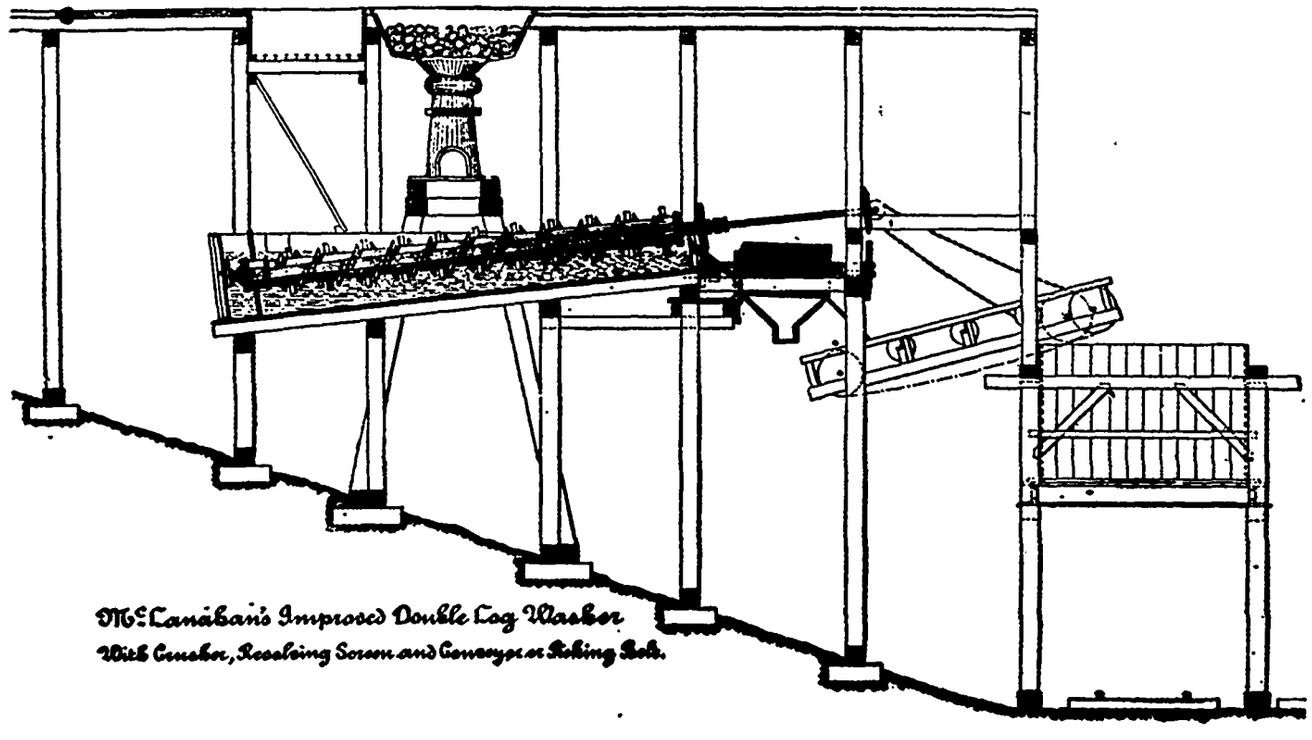
Same ore after jigging—metallic iron, 51.465. Insoluble residue, 15.3.

Ore before jigging—metallic iron, 43.20. Insoluble residue, 26.40.

Same ore after jigging—metallic iron, 50.59. Insoluble residue, 16.53.

Where phosphorus exists as apatite it is often reduced by washing and jigging the ore, thus bringing some non-Bessemer hematites nearer to, or within the Bessemer limit.

* Journal of the Charcoal Iron Workers.



McCanahan's Improved Double Log Washer
With Crusher, Receiving Screen and Conveyor or Picking Belt.

We had hoped in this issue to have given late results of concentration by magnetic separators, but at the request of parties interested we defer this data until the average of longer runs can be given. We may, however, note that considerable progress is being made towards placing concentrates on the market as a regular source of iron ore supply, and some excellent results have been obtained

The new plant at the Croton Mines, New York, is now in operation, using the Buchanan and Croton Magnetic Separators; the concentrating works near Bechtelsville, Pennsylvania, is now separating a very lean magnetite by the use of the Edison Separator, and at Michigamme, Michigan, the Wenstrom Magnetic Separator is being worked to utilize a large dump pile. A large concentrating plant is in course of erection in New Jersey, two others are approaching completion in northern New York, and a third is being remodelled in southern New York.

A New Oil Separator.—Letters patent have been issued to Mr. C. J. Stock, Superintendent of the Northwest Natural Gas Company, in Ohio, for a new automatic separator, that is designed to separate oil or other fluids from gas. The separator is attached to the line that leads from the well, and is so constructed that no liquid passes in the gas line. It will work readily on any pressure from 1 to 500 pounds. Mr. Stock has been experimenting with the invention for the past two years, and has at last attained success. He has several of them in use in the Dayton field; one by the city of Tiffin; at Bairdstown, and several by the Northwestern in Hancock County. The one at Bairdstown was timed recently, when it separated and threw out 55 gallons of oil in 30 minutes. The capacity of the separator is from 75 to 100 bbls. of fluid per day.

Convention of Ontario Mining Men—Important Resolutions Passed.

At the convention of Ontario mining men called by the Canadian Institute, which met in Toronto on the 31st ult. and 1st inst., Mr. W. Hamilton Merritt was elected chairman and Messrs. G. Mickle and T. A. Gorham associate secretaries. The delegates present were: Representing the Canadian Institute, Messrs. Allan McDougall, Carpmael, Pierce, Bain, David Boyle, H. Merritt, A. Blue, Wm. Ince, Dr. P. H. Bryce, J. Notman, R. W. Phipps, T. R. Clougher, Alex. Rankin, A. Harvey, A. E. Elvins, Chas. Livey, Rev. J. F. Latimer, R. Dewer; Lake of the Woods, W. Young, A. Rankin, C. S. Morris, A. S. Thompson; Sudbury, F. L. Sperry, W. J. Skynner, T. R. H. Ahn, Geo. A. Shaw, R. Gordon, A. McNaughtou, Geo. Dunstan, J. L. Nichols, E. J. Jarvis, J. A. Wright, J. A. Harvey; Port Arthur, T. A. Gorham, T. Marks, W. H. Hunter, W. L. Bell, Robert Martland, W. H. M. Pailand; Perth, W. C. Caldwell, E Elliott; Ottawa, J. M. Clark; Thunder Bay, Peter McKellar, John McKellar, Capt. J. T. McAdam, James McGee; Algoma, P. J. Loughrin, D. Blain, A. H. Barry, M. J. Paterson, Peter Thomson; Marmora, County of Hastings, W. Kelly, H. T. Strickland; Haliburton County, James M. Irwin, Chas. J. Pusey, T. Shortiss; County of Leeds, Robert O. Jones.

The following resolutions were passed:—

"That to secure the advancement of our mining interests as well as to encourage and foster this promising industry, this Convention is of opinion that the most important step is the establishment of a Provincial Department of Mines, to be presided over by a responsible Minister,

whose duty it should be to set in motion such machinery as would lead to the establishment of our mining and metallurgical industries on a firm basis. While some may think that a Bureau of Mines, presided over by one of the existing Ministers, would answer our requirements for the present, it appears to this Convention that nothing less than the establishment of a separate department will meet the exigencies of the case or properly serve the public interest, and that every year the establishment of such a department is delayed will seriously retard the due development of our mining resources.

"A Bureau of Mines will cost as much as a department, and cannot render efficient service. A bureau lacking executive power and having no will of its own could not grapple with the complicated and important questions involved in the development of our mining resources.

"A responsible head is needed to deal with the scientific development, the educational advancement and the practical measures of legislation which in the near future must be initiated.

"This Convention heartily endorses the action of the Canadian Institute in calling it together for the purpose of considering the establishment of such a department.

"That a Provincial museum would materially assist mining and metallurgical development in the Province as advocated by the royal commission, and for the reasons given in the report.

"This Convention remarks with great satisfaction the publication of the royal commission on the mineral resources of Ontario, which supplies a long felt want in the mineral and metallurgical reference literature for the Province.

"This publication has made more apparent the great need of a concise and complete volume on the mineral resources of the Dominion. This Convention therefore takes the opportunity of endorsing the petition presented by the Canadian Institute to the Dominion Government, which set forth that, 'in the opinion of your memorialists, it would be of the utmost benefit to those interested in mineral and metallurgical development were a compilation made of all information relating thereto in connection with the forthcoming census, supplying by that means the gap which has occurred since the publication of Sir Wm. Logan's summary of reports in 1863, since which no publication has been issued relating solely to mines, minerals and metallurgical operations.' And this Convention hereby resolves, that it would be in the best interests of mining and metallurgical development in the Dominion, for the Government to appoint a special commissioner in connection with the approaching census enumeration, for the purpose of carrying out the prayer of the Canadian Institute. And further resolves that a copy of this resolution be sent to the Premier, Sir John Macdonald, and to the Minister of Agriculture, at Ottawa.

"The Convention wishes to comment on the insufficient encouragement hitherto given to the prospector and the preliminary worker in the mining districts. The farmers are supplied with experimental seeds, specimens of fruit and shade trees, the germinating qualities of their grain are determined without charge, letters of enquiry are carried free and answered fully, experimental farms and travelling professors give them satisfactory instruction, so in order that the mineral resources of the Province may be successfully and economically developed, it is desirable that a scheme for the practical and scientific training of those engaged in mining should be adopted by the Government through the establishment of local schools of mines. Lectures by competent persons should be given in the mining settlements, and ready means should be afforded municipal bodies for establishing and aiding such schools and other means of instruction.

"That those portions of the Province containing unsold mineral lands in quantity, should be set aside as mineral districts, due reference being had to portions therein suitable for settlement by farmers, and to necessary reservation for lumbering territory. That the Government be recommended to proceed as rapidly as possible with the completion of the system of township surveys in what is now the unsurveyed territory of the Province, said surveys to accurately describe the topography of each particular township, and if possible the geological formation to be added, the stakes to be of a permanent character, the townships first surveyed being those which are most likely to attract explorers and purchasers; and that all surveys of mineral lands be made by theodolite and not by the compass.

"There should be a local agent in each mining district, whose duty it should be to receive and number consecutively all applications for mining lands within his jurisdiction and to keep the same for public inspection; to facilitate such inspection he should keep in his office in a conspicuous place, easy of access, a list showing the number of each application, the date upon which it was filed, as well as the date of the discovery to which it relates, and the date of the expiration of the same under any regulation relating thereto, together with the name of the applicant or applicants and their address, and having a reference by number to a description of the land so applied for on a map or plan, which he should also keep, showing the area covered by each application, which plan should also show all land patented and the date of the issue of the patent and the name and address of the patentee.

"That this Convention emphatically pronounces against all Provincial taxation in the shape of royalties and ground rents.

"That liberal grants should be made for the building not only of highways, but railways throughout the mining districts. There are millions of acres of Provincial lands which are wholly inaccessible by any other than a canoe route and cannot be mined without roads. The judicious and liberal expenditure of money in roads, and in some cases where experience has proved the value of the district, in railways, would tend not only to promote the actual mining, but the additional sales caused by such expenditures would more than reimburse the Province for its outlay, besides adding largely to its population and wealth. That this Convention heartily endorses the policy of the present Government in aiding railways in new districts, and while fully recognising the liberal aid already extended for the opening up of the new districts both by railways and colonisation roads, the Convention would urge that a still more liberal policy should be pursued.

"That the present system of taxing mineral lands in districts without municipal organisation be continued; but the system of selling for arrears of taxes be discontinued, and, instead, that when the lands are two years in arrears they be advertised, and if the taxes and advertising cost be not paid within one year from the date of such advertisement that these lands revert to the Crown and come then under the then existing regulations as if they had never been sold. Your committee finds that the amount realized by the Government for unpaid taxes, while not large at any time, is in many cases sufficient to cover many thousands of acres of land which is then bought at the sale for a comparative trifle by speculators, who neither sell nor improve their properties; thus the reselling at the Government price of even a portion of these lands would more than cover any loss of revenue that might ensue.

Proposed by MR. CONMEE: "Whether the principle should be recognized that the prospector be allowed to stake out his claim on surveyed and unsurveyed territories.

By MR. CONMEE: "Is it, in the opinion of this convention, in the interests of the mining development of this Province that there should be any development work required before the lands should be patented, except where the land has been bought and paid for forthwith?

"That whereas cases have been represented to this Convention that excessive rates have been demanded by the railways for carrying ore, this convention is of opinion that it would be in the best interests of mineral development that the lowest possible rates should be charged, and that it would be in the public interest that a railway commission with power to regulate rates should be created, and this Convention asks the co-operation of the mining and metallurgical interests of other Provinces in this direction.

"That where in any location development work has been performed by the locatee, a rebate of price should be allowed and an extension of time for payments.

"This Convention believes that in the pending negotiations for a treaty of reciprocity with the United States, a free market for mining products would be to the advantage of both parties, and greatly tend to the development of the mineral resources of Ontario."

"That this Convention is of opinion that the price of mining lands in unsurveyed districts is sufficiently high.

"Whereas an idea has been discussed in the public press relating to an export duty on nickel ores; and whereas it is cheaper to smelt the ores to the state of matte, while the extraction of nickel from the associated metals taxes the resources of the oldest centres of metallurgy; as such a duty would be greatly to the prejudice of the public interest, and contrary to economic principles, this Convention does not hesitate to record its opinion that no such proposition should be seriously entertained.

"That the Convention requests the Government to appoint suitable persons as magistrates to administer oaths for the purpose of the Mining Act in convenient places in the mining districts.

"That the thanks of this Convention are due and are hereby tendered to the Canadian Institute for having invited the members of the Convention to assemble in Toronto and meet in the Institute to discuss the questions that have been passed on during the past two days in the interests of mining, and this Convention believes that the action of the Canadian Institute in this matter and the adoption of the resolutions that have been passed will be found to greatly advance the interests of the mining community in all parts of the Province; and it is further resolved that a copy of the resolution be transmitted by the secretary of the Convention to the secretary of the Canadian Institute."

A Phenomenal Diamond.—One of the strangest lapidarian freaks within the knowledge of diamond experts is on view at Kimberley, South Africa. The stone is in shape and size like a pigeon's egg, of a dark brown color externally, and at first sight opaque. If viewed in a dark place, with a candle or other light so placed that the rays pass through the stone before falling on the retina, however, one sees distinctly the image of a man from the waist upward. Turning the pebble, he sees at another point a woman's face, partly concealed by heavy tresses, and yet, again, on another portion of the surface being applied to the eye, a moonlit cloud sketch is clearly delineated.—*Jewellers' Weekly.*

West Indian Phosphates.

Careful planimeter measurements of the phosphate areas, based upon instrumental field work, show the Island of Navassa to have originally contained about 244 acres of gray phosphate, confined to the lower flat, while of the upper flat red phosphate there were originally nearly 300 acres.

Of the gray phosphate area, perhaps one-half has been exhausted during the last thirty years of development, yielding about 2,000 tons per acre; 95 acres have been partially worked over, and should still yield about 400 tons an acre, while 32 acres is virgin territory, from which the yield may be estimated at 1,500 tons an acre.

The red phosphate areas have scarcely been drawn from at all. An estimated area of about 40 acres already worked out is said to have furnished about 45,000 tons, and from this and correlative testimony, these upper fields may be expected to yield an average of 1,000 to 1,200 tons per acre.

The principal deposits on the upper part of the island have been divided into seven large districts or "fields;" but the surveys demonstrated the existence of at least fifty-six additional separate areas, varying from a few square feet up to 165,000 square feet (or four acres), in area, the aggregate of whose yield in tons will be considerable.

The present methods of digging, transporting and shipping the phosphate material are extremely crude and expensive, and have no doubt been largely the result of plans originally adopted when the material dug occurred close to the present wharf. The company, however, contemplate a radical change in the manner of transporting the phosphate from the diggings to the wharf and vessels, though it is extremely doubtful whether the conditions under which the material exists will justify any change in the system of mining. From the wharf a narrow gauge railroad track, about 1¾ miles in length, extends along the lower flat to the present diggings, being advanced as the phosphate is exhausted. Cars 12 feet long and 4 feet wide outside, and 9' 1½" x 3' 9" x 1' 5" inside, holding about 50 cubic feet of phosphate, are shoved by hand from the diggings to the wharf, where the material is stored in covered houses.

The phosphate rock is readily extracted from a series of contiguous pockets, though at a considerable discomfort sometimes to the laborer, who frequently has an opening only large enough to squeeze his body into, affording scarcely room enough to scrape or dig out the material. Occasionally, when the phosphate is hard, striking bars from a foot to fifteen inches long are used to cut it loose from the surrounding limestone wall, while often it is necessary to resort to dynamite to effect the same purpose. When the phosphate is loose and earthy, which is the character of nearly 85 per cent. of the deposit, short iron scrapers or scoops are used, when the material is thrown into a cylindrical can and drawn to the surface; here it is filled into a box tray holding about half a ton, and placed conveniently to four or five holes, thence it is wheeled to the drying pile beside the railroad track. In rare cases the phosphate holes become large enough to admit several men at one time, when pick and shovel can be brought into service, and the yield per man greatly increased, and this would seem to be more frequently the case on the upper (red phosphate) flat.

In partially dug fields it has been found possible to average about two-thirds of a ton per day per man, mostly rock phosphate; but in a new, untouched area the yield is about 1½ tons per man. From the storage house the material is thrown into hoppers on the wharf 47 feet above sea level, and from there it is drawn through long sheet iron chutes into lighters, carrying about 3½ to 4 tons, and thence conveyed to the ship.

The work so far done in the upper flat is carried on in very much the same manner, the material being conveyed in cars to the edge of the cliff and dumped there through a chute 194 feet long to cars on the lower track, and thence to the storage house. The two varieties of phosphate are stored in different compartments near the wharf, and drawn from at will. Each lighter, of which there are at present seven, is manned by five men, and during good weather is capable of making two round trips an hour to a vessel moored from a quarter to half a mile from the shore. As the average load carried cannot be over 4 tons, the loading capacity under the most favorable circumstances of wind and weather would be about 75 tons a day of 10 hours for each lighter in service. The sea current is generally so strong, and the swell so great, that this output is rarely maintained for two consecutive days, and the material when dry is constantly exposed to loss in its frequent handling, blowing away in clouds of dust. Still with all the disadvantages under which the company labors, compelled as it is to transport men, food and materials of all kinds from the United States, and greatly handicapped by the lack of sufficient appliances for landing and utilizing the same, a considerable annual output is regularly maintained, and if the plans now in contemplation, looking toward a more rapid and economical movement of material from the pits to the vessels, are carried into effect, the output can be readily trebled and the cost very materially decreased.

Welsh Coal for Germany.—The North German Lloyd Steam Navigation Company are reported to have ordered 70,000 tons of coal from Cardiff, and the Hamburg-American Packet Line are also getting a large quantity of fuel from the same place. The leading German steamship companies, it is said, are resolved to buy English and American coals until the German coal ring is broken up.

MINING NOTES.

[From our Correspondents.]

Nova Scotia.

Whiteburn.

This district has been dull, only one mine, the Queen, having worked in March. There are reports of coming activity this summer, and of fresh capital being invested.

Lake Catcha.

Work at the Oxford mine goes on uninterruptedly, and several new and very promising lodes are reported. The development work on the old lode is proceeding rapidly, and the Rand drill plant is pronounced a decided success.

Mr. John H. Anderson has begun the erection of a ten stamp-mill to stamp his own quartz and that of tributers.

Mooseland.

The Mooseland G. M. Co. are erecting a steam hoisting and pumping gear, made by W. W. Howell & Co. of Halifax, and will develop the property purchased from Mr. Stemshorn and others. Prospects are reported as bright.

Darrs Hill District.

The new twenty stamp mill of the Dufferin Co., which was put in commission the latter part of February, ran twenty-four shifts in March, and gave great satisfaction. The iron work of the mill was supplied entirely by the Truro Foundry and Machine Co., and the mortars are of their "Homestake" pattern. The managing director of the company, Mr. A. K. Archibald, expresses himself as fully satisfied with the performance of the mill, and states that the mortars save a much higher percentage of gold than the old pattern; in fact in one run less than 7 per cent. of the total cleanings came from the plates.

Beaver Dam.

The ten stamp mill which was completed and started up in December has been running regularly, and Mr. Turnbull reports excellent results. This mill is also from the Truro Foundry Co., and in three months use shows no signs of defective material or construction. The grade of the ore obtained in March is reported considerably above the average.

Gay's River.

The fifty stamp mill of the Coldstream Mining Co. was completed last month and turned over by the contractors. Ten stamps were started and some test lots, amounting in all to over 100 tons, have been run through. It is reported that some additions will be made to the mill in the way of rock breakers and accessories. Considerable crushing stuff is stacked ready for the mill, but the mine has not yet been opened to the capacity of the mill.

Renfrew District.

There is little or nothing doing here, some five or six men only being employed. Rumor has it that more extensive operations will begin this month.

Malaga Barrens.

The Parker-Douglas Molega Mining Co., and the Boston Gold Mining Co., are all working quietly and there is nothing new of especial interest in this district. It is reported that the Molega Co. will open up the north lode again this summer; only the Rabbit lode has been worked for some months past.

Pictou County.

Some large feeders of water have lately interfered with long-wall work in lower lift of the "Six foot" seam at the Vale. A larger pump has been put in.

The principal operations at the Foord Pit being mainly in the nature of masonry linings for shaft, and other work incidental to the re-opening of the old workings, the output of coal is naturally small, being in the neighborhood of 50 tons per week.

Work at the Black Diamond goes along steadily.

The engine house and new hoisting plant at the Acadia has been completed and is giving satisfaction. The new plant is reported to be highly creditable to the management.

The Jenckes Machine Co. at Sherbrooke, Que., has just completed a very large colliery winding engine, sixty tons in weight, ordered by the Intercolonial Mining Co.. for work at their Drummond colliery, Westmill, Nova Scotia. The engine is a double one with cylinders 28x60 inches, fitted with Cornish valve gear, and is 500 horse power. The drums are ten feet in diameter, and will wind over 5,000 feet of rope each, and it is intended to hoist seventeen boxes of coal at each lift from the slope of the mines, which are at present close upon 4,000 feet in depth.

The New Glasgow Iron, Coal, and Railway Company (Limited), says the *Enterprise*, New Glasgow, has issued $500,000 of 8% first preference shares, and we are glad to know that four-fifths of the issue is already taken up. The whole issue of the ordinary shares ($500,000) is held by the founders. In view of the amount of preferred shares already taken up the directors have felt themselves warranted in contracting for the furnace plant. They will also now arrange for the immediate construction of the railway and the further equipment of the iron mines, and we are assured that the first furnace will be producing iron before the end of the present year. Only one furnace will be built this year, but it is the intention of the company to begin a second furnace as soon as the first is in operation. These two furnaces will embody the very best proven modern ideas for the cheap and rapid production of pig iron, and will suffice to produce an amount of pig equal to all now imported. This company holds large areas of iron ores of fine quality. They also hold two very large deposits of limestones, both the lime and ore being tapped by their own railway, the total length of which is only about twelve miles. They also have two fine coal seams in the Marsh district, and not more than ten miles from their furnace site. In short, they are extremely well situated as regards raw material, and we confidently expect that they will, within a short time, displace the bulk of the imported pig. It certainly looks as if, unless the consumption of pig iron in Canada is increased very largely, that this company will be able to meet the entire Canadian demand for some time. The directors are: John F. Stairs, president, M.P., Halifax; Graham Fraser, vice-president, (president of the Nova Scotia Steel and Forge Co.), New Glasgow; William Jacks, Glasgow, Scotland; Frank Ross, Quebec; George F. McKay, New Glasgow; J. Walter Allison, Halifax; Harvey Graham, New Glasgow.

Satisfactory progress has of late been made floating the stock of the New Glasgow Iron and Railway Co. Of the $500,000 preferential stock all has been subscribed with the exception of $60,000, and this, it is thought, will be taken up in a day or two.

It is reported that the New Glasgow Iron and Coal Company is proceeding with the erection of a blast furnace, 60' in height, 14' diameter of bosh.

Mr. E. Gilpin, jr., secretary of the Board of Examiners of Colliery Officials, announces an examination of candidates for certificates of competency as Underground Managers or Overmen, to be held at Sydney, Springhill and Stellarton, on the 27th May.

E. Sjostedt is mining a good deposit of iron ore on East River, Pictou Co., and shipping it to Londonderry. He is organizing a company partly Canadian and partly American, and the proprietors of the Katahdin Iron Works, Maine, of which Mr. Sjostedt was formerly manager, contemplate removing the whole of their smelting plant from Maine to Pictou County, as they are also interested in the property. It is proposed to build a furnace for charcoal pig with a production of some 40 tons per day. A car-wheel factory is also being considered.

Cumberland County.

At Parrsboro', twenty miles west of Springhill, a four foot seam has been opened and a company formed to operate it during the coming summer.

At the Springhill colliery, work is now as brisk as ever, and the output is rapidly coming up to the well known standard.

Very little mining is going on at the Joggins, the work having been temporarily suspended in order to carry out some improved facilities in carrying coal from pit's mouth to wharf. Formerly the coal was sent down a shoot nearly two hundred feet, which had a tendency to crush and damage the coal. This is to be obviated by the construction of a tram line 1½ miles, operated by endless cable, which will carry the coal direct from the pit to the vessel at wharf.

Mr. R. G. Leckie, general manager of the Londonderry Iron Works, was in Ottawa the other day, and kindly furnished our representative with the following details regarding the improvements recently made in the company's plant: A new blast furnace has been built and was blown in on the 6th inst. Its dimensions are: height of stack, 75'; diameter of bosh, 18'; width of hearth, 9'; and it is constructed on the most approved plans. There are three hot blast stoves upon the Siemens-Cowper principle, 60' in height and 20' in diameter. Two blowing engines, made by Daniel Adamson and Co., Manchester, Eng., have been put in. The cylinders have a diameter of 48" and a 5' stroke. The weekly product will be between 600 and 700 tons pig iron. Two gas kilns for roasting ore, capable of treating 160 tons daily, have also been erected, with gas producers in connection. In the rolling mill, two new puddling furnaces have been added, which brings the daily capacity up to between 35 and 40 tons of puddled bar.

There have been very important developments of ore at the East mine. A large body of spathic ore has been opened at Slack's Brook, having a width of over 30 feet. About three-quarters of a mile further east the same vein is being worked in an open quarry; there it is 50 feet wide. The ore, which is free from sulphur and phosphorus, after calcination in the gas kilns averages about 42 to 45 per cent.

There are about 900 men now in the company's employ in the works and mines. The output of ore from the mines last year was about 50,000 tons; and the total production of pig iron was 18,000 tons.

A mine has also been opened up in Torbrooke, Annapolis Co., where a six foot vein of clean ore has been located and opened upon at different places over fully two miles. The ore averages 60 per cent. iron, and the earthy constituents render it very easily smelted. As a mixture for the Londonderry ores it is highly beneficial, producing the best foundry pig iron yet made in Canada, and considered equal to "Coltness" and other highest brands of Scotch pig iron. About 80 tons per day are mined from this property; 40 men are employed.

Cape Breton.

The sales of Cape Breton coals, in contracts, so far reported are: International, 90,000 tons; General Mining Association, 60,000 tons; Caledonia, 55,000 tons; Reserve, 60,000 tons; Gowrie, 45,000 tons, making an increase in contracts this year, over last year, to date of about 100,000 tons. Shipping has been almost continuous through the winter from Cow Bay. Coal is being briskly banked from all the mines, and the preparations for re-opening and working the Emery, Gardiner and Ontario collieries are about complete. It is said that there will be a general demand for an increase in the prices for cutting coal in Cape Breton collieries as soon as navigation opens.

The Gowrie Coal Mining Co., Messrs. Archibald & Co., has purchased a large steamer for the coal and general trade between Cape Breton and Newfoundland.

Colchester County.

"In the East Brook," writes Mr. Hugh Fletcher, "which flows into Stewiacke River from the south, about eight miles above the station, a seam of coal, apparently not exceeding eighteen inches in thickness of mixed coal and carbonaceous shale, was lately opened. A boring sunk about 80 feet at Johnston Brook, not far distant, is said to have cut black gypsum, and the coal is probably about the same horizon as that of Kennetcook. The celebrated scythestone of Birch Hill, a fine gray sandstone, with sharp grains of silica, is found in the same neighborhood. Coal was also reported to occur at Selma, but the report seems to have arisen from the presence of thin bands of dark grey shale, marked with fossil plants, among thick beds of grey flinty sandstone, which forms barrens in the neighborhood At the request of Mr. Robert H. Fraser, Superintendent of the Nova Scotia Central railway, a visit was paid on the 20th of October to borings made in search of coal at Spa Springs, Annapolis county. One hole had been sunk 100 feet, but nowhere in the neighborhood were rocks seen in which coal could reasonably be expected to occur."

Quebec.

Ottawa County.

There is much activity in phosphate mining in the Templeton district, and the aggregate output promises to be the largest since mining was begun. Twelve companies and individual operators are at work.

McRae & Co. have 25 men on surface work. A fine show, reported to be 20 feet wide and 50 feet long has lately been uncovered. It is intended to add an electric percussion drill to the plant already in place.

Messrs. Lomer, Rohr & Co., have opened a pit on lot 8, about eight acres from the Blackburn pit. A steam plant is being put in.

About 115 men are at work at the Blackburn. An output of 20 tons, high test, per diem, is reported.

The Macgregor Lake Phosphate Co. has started work on the Pearson property. An efficient steam plant is being put in here.

C. B. Falardeau has a force of 20 men on the old Canada Industrial property.

The Netherlands Company have 40 men on the lots purchased recently from the Templeton and Blanche River Co.

McLaurin & Sons have 25 men on N½ lot 9 in the 12th Range.

Messrs. Fissiault and Lepage have purchased the Grandmaison property, 300 acres in extent. Price reported to be $6,000. Property undeveloped. They have also 22 men working on their property on 4th Range.

Two men were killed about three weeks ago by a fall of rock at the Perkin's property, operated by Messrs. Lomer Rohr & Co. Coroner's jury gave a verdict of accidental death.

Mr. Thos. Fee has taken out about 80 tons from the old Jackson Rae mine.

Navigation on the Lievres has been resumed.

The Dominion Phosphate Co. have, in addition to their operations at the North Star, started a gang on their Washington property adjoining the Emerald.

Much interest is being taken in the suit of the Emerald Mining Co. *v.* the Anglo-Continental Guano Co., now before the Aylmer assizes. The plaintiffs claim heavy damages for alleged encroachments on their property.

Eastern Townships.

The early opening of spring causes the asbestos miners in the Thetford and Black Lake region to hope once more. The past winter has been a hard one. A great deal of snow has been handled at the mines. Notwithstanding all, the output at most of the mines has been kept up better than other winters. There is now available an abundance of water, for which all are grateful.

Some mines, as noted in previous issues, were compelled to close down nearly all of their machinery during two months, are now working with all force.

Much new machinery is being added to the plants. Messrs. King Bros. have their crushing plant in operation at Thetford mines, and it is giving satisfaction.

The principle difficulty encountered so far in connection with the dressing of asbestos by machinery, is in separating or grading the fibre after it has been passed through the crusher and rolls. Little has been done in this direction yet other than with screens, but we think with the plants of Messrs. King and the Scottish Co., and the American Co., a great deal of the hand labor employed before will be done away with.

The property of the Scottish Canadian Asbestos Co. in liquidation, was sold April 19th, by tender. The property was bought by Col. R. E. Aitken, Glasgow, representing a new company called the Glasgow and Montreal Asbestos Co., by which name the mines will be known in future. Work has been commenced, and in a few weeks a large force of men will be employed. Mr. Matthew Penhale continues with the company as superintendent.

The Beaver Asbestos Co. at Thetford, have given an order for more machinery to be put in position at once. They will also erect a cable derrick in place of the ordinary boom.

A boiler and steam drill has been added to Messrs. King Bros. plant at their Black Lake mine.

All the mines are increasing their forces as the season advances. There is every indication of a good year's work, with a much longer output than last year.

A dividend of 20% has been declared by the Anglo-Canadian Phosphate Co. This must be very gratifying to Messrs. Irwin & Hopper, the Canadian management.

Pontiac County.

The engine house at the Bristol Iron Mines was destroyed by fire about three weeks ago. It has, however, been rebuilt and the machinery repaired.

Temiscamingue.

Work at the galena mine here has been temporarily suspended, water having been struck in the workings. Suitable pumping gear will be installed and operations resumed in a day or two.

Ontario.

The development on the Belmont Bessemer Ore Co's. property has so far been very satisfactory. No. 1 diamond drill hole has been put down 100 feet, and shows at least 60 to 70 feet of good ore—perhaps 75 feet. The cores seen show no sulphur, which had been feared; at 90 feet fine pure ore is shown with a little lime, which will help to flux it. The showing so far is fully equal if not superior in quality to some of the best Port Henry mines, and the quality is first-class Bessemer. The New York owners are much pleased, and intend to put on a large force of men at once.

The following notes of Mr. H. P. Brummell, who spent some time last year in the oil fields making investigation for the Government, will be of interest: "In Essex county extensive drilling operations were in progress at various points, more especially in the district between Essex Centre, Harrow and Leamington. At Essex Centre the Central Gas and Oil Company of that place have finished a well 1,200 feet in depth without, however, any economic result, as neither gas nor oil were obtained. At Walker's Marsh, the Messrs. Walker and Sons, of Windsor, have finished three wells from which a very considerable flow of oil was obtained. They have also been actively carrying on operations in other parts of the county, and in the adjoining county of Kent. The Citizens Gas, Oil and Piping Company, of Kingsville, during the year drilled on the road allowance, west of the well known as 'Coste No. 1,' where a daily flow of gas amounting to over 7,000,000 cubic feet per day was obtained; this gas is now being utilized in lighting the streets of Kingsville, to which town it has been piped. The drilling of this well was the cause of considerable litigation between the owners and the Ontario Natural Gas and Fuel Company, the owners of 'Coste No. 1;' the result of the suit was, however, in favor of the former company, the injunction given at the instance of the latter company not being sustained. The Ontario Natural Gas and Fuel Company have, it is understood, again undertaken operations in the county, in that part between 'The Marsh' and Essex Centre, with what result, however, we are unacquainted. Various other operators have been working throughout the county, but owing to lack of time I was not enabled to ascertain the result nor the extent of their operations.

"In Kent county, in addition to the work done by Messrs. Walker & Sons, mentioned above, a certain amount of work has been carried on, notably the well sunk by the Citizen's Gas Company of Blenheim, where in a boring 900 feet deep small flows of gas were obtained at 700 and 800 feet.

"At Stratford, Perth county, a boring was undertaken by the Stratford Natural Gas Company, which at the time of my visit, on the 12th of August, had reached 900 feet without encountering gas or oil.

"In Welland county the Provincial Natural Gas and Fuel Company, have finished their series of wells to the number of fourteen, all of which are situated in the townships of Bertie and Humberstone, in the vicinity of Sherks Station on the Grand Trunk railway. Other operators have been busy throughout the county, notably Messrs. Conmiller & White, who drilled for and obtained gas in the town of Port Colborne. John Rube struck gas a few miles west of that town; this gas is being utilized in the firing of lime-kilns owned and operated by Mr. Rube. Another lime producer, Mr. Carroll, drilled in the south-west part of Bertie township, and in the northern part of Port Colborne, Mr. Edward Wear struck a well from which a daily flow of gas of over 400,000 cubic feet is recorded.

"In Wentworth county considerable activity has been evinced in the search for gas and oil, several wells having been sunk in the vicinity of Hamilton, though with what result was not ascertained.

"Outside of the counties above mentioned, but little has been done except in the County of Lambton, where, in the oil territory of Enniskillen township, the usual amount of boring has been carried on and many new wells brought in with the usual average daily flow of oil."

Later information regarding the development work on the Belmont Bessemer Ore Co.'s property in Belmont Township, states that a diamond drill hole has been put down vertically 100 feet, fully two-thirds of which depth gave cores showing good ore with very little sulphur, but most of it carrying a little lime, which will help to flux it At 90 ft. the core showed very fine solid ore without a trace of sulphur. This depth was considered sufficient for the first hole. They then started No. 2 hole about 300 ft. south east of No. 1, and passed through 8 ft. of very fine ore, which has analysed 68 to 70% of metallic iron, almost free from impurities. After that, however, some very hard green rock was struck, and two of the diamonds were lost and others loosened, so the bit was sent to Chicago to be re-set. This rock is much the same as was met with in No. 1, and it is expected that ore will be found below it. It is intended to connect the mine with either the C.P.R. or Central Ontario Railway, and a charter is now being applied for from the Ontario Legislature, under the name of "The Ontario Northern and Belmont Railway." Recent analyses show the ore to be of remarkable purity, as will be seen:—

Pit.	Metallic iron.	Phosphorus.	Sulphur.
No. 1.....	63.131	.023	.004
2.....	69.33	.016	.0375
3.....	69.85	.013	.012
3.....	70.326	0056	.0023

The ore bed has been found to extend over 600 ft. north and south, with a width in some places of 400 ft., and other outcrops have been found about 300 yds. north-east of the present workings. It is intended to put a large force of men at work immediately.

Madoc District.

Reports from Madoc state the old Malone gold mine has been reopened. A small force is employed. Results to date satisfactory. The owners are talking of erecting a stamp mill.

There is also talk of the Delora mine starting up soon.

Some excitement has been caused by the reports of a rich discovery of gold ore at a point about 10 miles north of Malone. Particulars are not to hand yet.

Sudbury.

R. P. Travers, of Chicago, manager of the Chicago Nickel Co., has twenty men and two steam drills at work in Drury Township. Between 800 and 1,000 tons of ore have already been mined.

A Chicago company has commenced development work on D. O'Connor's property in Lorne Township. Fifteen men are at work there.

Mr. A. Merry, formerly with H. H. Vivian & Co., is opening up the valuable property sold by J. Stobie and others to the Huntington syndicate of London, Eng. The property is in Levack Township, near the Onaping River. Sixty tons of ore are now awaiting transportation to England.

Considerable interest was manifested in the Sudbury region in the recent mining convention, held in Toronto. F. L. Sperry, Judge McNaughton and W. J. Skynner, were the Sudbury delegates in attendance.

Leave the price of mining lands as they were before the 1st of last December; require a certain amount of work to be done annually on all claims taken out; open an office in Sudbury under a Bureau of Mines for the adjudication of mining claims; tar and feather the country editor who shouts "export duty," and the future of this great mining region will be assured.

The erection of the new Bessemer plant by the Canadian Copper Co. at Copper Cliff, will probably be completed in June or July.

Mr. Daws, who has been manager of the H. H. Vivian & Co. plant at the Merry Mine, for the past year, has resigned his situation and returned to England. Mr. Hendrickson succeeds Mr. Daws as manager.

Port Arthur District.

The Port Arthur Board of Trade has appointed a committee to draw up a memorial to the Ontario Government praying for the repeal of the clause in the new Mining Bill, which exacts a royalty on the product of provincial mines.

The Dominion Coal Company, of Canada, recently addressed a letter to the city council of Port Arthur, offering, for a bonus of $11,000, to build additions to its docks at Port Arthur sufficient to accommodate all the coal received by them and to handle all coal in the local trade and also all coal for shipment east and west. It is understood that the company also asks certain exemptions from taxation for the next ten years, but this point does not appear altogether clear. The company has not, thus far, done a very heavy business in Port Arthur, handling only 17,380 tons of coal last season, but the trade is a growing one and promises to be a good thing for the town.

At the Porcupine, sinking is being done from the second level and the shaft is now down about 20 feet from that point. Good ore is being encountered. Work is also being pushed in No. 3 vein where drifting is being done and here they are in good mill ore. It is expected that the mill will resume operations in about two weeks, or as soon as they can get water. A shipment was made from this mine of 40 barrels of ore a week ago Tuesday.

Apropos of the sale of the Badger and the application for letters patent by the new company, referred to elsewhere, we have been advised that Mr. H. N. Nichols is now superintending operations at the Badger and Porcupine mines. The mill is not working at present, as it is being repaired and enlarged. It will probably be ready in a short time, and will be at once put into operation. A tramway is now being built between the two mines. There are now about 65 men at work in the Badger.

British Columbia.

In our Company Column our readers will see the memorandum of association of the Westminster Slate Company, Limited. This company has been formed to purchase and carry on the Jervis Inlet Slate Quarry, now owned by H. V. Edmonds, J. A. Webster, C. E. Woods, T. F. Sinclair and H. F. Clinton. The quarry is situated near the water of Jervis Inlet, thus making the cost of transportation very light. The slate is of very good quality, of a uniform blue color, without flaws or impure matter in it, splits easily, and is said to cut much closer than the Bangor product.

The shipments from the collieries for the month ended 31st ulto., were:—

		Tons.
New Vancouver Coal Co	.....	35,876
Wellington	"	17,972
East Wellington	"	3,806
Union	"	4,400

"There is now in the C. P. R. freight sheds," says the *Vancouver World*, "awaiting shipment to Cariboo, a powerful piece of machinery to be used in separating the gold from the gravels of one of the mining claims in that famous gold producing country. It is none other than a hydraulic giant, from the Joshua Hendy Machine Works of San Francisco, of the largest size turned out by those famous works. In fact only one other of the same size has been made, and that for the noted Benjamin claims, in Trinity County, Cal., owned by D. V. Hays of Boston.

The machine has been purchased by the South Forks Hydraulic Mining Company, for their claim on the South Fork of the Quesnelle River. Some idea of the power of this hydraulic giant may be got from a few details of its construction. The discharge pipe is 15 feet long, on the smaller end of which a deflector is placed to control the direction in which the stream is to be thrown. With the head of water which the company will have at their command, the seven-inch nozzle will discharge about 1,800 miner's inches of water, and as 50 miner's inches is equal to one cubic foot per second, this means 36 cubic feet per second. Should circumstances demand it smaller nozzles may be used down to 5 inches in diameter. The water is brought from the tank or pressure box, 300 feet vertical height above the machine, by a pipe of steel plates 18 inches in diameter. It consequently passes through the machine into the discharge pipe under a pressure of about 130 pounds to the square inch, and comes from the nozzle with a velocity of about the same number of feet per second. The discharge pipe fits upon the machine with a ball and socket joint which gives it a deflection of almost 90 degrees in a vertical direction. The upper part of the machine, and to which the discharge pipe is attached, turns horizontally on the lower or bed part so that all these parts combining give the operators complete control of the direction of the stream. The company owns a claim which consists of a bank of gold bearing gravel with a face about 200 feet in height. Against this bank the powerful current thrown by the machine impinges, washing the earth and gravel into the sluice box four feet wide at the bottom. The gold being the heavier falls to the bottom and is caught in spaces left between the blocks with which the flume is paved. The work of such a giant apparatus is quick and effective, saving a great deal of labor, and accomplishing what would be almost impossible in any other way.

The diamond drill, working at Northfield, is going through some very hard cement filled with small black pebbles that will cut glass like a diamond, and consequently work is rather slow.

The boring machine at present in use at Comox is to be brought down to Nanaimo and started in operation at Departure Bay near South Wellington wharf.

A correspondent of the Westminster *Ledger* has had an interview with Mr. J. Bowron, Gold Commissioner for the district of Cariboo, and also with Mr. W. C. Price, foreman of the Government reduction works at Barkerville. It was learned from Mr. Bowron that a large bed of auriferous gravel had been discovered running parallel with the Quesnelle river, and extending for about ten miles, every linear foot of which has produced the value of $1. The bed, which was discovered by some Chinamen working close to the forks, lies behind the perpendicular cliffs which here border the river. It is now taken up both above and below the forks, and among the firms working on it are the following: The Victoria Hydraulic Mining company, the South Walk, Champion, Pomeroy and Whittier hydraulic mining companies. Mr. Bowron considers this one of the most important finds that has been made for many years. Both gentlemen were warm in their praises of the good work done by the reduction works, under the able superintendence of Mr. E. A. Martin, a gentleman in whom all have the most unbounded confidence, and it is their opinion that these works will do wonders towards developing the quartz mining of the district, which, on the showing of the Black Jack mine, undoubtedly has a great future before it. But on the other hand both Mr. Bowron and Mr. Price are positive that a railway going by way of the Yellow Head Pass is an absolute necessity to the thorough development of the country, both in its mining and farming districts, and also that such a line could not help proving a paying investment to its promoters.

The contractors who have the sinking of the new shaft to connect with workings of No. 1 mine of the New Vancouver Coal Co. at Protection Island Point, are making rapid progress with their work. The principal difficulty encountered as yet has been a strong spring of sulphur water which is hard on the eyes of the workmen. The shaft is being substantially timbered as the sinking proceeds. Three shifts daily are worked.

The New Vancouver Coal Co. will, during the summer, build several houses for the use of their employés. The wharf for shipment of coal will probably be commenced in the early fall, but there is no hurry for that as the shaft has to go down about five hundred feet from the surface before striking the No. 1 level.

The apparatus for lowering coal at No. 1 shaft, New Vancouver Coal Co., is giving great satisfaction and the idea will probably be extended to the other shutes in the near future. The one at present in use is capable of lowering 120 tons of coal per hour and as it is situated right over the hold of the vessel to be loaded the coal is not pulverized as when it is shot down an inclined plane for some distance.

All the shafts being sunk by the Company are going well and satisfactorily. The bore at Northfields is down 300 feet having gone through two bands of very hard conglomerate, one 80 feet in thickness and is now in another small one of the same sort.

LEGAL.

The action of White's Asbestos Company (Limited), vs. Hoare, which was heard in December last before Mr. Justice Day and resulted in a judgment for the defendant, came before the Appeal Court, consisting of the Lord Chancellor, the Master of the Rolls, and Lord Justice Fry, on appeal by the plaintiffs; but it was stated that the parties had arranged that an order should be taken by consent, dismissing the appeal with costs, and for repayment of the sum of £150, being the amount recovered by the defendant on his counter-claims, and which had been paid into Court pending the result of the appeal.

Macintosh v. Wills.

This case came up before Mr. Justice Malhiot in the Circuit Court at Aylmer, on the 15th inst. Mr. T. P. Foran appeared for the plaintiff, and Mr. C. J. Brooke for the defendant. The action arose out of the suit of The General Phosphate Corporation against Macintosh, noted in our February issue, in which the plaintiffs sued to recover certain plant alleged to have been unlawfully removed from their property. For the defence it was pleaded that said plant had not been transferred with the property, but belonged to defendant, one of the original owners, and the action was dismissed. The defendant then brought suit against the former plaintiff personally, to recover $59 damages for illegal seizure and the costs incurred. In response it was put forward that the defendant had acted in good faith as the manager of the company and believing himself to be the legal custodian of the property he had felt bound to take action to recover it. The case was taken *en delibere*. Judgment was rendered on the 20th inst., the case being dismissed.

CANADIAN COMPANIES.

De Nederlandsche Phosphaat Matschajpy.—This company has been formed for the purpose of working the phosphate properties formerly owned by the Templeton and Blanche River Phosphate and Mining Company, viz., certain areas in the 9th, 10th and 11th ranges of East Templeton, Que. Messrs. Miller & Company, Commissioners street, Montreal, are the Canadian agents for this company, of which we hope at some future date to give the financial particulars. Twenty-five men are employed.

The Westminster Slate Company (Ltd).—Application will be made for incorporation under British Columbia laws for the purpose of purchasing and carrying on the Jarvis Inlet Slate Mine, and the acquiring and working of other mineral claims, mines and stone quarries, together with other powers. Head office, New Westminster, B.C. Capital stock, $100,000 in 1,000 shares of $100 each; with power to increase to $250,000. The time of existence of the company to be fifty years. The applicants are: H. V. Edmonds, A. G. Gamble, and H. Fiennes-Clinton, all of New Westminster, B.C., who are to be the first trustees.

The Glen Iron Mining Company (Ltd).—Application will be made for the incorporation of the above company under the British Columbia "Companies Act," for the purpose of prospecting for, acquiring and working mineral claims and coal lands; the erection of the necessary plant; the operation of railway and steamship service in connection therewith, and for all other customary powers. Head office, Kamloops, B.C. Capital stock, $50,000 in 500 shares of $100. Applicants, J. W. Mackay, J. A. Mara, J. O. Grahame, H. Burchell, W. E. Scott, F. J. Fulton, all of Kamloops, B.C., and F. S. Barnard and John Irving, both of Victoria, B.C. The trustees are to be five in number. The first are: J. W. Mackay, J. A. Mara, J. O. Grahame, W. E. Scott and F. J. Fulton. The time of existence of the company is to be fifty years.

The Nelson Smelting and Mining Company (Ltd).—Application will be made for the incorporation of this company, to carry on the business of smelters and refiners, founders, assayers and dealers in bullion and metals, and products of smelting of every description; to work mines, and anything that comes within the province of a general mining and smelting business, with the customary powers thereto attached. Head office, Nelson, B.C. Capital stock, $500,000 in 50,000 shares of $10 each. Applicants, E. R. Atherton, W. A. Crane, A. J. Marks, T. C. Collins, W. Hill, C. H. Ink, G. A. Bigelow, of Nelson, B.C., all of whom are to be the first trustees.

British Columbia Roburite Explosives Company (Ltd).—This company is applying for incorporation under the British Columbia Act, in order to acquire from John Wilson, one of the applicants, for $3,000, the license to use and exercise within the Province of British Columbia a certain invention consisting of an approved explosive called "roburite," granted to the said John Wilson by an indenture dated the 29th day of May, 1889, and made between The Roburite Explosives Company, Limited, of 103 Cannon street, London, England, of the one part, and the said John Wilson, of the other part. To carry on the manufacture of the said explosive called roburite, also of powder and explosive substances and compounds of all kinds which can be manufactured or dealt in consistently with the said license; to import, purchase and otherwise acquire all compounds, matters, materials and things necessary or incidental to, or for objects aforesaid, and to sell and deal in the said explosive, powder, substances and compounds, with other powers. Head office, Victoria, B. C.; capital stock, $50,000, in 500 shares of $100 each. Applicants, J. Dunsmuir, F. G. Vernon and John Wilson, all of Victoria, B.C., all of whom are to be the first trustees.

The Phosphate Milling and Shipping Company (Ltd).—Registered by J. T. Heppell, 8 Frederick's Place, London, E.C., with a capital of £10,000, in £5 shares. Object, to acquire, in the Dominion of Canada or elsewhere, any phosphate or other mines, and to carry on generally the business of phosphate miners, etc.

Kingston Phosphate Company (Ltd).—Notice is given in the *Ontario Gazette*, that this company, incorporated under the laws of Great Britain, is by letters patent, empowered to acquire phosphate or other mines or mining claims; to carry on the business of mining, crushing and rendering merchantable such ores, manufacturing chemical manure, etc., with all customary powers and privileges.

Bras d'Or Lime Company, (Ltd).—A very satisfactory report was presented at the annual meeting of this company held in Halifax. The output of lime at Marble Mountain has been largely increased by the erection of a second patent draw kiln, bringing the total capacity for the current year up to 60,000 barrels. Other departments have also been proportionately enlarged. There is a good local demand, but the majority of the output of 44,000 barrels was shipped to New York and Boston. The financial statement was satisfactory, a good profit having been earned.

The Belleville Natural Gas and Oil Company, (Ltd).—Application will be made to the Ontario Legislature for the incorporation of this company, for the purpose of prospecting, boring and mining for gas, oil, salt or other minerals; with the customary powers respecting pipe-lines, plant, real estate, etc. Operations to be carried on in the counties of Hastings, Prince Edward and Northumberland. Head office, Belleville. Capital stock, $25,000, in 2,500 shares of $10 each. Applicants, H. Corby, M.P., T. Ritchie, J. L. Biggar, U. E. Thompson, H. Pringle, W. S. Hunter, M. E., T. S. Carman, J. E. Walmsley, S. A. Lazier, G. H. Pope, W. N. Ponton, all of Belleville, of whom the first nine are to be the first directors.

The Mattawin Iron Mining Company.—This company is applying for incorporation under Ontario laws, for the purpose of developing and operating iron and other mines in the District of Thunder Bay, and manufacturing the products of the same, with the customary powers respecting real estate, hydraulic privileges, etc. Head office, Kingston. Capital stock, $100,000 in 1,000 shares of $100 each. Applicants, B. W. Folger, M. H. Folger, F. A. Folger, M. J. Grady, Kingston, and J. Hammond, Fort William, all of whom are to be the first directors.

The Badger Silver Mining Company, of Gillies, Ontario.—This company is applying for letters patent under Ontario laws, in order to carry on the business of exploring, mining, smelting, manufacturing and refining, etc., of silver and other ores and metals; to acquire land, put up plant and machinery, etc. Operations to be carried on in the District of Thunder Bay. Head office, Port Arthur. Capital stock, $250,000, in 50,000 shares of $5. Applicants, John M. Stowell, M.E., Chas. A. Read, Walter Read, Chas. G. Sammond, and C. Preusser, all of Milwaukee, Wis.; J. M. Stowell, C. A. and W. Read and C. Preusser are to be the first directors.

The Ontario Nickel Company, (Ltd).—This company will apply to the Ontario Legislature for incorporation with power to explore for, mine, smelt and refine, nickel, lead, silver, gold, copper and other ores and metals; to acquire real estate, erect plant and machinery with other customary powers. Operations to be carried on in the District of Algoma and Toronto. Head office, Toronto. Capital stock $50,000, in 1,000 shares of $50. Applicants, J. Wright, G. S. Crawford, A. B. Cameron, W. M. Richards, G. W. S. Lindsay, W. L. McK. Lindsay, all of Toronto, of whom the first three are to be the first directors.

Newfoundland and Canadian Exploration Trust (Limited).—Registered by Burn and Berridge, 11 Old Broad Street, London, E.C., with a capital of £150,000 in £1 shares. Object, to acquire and take over the mining and other rights and property of the Newfoundland Colonization and Mining Company (Limited). The first subscribers (who are each down for one share), are: J. H. Filmer, 12 Wentworth Terrace, New Southgate; H. de J. Chudleigh, 13 Richmond Gardens, Forest Gate; P. R. Stamper, 6 Rebecca Terrace, Gomm Road, S.E.; T. Jones, 212 Boundary Road, Walthamstow; C. Ruff, Farncombe, Godalming; B. Wilkinson, 66 Torrington Square, W.C.; M. J. Burn, 11 Old Broad Street, E.C. There shall not be less than three nor more than twelve directors; the first to be appointed by the subscribers to the memorandum of association. Qualification, £250. Remuneration, £1,500, divisible. They shall also be entitled to 5 per cent. of net profits available and appropriated for reserve bonus or dividend. Such percentage shall in no year exceed £5,000, and shall be divisible.

Glasgow and Canadian Asbestos Company.—This is the name of a new company formed to take over the property at Black Lake, Que., formerly owned and operated by the Scottish Canadian Asbestos Co.

Anglo-Canadian Asbestos Company.—At the general meeting of this company held in London on the 16th instant, a dividend was declared for the past year at the rate of 20% per annum.

The Incorporated Construction Company of Canada.—Notice is given that the above company will apply for incorporation to the Dominion Parliament at its next session, with power to carry on the business of mining and manufacturing of iron and steel, of vessels, railway rolling stock, etc., with other powers.

The Montreal Coal and Elevating Company.—This company will apply to the Dominion Parliament at its next session, for incorporation, for the purpose of erecting wharves, warehouses and elevators and affording additional facilities at certain ports of the Dominion of Canada for the unloading and warehousing of coal, and for other powers.

The Hamilton Light and Power Company (Ltd).—This company is applying for letters patent under Ontario laws, with power to acquire the electric light plant, property and franchises as heretofore carried on in Hamilton, and to carry on the business of generating and supplying electricity for light, heat and power in Hamilton and within a radius of ten miles therefrom, with usual powers. Head office, Hamilton. Capital stock, $200,000, in 2,000 shares of $100 each. Applicants, W. H. Howland, H. M. Pellatt, Toronto; D. Graham, Montreal; R. Kennedy, J. M. Lottridge, R. Thompson, J. V. Teetzel, H. S. Stephen and D. R. Dewey, all of Hamilton, all of whom are to be the first directors.

The Grimsby Quarry and Transport Company (Ltd).—This company is applying for letters patent under Ontario laws, for the purpose of acquiring, leasing and selling lands for quarrying purposes in the County of Lincoln, working quarries, dressing and cutting stone, and carrying on the business in all its branches, with the usual powers. Also to carry on a general forwarding business, to build a tramway, own vessels, etc. Head office, Grimsby. Capital stock, $20,000, in 200 shares of $100 each. Applicants, S. Webster, Toronto; F. L. Webster, Grimsby; F. T. Webster, A. B. Webster, Toronto, and J. Lush, Lambton Mills, the first three to be the first directors.

The Montreal Metal Works (Ltd).—Application will be made by this company for letters patent under the Dominion "Companies Act." The powers required are: (*a.*) To deal in, manufacture and draw brass, copper and other metals, and to manufacture wires, rods and cables. (*b.*) To manufacture and deal in every description of apparatus and metals, and the appurtenances of the same used in connection with the business of telegraph, telephone, electric light, electric railway or cable companies. (*c.*) To construct or contract for the construction for others of electric light, telegraph, telephone or cable lines or plant. (*d.*) To purchase or lease electric light, telegraph, telephone or cable plants, works, lines or apparatus or any other portion thereof from other companies or corporations, or from any person or persons; or to advance money to build or operate such plant, works, lines and apparatus. (*e.*) To become a shareholder in or amalgamate with any electric light, telegraph, telephone or metal, wire, brass or cable company or corporation. (*f.*) To obtain and hold and operate and to purchase, lease or license, patents or patent rights or industrial designs, and to sell, lease or otherwise dispose of the same; with customary financial powers. Head office, Montreal. Capital stock, $50,000, in 500 shares of $100 each. Applicants, C. F. Sise, G. W. Moss, Hon. J. R. Thibaudeau, Frederick L. Béique, Q.C., advocate, John Carroll, manufacturer, all of Montreal; Charles A. Hamilton, Henry Stanley, both of Bridgeport, Conn., and Eugene F. Phillips, Providence, R.I.

Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	—	
Nicola, Limited, £35,000 fully-paid shares of £1	—	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	—	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	—	
Ditto, £80,000 5½ per cent. debentures	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3	3¼
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¼	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	—	
Ditto, £149,500 fully-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	2⅞	3⅛
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	—	
Ditto, £25,000 fully-paid deferred shares of £10	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	12⅜	12⅝
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	—	
Ditto, £5,000 fully-paid founders' shares of £10	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—	
Ditto, £99,850 fully-paid shares of £50	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £60,000.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos.—Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on.

Phosphate Quotations.—Messrs. Wilson & Green quote, f.o.b., Montreal: 85 per cent. guaranteed, $23.75; 80 per cent. guaranteed, $21.25; 75 per cent. guaranteed, $16.50; rising 40c. per unit per ton. 70 per cent. is worth about $13.50, 30c. per unit.

The Placing of Mining Companies on the Stock Exchange.—The following valuable suggestions in the form of a series of questions, were addressed to a Committee of the Melbourne Stock Exchange, Australia, by the Minister of Mines of the Colony:—"1. Is it desirable that before a mining company is registered or is placed upon the share market a report upon the mine be made by a certificated expert showing the facts only without inference, such expert to be appointed by, and, if necessary, responsible to the Department of Mines; no expert to be employed that has not passed an examination relative to his fitness for his position?—2. Is it advisable that companies should not be permitted to register until the percentage of capital required by law has been subscribed and a certificate produced from a bank manager that such money has been lodged in the bank? Further, that provision should be made rendering it illegal to use any money so lodged for payment to promoters or for any purpose other than mining or the management of the mine or company?—3. Is it desirable that the amount now required by law to be subscribed, namely, 5 per cent., be increased?—4. Is it desirable that persons wishing to register a company should lodge with the Registrar a declaration showing in full detail the nature of the work done with respect to the mine, its position at the date of registration, and such other particulars as are requisite to enable intending investors to form an opinion as to the *bona fides* of the promoters, and the value of the property?—5. Is it advisable to take any steps with respect to the nature of the prospectus issued by a company, and could the English Directors' Liability Act be utilised as a basis of legislation; if so, what alteration or modification is necessary?—6. Is it advisable to require companies to put aside a certain percentage of profits as a reserve fund?—7. Is it advisable to provide for the registration of brokers and jobbers?—8. Is it advisable to introduce legislation analogous to the Canadian 'Act for the Suppression of Gambling in Stock?'"

Mineral Wealth of Alaska.—A bulletin dealing with the wealth and resources of Alaska, prepared by Mr. Ivan Petroff, special agent of the eleventh census of the United States, has been issued by the Census Office. It deals with the four principal sources of wealth in this remarkable region, viz.: furs, fish, minerals and timber. The Alaskan products ranking next in value to furs and fish are gold and silver. Of other minerals only coal has thus far been prospected, and it has been discovered in various parts of the territory. The veins thus far discovered show only lignite coal, some of which is of the best quality. At the present time only one of these coal veins is operated, and this vein is situated on Herendeen Bay, on the north side of the Alaskan peninsula. The product of this mine was tested for the first time during the summer of 1890, and although the surface yield did not prove very satisfactory in steam-making qualities, there is every prospect of better coal being found as the deeper layers of the mineral are reached. This mine has the advantage of being accessible both from Behring Sea and the North Pacific Ocean, two deep bays being separated only by a narrow isthmus thirteen miles in width, over which a railway will be built in the near future. Some veins of coal near Cape Lisburne, on the Arctic coast, are utilized annually by whale ships and revenue cutters to replenish their stock of fuel, but they cannot be said to be systematically worked. Another coal mine is being developed on Kuchekmak Gulf, at the mouth of Cook inlet, but this deposit has not advanced beyond the prospecting stage, its nature being lignite, like all other veins previously mentioned. Large deposits of copper, said to be of great richness, are known to exist in the interior of Alaska, but their location is such that the difficulties of transportation are almost insurmountable. Several deposits of cinnabar are also known to exist in the Kuskokwim region, but, though located on the banks of a river navigable by light-draught steamers, mining men have thus far declined to invest money in their development.

Electricity in Mines.—The recent accidents in the Pennsylvania mines have drawn attention to the general way in which mine laws are disregarded, and emphasized the value of electricity as a lighting power. There is a certain class of men, who, disregarding all injunctions to the contrary, will go into dangerous places with a naked light, risking not only their own safety but imperilling the lives of others. This could be avoided by the use of electricity as a lighting power in mines. The Mammoth mine disaster has served to call attention to this question, and also to another one of equal moment and equal importance. That is, that the changes in the barometer, indicative of a storm, have a considerable effect upon the accumulation of gases in a mine. The barometric depression is peculiarly productive of this condition of affairs in England, and the belief exists that the same influences affect the Pennsylvania mines. If this should be the case the necessity for the use of electric lighting in mines would be of greatest value. Electricity is rapidly being accepted as an absolute necessity for clean, quick and cheap mining, and the day is undoubtedly rapidly approaching when all the motive force used in coal mining will be drawn from electricity. It is the experience of those who have placed electric plants upon their property, not only that the productive capacity of the mines has been increased, but that the character of the ore mined is of a higher order. With electric lights in mines, not only would the safety of the miners be rendered almost certain, but the property itself would be more secure, and ruinous accidents might be averted.—*Black Diamond.*

MACHINERY MECHANICS & INVENTIONS

Electric Power Transmissions in Mining Operations.

By H. C. Spaulding, Boston, Mass.

The rapid increase, during the past few years, in the number and magnitude of applications of electric power-transmission to commercial uses in this country, has been due principally to three causes: First, the ability and enterprise of those who have been identified with the progress of electrical industries, since electric illumination became an economic fact instead of a laboratory experiment; second, the readiness of the American people to adopt new and advanced methods as soon as their superiority has been fairly demonstrated; and thirdly, the economy and flexibility of the apparatus employed, when properly designed and constructed, and installed under suitable conditions.

FIG 1.—ELECTRIC DIAMOND DRILL.

Basing our judgment on the world's advance in scientific developments during the past century, we may reasonably conclude that in no other country would the pioneers of electrical invention, whose names have now become household words, have received the prompt and plentiful financial support which has enabled them to inaugurate undertakings of exceptional magnitude, even in this era of tremendous monetary organizations. And, on the other hand, we have seen, in the numerous financial and engineering failures inseparable from such rapid development, the natural results of a too implicit faith in electrical omnipotence.

It is not to be wondered at that conservative engineers have been slow to adopt this new and mighty agent in the solution of extensive problems, and under circumstances where a single failure means not only a greater or less financial sacrifice, but the loss, in a greater or less degree, of professional reputation.

The mechanical engineer, while recognizing the fact that thousands of horse power are to-day transmitted by electrical means, from running the lathe in a dentist's office to the operation of a fifty-ton travelling crane; from passing a cooling draught of air through a sick chamber to printing the plethoric sheets of our daily papers, hesitates, nevertheless, before placing reliance upon a system which has undeniably had its failures.

The mining engineer looks with interest upon the statement that 258* electric roads in the United States alone, with 1927.26 miles of track, and 3,024 cars are in daily service or under construction, and then compares the demands of street service with those found in mining practice, looking meanwhile for practical suggestions from those who have "been there" and can hold up a warning or beckoning finger to the traveller in this unfrequented path. It is the object of this paper to present briefly some of the work already done towards the application of electrical apparatus to mining processes, as well as to embody some practical suggestions and statements from those who have had personal experience in the operation of such apparatus.

Following the natural order of operations, let us consider drilling and cutting machinery in the first place. Fig. 1 shows the drill manufactured by the Diamond Prospecting Company of Chicago. This is designated by them as a Type "R" machine, nominal capacity 300 feet, and equipped with a motor of 3 horse power rated capacity. The total weight of the machine, set up and running, is 1,000 pounds, and the heaviest piece, when taken apart for shipment, weighs about 170 pounds. This machine is mounted on trucks fitting the gauge of the mine track for easy handling, and can be taken apart in fifteen minutes, and put up in a half hour without difficulty.

The drill swivels, so that holes can be put in at any angle, and can be operated in a space giving 5 feet in the line of the drill rods.

The general arrangement of electrical and mechanical parts is sufficiently evident from the illustration, though the pump is hidden by the pedestal on the right. This is operated by the horizontal shaft driven by the bevel gearing shown, and supplies a constant stream of water to the diamonds through hose connected with the top of the drill tube. In a recent test on a granite boulder, hole 1½ inches in diameter, with slow speed, this drill cut 22 inches in 40 minutes. When set up in the mine, and working on hard compact limestone, it cut the rock at the rate of 1 inch per minute, not including stoppages for changing the rods.

For general prospecting purposes this drill seems to meet satisfactorily the requirements of its special line of work.

The general principle of construction of most electro-dynamic machinery provides us with a rotary motion, which it is necessary to transform to a reciprocating in order to obtain drills of the Rand or Ingersoll type. Any such transformation, however, entails a considerable loss of power, and we are happily relieved of this necessity by recent inventions which are based on the general characteristics of the solenoid. Fig. 2 shows such a drill for general tunnelling work. Mr. C. J. Van Depoele, of Lynn, Mass, was one of the first to appreciate the demand for this class of apparatus, as well as the possibilities of the principle involved; and a large factory is under course of construction by the Thomson-Houston Company, which will be especially devoted to drilling and pumping machinery of the reciprocating type.

A description of the general features of these drills will be found in the communication of Mr. Van Depoele.

Many machines have been placed upon the market, in recent years, for making the under-cut in soft-coal mining. Several of them have met with a certain degree of success in clean and easily worked veins—steam or compressed air (generally the latter), being the operating force. Perhaps the most successful of these machines has been that manufactured by the Jeffreys Manufacturing Company, of Columbus, Ohio; and a communication from Mr. Doe, their engineer, will be found appended.

Appreciating the advantages of electric power for this class of work, Mr. Jeffreys was not slow in adopting a motor, and has used a number of those manufactured by Foree Bain, the coal-cutter being modified somewhat to utilize this power to the best advantage.

In the opinion of many practical coal miners, the principle of the rotating drill has many points of superiority in under-cutting machines, and Fig. 3 shows the result of considerable experimenting and outlay in this direction by the Hercules Mining Machine Company, of Pittsburgh. A series of drills is operated by a Tesla alternating motor, the power being transmitted by a belt as shown, and the current being supplied to the motor by three armored cables. When in operation, the cutter is clamped upon rails parallel with the face of the coal, being shifted along this track after each cut, ready for another.

Compressible springs are wound upon each drill rod, and serve as conveyers for the coal dust cut out by the drills.

A machine also embodying the boring principle, though entirely different in its mechanical and electrical design, is shown in Fig. 4.

A Thomson-Houston motor of a special type is used in this machine, current being supplied from the main-entry wires (which may also be used for lighting, haulage, and pumping), by flexible wire-covered cables.

The series of cutters (nine in number, each 4 inches wide), is so arranged as to cut close to the wall beside which the machine is placed, and within ⅛ inch of the level of the floor.

Although the weight of the apparatus complete is less than 1,400 pounds, no clamping is needed, as the drills will "pull themselves into the coal," with only the friction of the machine behind them as it rests on the floor. The device for clearing the drills of coal dust is as simple as it is effective. It consists of a series of hinged scrapers hung from the under side of reciprocating bars, one of which is placed between every pair of drills, and which also operate an ingenious device for cutting out the triangular space left by the drills at top and bottom of the cut. The present type of machine makes a cut 3 feet wide, 5 feet deep, and 4 inches thick, in two minutes and a half, including withdrawal of the drills. With these figures in mind, the claim of 180 tons capacity per day for this machine does not seem excessive. As the extreme height of the apparatus is only 23½ inches, it can be used in a vein of any thickness, and two small drums are so placed in the rear of each machine as to enable it to draw itself on to a truck which accompanies each machine, ready for moving into another chamber.

A simple but ingenious rotary drill is being constructed for operation in connection with this apparatus, deriving its power from it by a flexible shaft, and drilling the blast holes at the same time that the vein is being undercut.

Having thus briefly examined the present electrical apparatus for boring into ore or coal, so that it may be blasted out, let us see what means are at disposal for hauling it out of the mine, or from one point to another under the surface. Of course, in the majority of cases, the blast will be fired by the electric current, but a discussion of this application hardly comes within the scope of this paper.

To Mr. W. M. Schlesinger, of what was, at the period referred to, the Union Electric Company, is due the honor of constructing the first electric locomotive for strictly mining uses in the United States. This was of 35

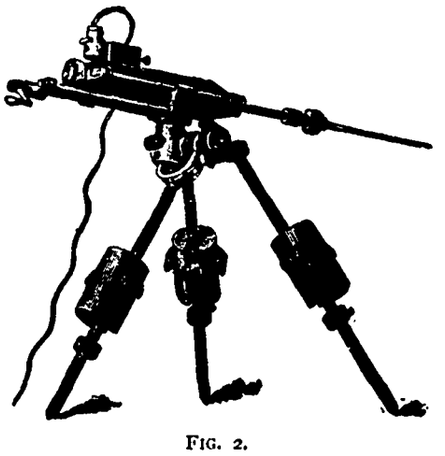


FIG. 2.

horse power rated capacity, and was put in by the Lykens Valley Coal Company, Lykens Valley, Pa.

A series of iron rails were joined together to form a conductor for the current, which, after passing through the motor, completed its circuit to the generator by the track rails, which were connected also by copper wires.

A locomotive of 40 horse power capacity has been in operation at the Hillside Coal Company's Erie Colliery, near Scranton, Pa., and the installation is fully described here as showing very fairly the conditions to be fulfilled by this class of apparatus in the anthracite coal regions of Eastern Pennsylvania.

The power plant consists of a standard Armington & Sims engine capable of developing 60 horse power, and a 50 horse power Thomson-Houston generator wound for a current of 220 volts potential, and the necessary appli-

* August, 1890.

FIG. 3.—ELECTRIC COAL CUTTER OF THE HERCULES MINING MACHINE COMPANY.

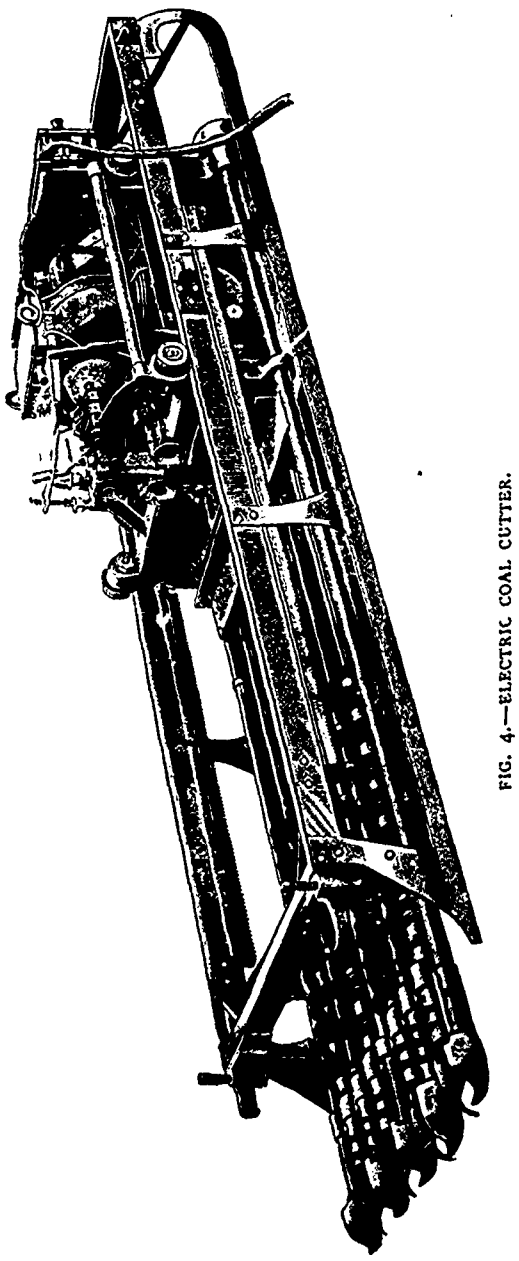


FIG. 4.—ELECTRIC COAL CUTTER.

ances for its operation. The engine and dynamo room at the top of the shaft are in charge of the engineer and assistant, who operate the other mining machinery.

From the dynamo to the foot of the shaft the current is conducted by No. 0 Clark wires, enclosed in gas pipes to protect them from damage. From the bottom of the shaft the wires are carried overhead, about 12 inches outside of the low rail of each track, and are suspended from an insulator specially designed for this class of work, the construction of which can be readily seen from the accompanying illustration (Fig. 7).

black dots in Fig. 8, Plate 1.

The rails are used as conductors for the return current, copper end connections effecting a complete metallic circuit. In adapting the tracks to the electric system it was found necessary to make a few changes to accomodate the increased output. The shaft sidings, as shown in the plan, will accomodate seventy loaded cars and fifty empties, whereas, before, they had a capacity for but fifteen on each side. The profiles and plan of the tracks will be seen from the diagram (Fig. 8). The track from X to R, or foot of the rock plane, is 36-inch gauge. The other

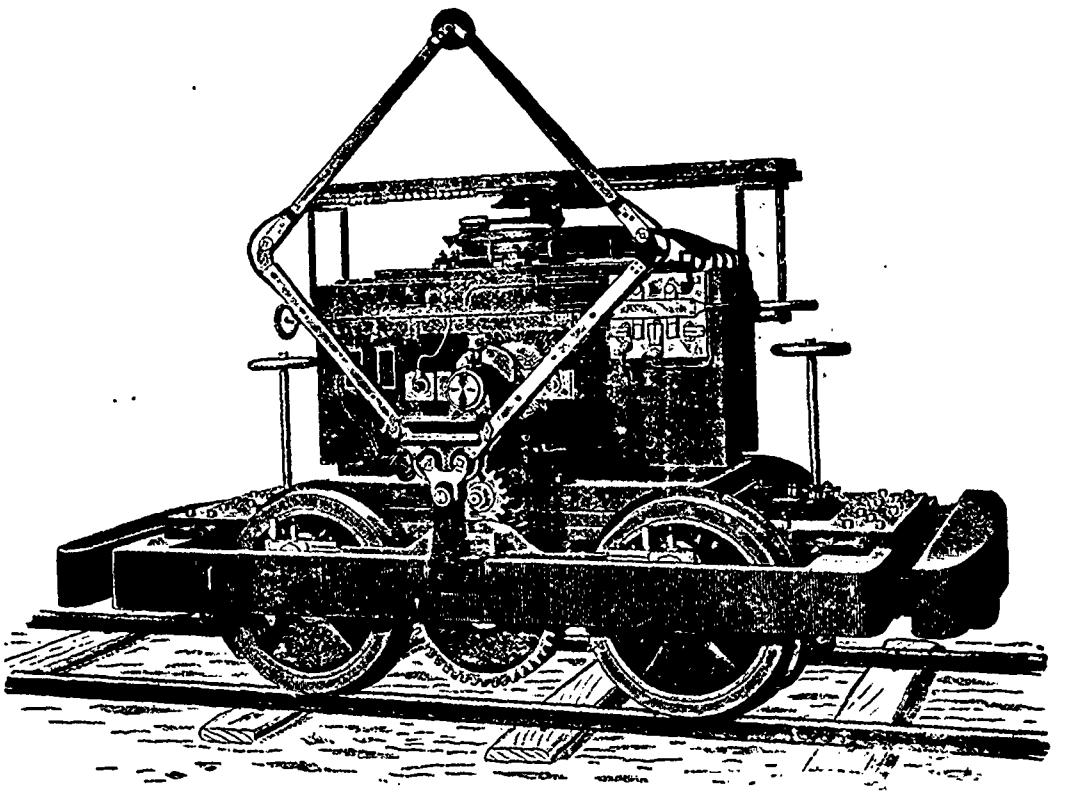


FIG. 5.—40 HORSE POWER ELECTRIC MINING LOCOMOTIVE.

Wherever turnouts occur, frogs (shown in the cut) are used, the conductors being soldered to them in the same manner as when used for street railway work. Connections from the mains to the overhead conductor are made at suitable intervals, and a portion of the current is utilized for lighting purposes, two 110 volt lamps being placed in series. There are fifty of these lamps—eight at the foot of the shaft, two in the pumping room, four in the blacksmith shop, and two in the slope room; the remainder being distributed along the gangway, as shown by the

tracks are double gauge, or three-rail tracks, the gauges being 36 and 28 inches. They are made in this manner to accomodate the slope wagons, which are all of the narrower gauge.

The locomotive shown in the illustrations (Figs. 5 and 6), embodies many new features in motor construction and general design, and, under practical test, has shown that it is particularly adapted to the work required of it. It is built for a 3-feet gauge, and is of the following dimensions: Length over all, 9 feet 7 inches; width, 5 feet 3

inches; and height, 5 feet 6 inches. This last dimension can be considerably reduced by placing the rheostat at one end instead of on the top, as has been done in the present instance. The weight of the locomotive is 10,500 pounds, to which 1,800 has been added to increase traction. The motor employed is of the type "G" railway motor of 40 horse power.

A novel trolley arm is used, which requires no attention when the motor is reversed. Its construction is such that a wide variation in the position of the conductor is permissable, a range of 3 feet 6 inches being easily covered, while the meeting of an obstruction simply causes the trolley arm to fall by the side of the car without resulting in any damage. From the trolley wheel the current passes along the arm to the fuse boxes, then through the rheostat and motor to the rail. Pinions on the armature shaft mesh with intermediate gears, connection between these and slotted connecting rods being made through the ordinary crank pin and box. This arrangement allows for variation in position between the wheels and body of the locomotive which carries the motor; and, as the crank pins on opposite sides are placed at an angle of 90 degrees, there are no dead points. The brake mechanism, rheostat and reversing switch may be operated from either end by the hand wheels shown in the cut. The operator has everything under complete control, and can start or stop the car and reverse its direction, without moving from one position.

The locomotive is run by one man, who is assisted by a boy in making up the trains and turning the switches. It displaces seven mules and three drivers. During a period of 11½ days the average number of cars delivered at the shaft bottom by the locomotive was 559.5, against 526.95 per day delivered by mule haulage, much time being consumed by waiting at the bottom of the shaft for empty cars. Thus far, the locomotive has shown that it will increase the daily output to 700 cars per day. The operations are as follows:—

EAST OR SLOPE SIDE.

Distance run per trip, including making up, etc.,	2,884 ft.
Time of trip,	10½ min.
Cars per trip,	15
Trips per day,	16
Miles run per day,	8.73
Total time,	2 hr. 40 min.

Locomotive reversed 128 times per day.

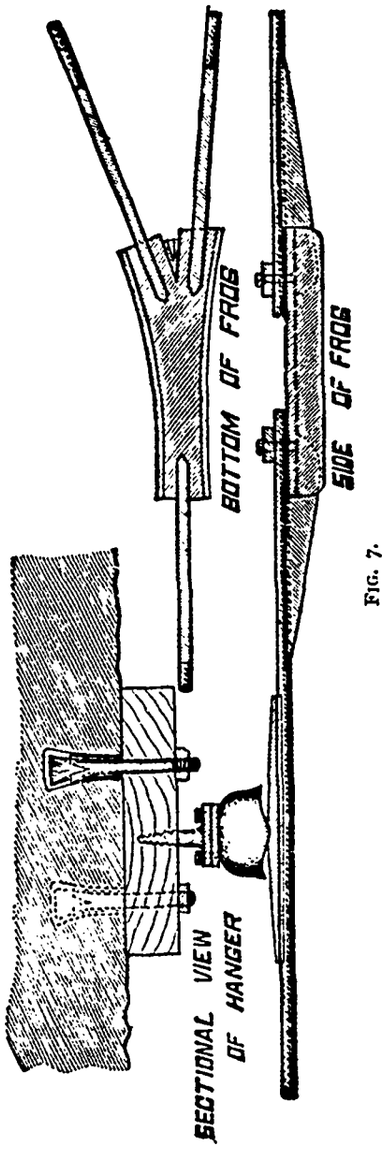


FIG. 7.

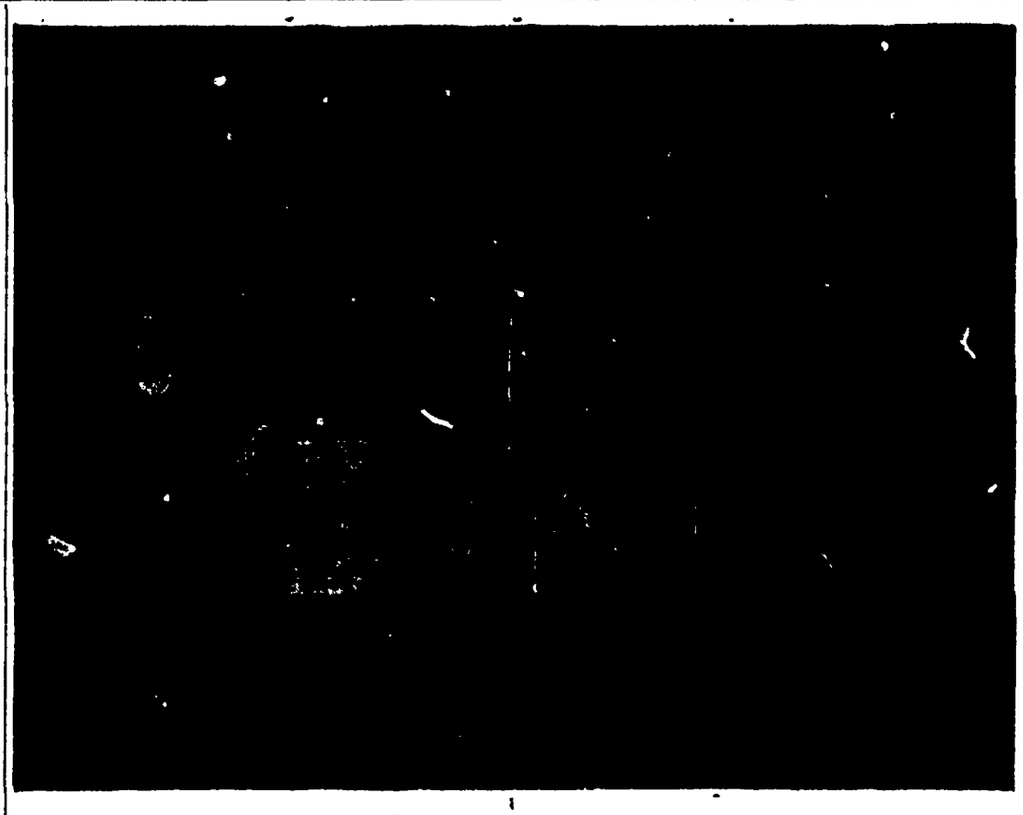


FIG. 6.—ELECTRIC MINE LOCOMOTIVE.

WEST OR PLANE SIDE.

Distance run per trip, including making up, etc,	2,546 ft.
Time of trip,	6½ min.
Cars per trip,	20
Trips per day,	25
Miles run per day,	12.55
Total time,	2 h. 50 min.

Locomotive reversed 104 times per day.

To deliver 700 cars per day of 10 hours, the time of running the locomotive is 5 hours and 30 minutes, leaving 4 hours and 30 minutes for contingencies. The total distance run is 21.28 miles, and the locomotive is reversed 232 times.

The Thomson-Houston Company has now under construction for another Pennsylvania mine, a locomotive of 60 horse power capacity, which (although of the same general type), will be so modified in design as to stand only 4 feet in the clear, above rails, the gauge being 3 feet. (Fig. 6).

The same general plan is applicable to mine tramways, of even 12 or 18 inches gauge, suitable for narrow entries, such as are found in some of the western gold and silver mines.

For hoisting purposes, we may have a variety of forms and sizes, from a 3-horse whip, for hoisting small buckets, to a machine capable of operating a full sized cage under its maximum load. Fig. 9 shows a hoist of the Webster, Camp & Lane make, equipped with a motor, for use in the Ashland iron mine, at Ironwood, Michigan, while Figs. 10 and 11 show different views of a line of electric hoists recently put upon the market for miscellaneous uses and ranging from 10 to 80 horse power.

In the Castle Gate mine, Utah, a 35 horse power Lidgerwood Thomson-Houston hoist is located about 1,000 feet inside the main entry, for handling the trains at that point.

In pumping machinery, a peculiar apathy seems to exist among prominent manufacturers as to the demands of this kind of work. There are, of course, innumerable cases where centrifugal and plunger pumps have been belted or geared to motors to accomplish certain objects; but the pump shown in Fig. 12, is the first of considerable size which, to the writer's knowledge, has been designed, with special reference to operation by electric power, and which is in itself a mechanical unit, so to speak.

This pump is manufactured by the Gould Manufacturing Company, of Seneca Falls, N.Y., and the table of tests given below, shows its efficiency when operated by a 15 horse power motor of special winding. These tests were made with a view to determining the general fitness of the type for deep mining pressures, and the results have been considered sufficiently satisfactory to warrant the designing of a standard line of pumps of from 50 to 500 gallons per minute capacity.

TESTS ON GOULD PUMP, JULY 31, 1890.

Pressure, lbs. Per sq. inch.	Gallons per min	100	125	150	175	200	225	250
0	Electrical H. P.	1.2	1.5	1.8	2.2	2.7	3.3	3.9
	Mechanical H. P.	.12	.16	.18	.21	.23	.26	.26
	Efficiency	.10	.10	.10	.10	.071	.071	.072
20	Electrical H. P.	2.91	3.67	4.16	5.06	5.87	6.56	.....
	Mechanical H. P.	1.38	1.74	2.09	2.42	2.83	3.10	.....
	Efficiency	.48	.47	.50	.48	.48	.47	.....
50	Electrical H. P.	5.16	6.52	7.75	8.98	.....	.....	.....
	Mechanical H. P.	3.11	3.95	4.75	5.62	.....	.....	.....
	Efficiency	.602	.606	.612	.615	.....	.....	.....
75	Electrical H. P.	7.30	8.64	10.48	.....	.....	.....	.....
	Mechanical H. P.	4.69	5.79	7.06	.....	.....	.....	.....
	Efficiency	.643	.670	.674	.....	.....	.....	.....
100	Electrical H. P.	9.21	11.54	12.25	Speed of Pump, 27 revolutions.			
	Mechanical H. P.	6.16	7.77	8.36				
	Efficiency	.670	.673	.682				
125	Electrical H. P.	11.29	13.88					
	Mechanical H. P.	7.74	9 37					
	Efficiency	.686	.675					
150	Electrical H. P.	14.02	15.16	Speed of Pump, 22 revolutions.				
	Mechanical H. P.	9.17	10.19					
	Efficiency	.654	.672					

The Efficiency, in this Table, is the Mechanical, divided by the Electrical, Horse Power.

The pump as shown, consists of three vertical cylinders, within which are three single acting plungers, their cranks being hung from the main shaft at 120° angles, in order to produce the most even application of power. In addition to this class of pumps for general hydraulic work, the Van Depoele type of reciprocating engine is being adapted to a sinking pump which has, as yet, not been sufficiently tested to warrant further mention here.

I need hardly mention the subject of ventilating apparatus, as the application of motors to revolving fans of any kind is a mere question of belts or gears, though the fact that the fan with its motor, may be located at any desired point within the mine, with an expenditure of power hardly greater than would be necessary outside, has a marked bearing upon the general arrangement and efficiency of ventilating systems.

The question of lighting, also, though a most interesting one to the engineer and operator, hardly falls within the scope of this paper. It is sufficient to call attention to the fact that the same wires which furnish current for a part or all of the apparatus enumerated above, will make the interior of the mines as light as day, and give a beneficial result, not only directly in the amount of product, but indirectly in the satisfaction and comfort of the men. This is not theory, but has been demonstrated to the satisfaction of all concerned, and in cases were there was at the start, among the miners themselves, a hearty and bitter opposition to the new system.

Before considering the question of surface arrangements, let us pause a moment, to answer the oft-repeated question as to danger.

The danger of accident from any class of electric machinery in mining operations is of three kinds: first, physical injury from contact with conductors or apparatus, through which a current is passing; secondly, danger of fire or explosion from a spark in some part of the electrical apparatus; and thirdly, failure of the apparatus to work properly at critical moments. Regarding the first point, it may be said that a limit of 250 volts has been fixed by many experts in mining and electrical engineering for all apparatus to be used below the surface; and that *permanent injury* from a current of this tension, *regardless of its amount*, is *absolutely impossible*, the only liability to danger lying in secondary and indirect accidents, owing to the surprise and momentary discomfort due to an accidental shock. A hot steam pipe carries more danger for the man who unexpectedly touches it than a bare copper wire carrying enough current to cut and

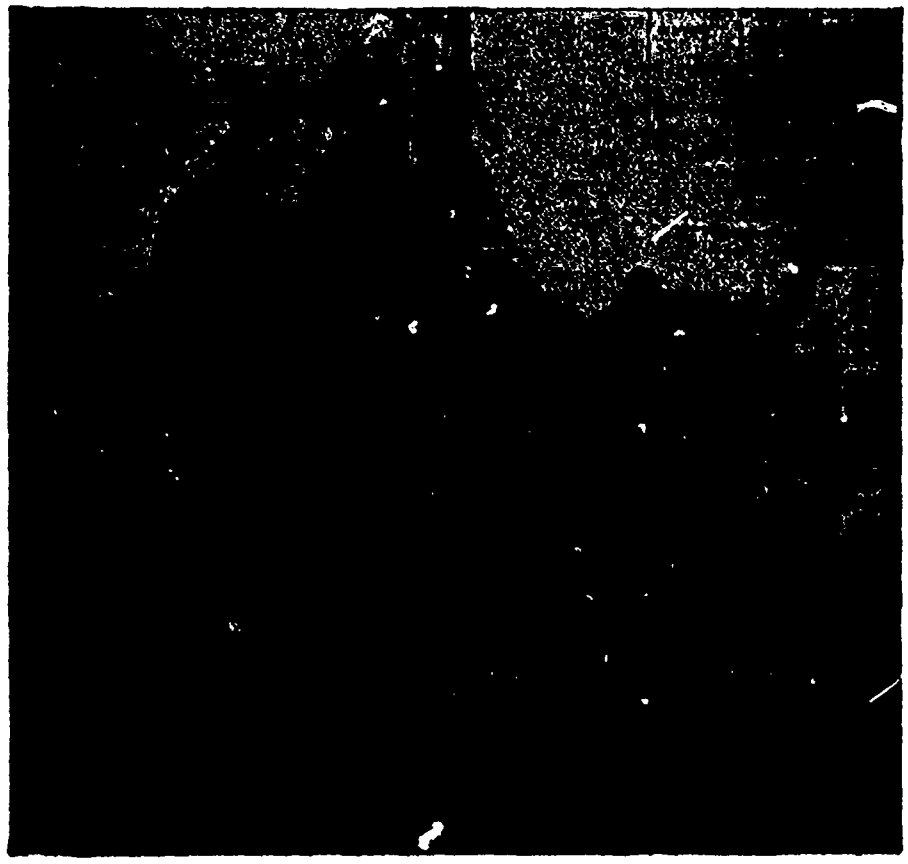


FIG. 9.—ELECTRIC HOIST OF WEBSTER, CAMP AND LANE.

broken wire, and we need not wonder at the recent prophecy of a prominent naval officer, that coming warships would carry no steam outside their boiler and engine room.*

Let us consider now the demands of the generating system which will enable us to furnish the proper current to our apparatus to the greatest advantage.

If we have an abundant and steady water power at hand, so much the better, as the expense of maintainence bility of accidental derangement, and at critical moments. But of electrical apparatus, it may be said that no type of machinery will answer more quickly to sudden demands upon its capacity, or give a plainer indication of continued abuse; while, on the other hand, no system of power transmission is capable of more rapid repair in case of temporary derangement. We have but to compare the work of mending a broken air or steam pipe, or splicing a parted cable, with that of making a simple twist in a casual observers when the fault lay between the coal pile and the dynamo belt. It is, however, the province of this paper to consider, not the generation of mechanical energy, but its transmission; and, accordingly, attention will be given first to the current generators.

Fig. 13 shows a generator of 85 horse power capacity, suited for mining work, manufactured by the Thomson-Houston Electric Company. It is equipped with sliding base, and self-oiling bearings, and weighs 10,000 pounds.

Mounted on brick or stone foundations in a dry cool room, free from flying dust of any kind, these, with A 1 oil, and *cleanliness*, should need practically no attention except at starting and stopping.

Cheap machines will not answer for mining work. One cannot shut down for a few hours whenever it is desirable to have a new commutator put on, or a little shellac and braid here and there; and a thousand dollars more on the original investment is a good deal better than six or seven hundred a year for repairs.

Plates II, III, and IV, show respectively, the front and end elevations and floor plan of a power plant just erected by the Pleasant Valley Coal Company, at Castle Gate, Utah, which is, in many respects, a model of its kind.

It has a capacity of about 750 horse power of generating machinery, which will be used for furnishing current to electric coal cutters, drills, pumps, haulage engines, ventilating fans, etc., the entire power needed for the various mining operations being transmitted electrically. As this is the first plant of such magnitude employing electric apparatus to the exclusion of other systems, the result will be watched with interest.

I append some communications kindly furnished by gentlemen who have given special attention to various branches of the subject of this paper. To these, as well as to others who have furnished various data of interest, I wish to express my thanks.

(To be continued).

A Good Report.—The Thomson-Houston Electric Company's report for the year ended January 31, 1891, shows that the surplus account at that date was $6,022,533, against $1,685,415. The total assets were $18,905,106. Eighteen months ago the direct liabilities of the company were over $1,250,000 in excess of present liabilities, besides which the company had unmatured payments on account of contracts of about $2,500,000. These have all been met.

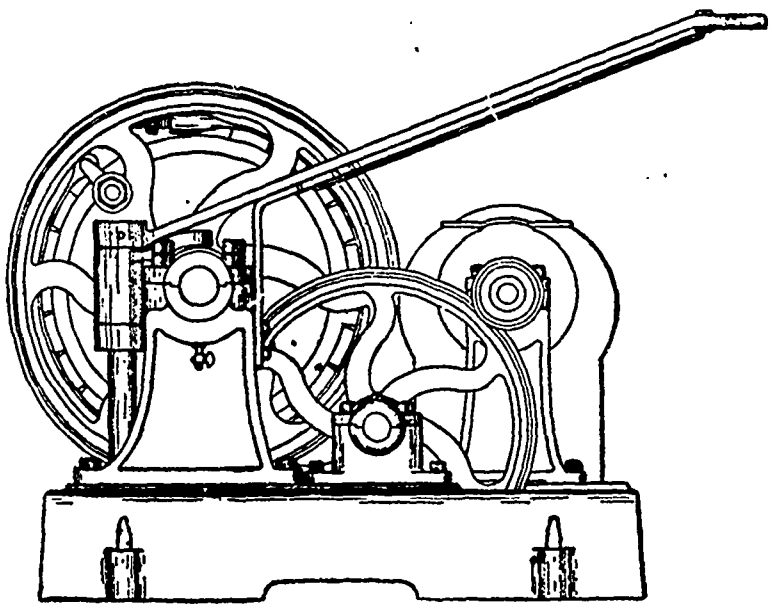


FIG. 10.—ELECTRIC HOIST, SIDE VIEW.

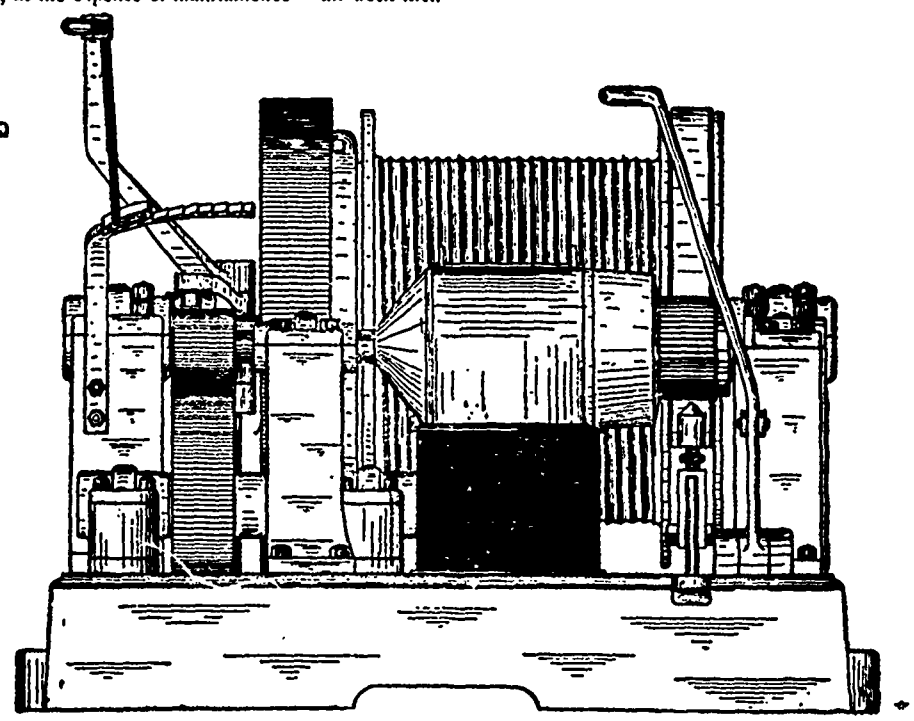


FIG. 11.—ELECTRIC HOIST, FRONT VIEW.

haul two thousand tons of coal a day, at the voltage named above. As to the second source of danger, no electrical apparatus, if properly installed, should ever spark at known and properly guarded points; the amount of protection at these points being entirely dependent upon the knowledge of the designer, faithfulness of the operator, and common sense of the purchaser, in spending sufficient money on safeguards. As to the third point, no class of apparatus ever designed is free from the possi- then becomes practically a matter of interest on investment. If, on the other hand, we must rely on steam, let us be sure and have an ample boiler capacity to begin with. Many an electrical installation has been condemned by

*Some of our latest additions to the navy have more than twenty steam engines for hoists, pumps, etc., in different locations, any one of which might be rendered useless by a stray shot, not to mention the demoralizing effect of escaping steam; while the wires of electric apparatus for the same purpose may be almost instantly repaired.

Wastefulness of Steam Hammers.—To obviate the notorious wastefulness of steam hammers an improvement has been introduced at the Chemnitz Works, in fitting the hammers with two pistons of different diameters, compounding them, in fact. The tup is raised by steam at boiler pressure acting on the under surface of the smaller piston; and this steam, on expanding, adds to the force of the blow by acting on the upper surface of the larger piston.

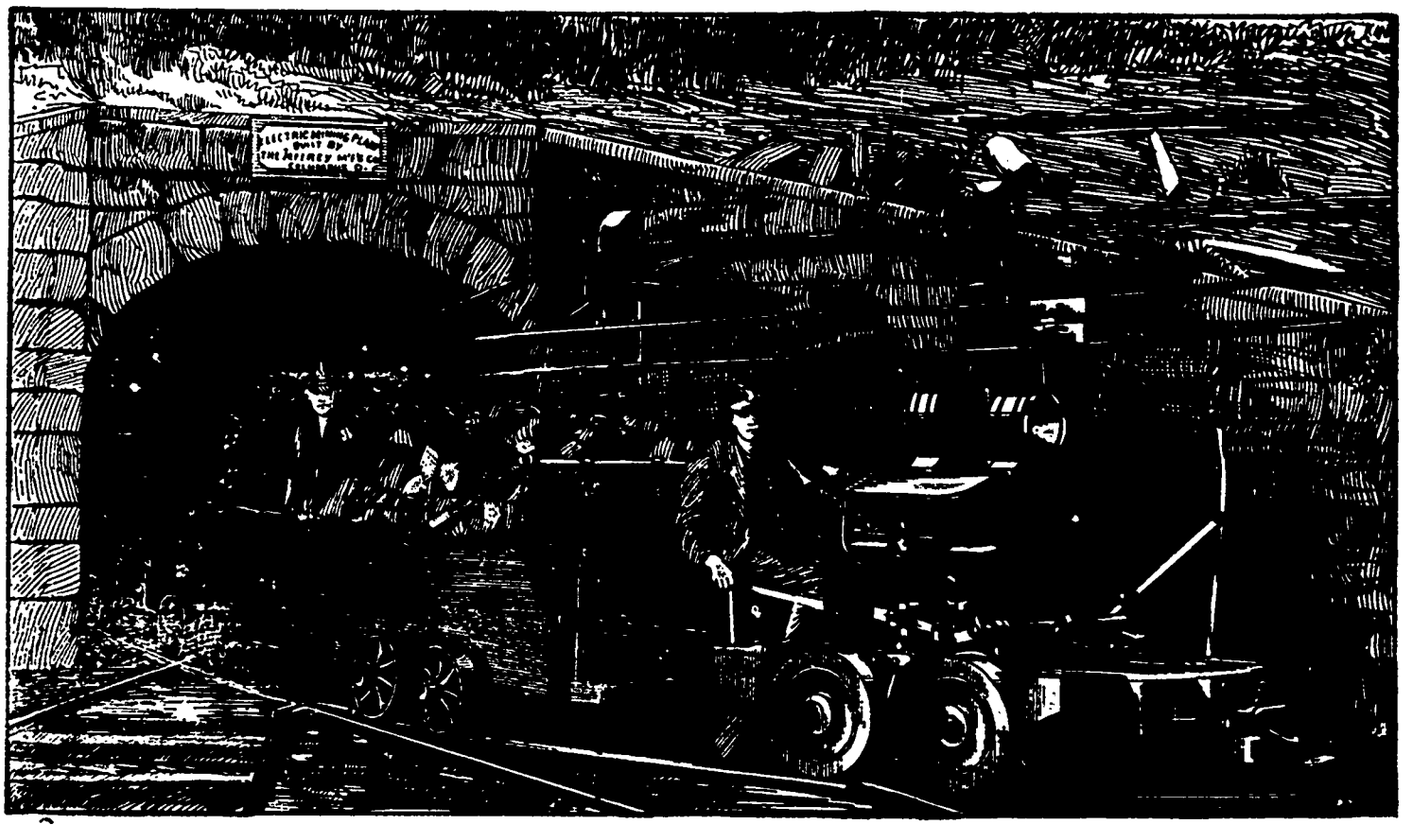
Motor Car Haulage at Shawnee, Ohio.

The Jeffrey Manufacturing Company of Columbus, Ohio, installed one of their electric mining plants at the mines of the Upson Coal Co., Shawnee, Ohio, late in the fall of 1890. This plant consists of one 100 H. P. dynamo, with the necessary electrical instruments, copper wire and Jeffrey patent trolly line transmitting the current at a pressure of 220 volts into the mine, where the eleven foot vein of Shawnee coal is undercut by two of the Jeffrey Standard mining machines.

The coal, after being loaded on cars of three tons weight each, is hauled from the parting to the tipple by a five ton 20 H. P. Jeffrey electric motor car, as shown in the engraving. The Upson Coal Company report that their electric plant is giving perfect satisfaction, and has not caused them a delay of half an hour since it was started.

The Jeffrey Manufacturing Company have installed a plant of two engines and two dynamos to run from six to eight mining machines, at the Helvetia mines, in Jefferson County, Pa. They are also installing a plant at the mines of the Union Colliery Company, Vancouver Island, British Columbia. They are receiving increased orders for electric mining machines from customers who have been using them for the past year. This speaks well for their success.

By the way, we have to acknowledge the receipt of a very handsome and beautifully illustrated catalogue of coal mining machines, coal drills, motor cars, coal screens and other specialities in mining machinery, manufactured by this company. Not only is the appearance of the work fine, but a great deal of useful information is to be found within its pages, which will be found valuable to the miner in his selection of machinery.



A Test of Rock Drills.

At the exhibition of Mining and Metallurgy held at the Crystal Palace, London, last summer, a trial was made of the various kinds of rock drills exhibited, with a view to testing the comparative efficiency of each class. Seven power and two hand drills were entered. All were of the striking or percussion kind, and may be classified into three general divisions: (1) Drills in which the valve is worked by air pressure; (2) drills having the valve worked through mechanical connections by tappets or cams; (3) valveless drills, in which the main piston itself performs the office of valve. In the first of these classes the piston performs the function of a valve for reversing the actual valve, while the latter, in its turn, causes the motion of the piston to be reversed. In the second class the motion of the piston is employed to reverse the valve by knocking it over the ports.

The rules governing the competition were settled by the engineer of the Exhibition and agreed to by all the competitors. The drills entered for the trial were: McCulloch's "Rio Tinto," Stephens' "Climax," Bickle's, Ingersoll-Mayne, Davis, Coles', Hathorn's "Eclipse," Ingersoll hand power, and Bromfield-Ingersoll hand power. All the drills were fed by hand, none being worked with a self-acting feed.

We excerpt the following from the judges' report: "Turning to the actual results of the work done by the rock drilling machines which were tried, it is difficult to form any broad and general conclusions as to the efficiency of the different drills, as this may be connected with variations in the principles and details of the valve mechanism employed. What really does appear is that the important points are purely of a practical nature; and the following may be profitably discussed:—mechanical details; certainty of action; weight of mechanism in relation to durability and portability.

"The mechanical details have already been described. It did not appear at the trials that there was any practical difference in the certainty of action between the valves moved by air and those worked by tappet.

"As regards weight of machine for a given size, it is of course desirable to have it as light as possible for the sake of portability; but considering the rough usage to which a rock drill must necessarily be subjected, strength of parts is still more important. In the trials the large and therefore heavy machines were those which did the best work, namely those with 3½ inch cylinder, weighing from 280 to 308 lbs. each. The 3 inch machines, weighing from 190 to 264 lbs., did good work. There was only one 2½ inch machine tried, but its full capabilities were unfortunately not properly tested, because the air was throttled at the inlet cock. Small and therefore light machines are no doubt required, and are serviceable for certain classes of work; but for quarry work the larger machines would appear to be superior. The stability of the machines which were tried on the quarry bar, was added to by the fact that there were always four drills on the bar during the trials, while only one was at work at a time; but in the tripod trials each drill was provided with its own tripod without any additional weights whatever. In all the trials the holes were vertical, or as nearly so as practicable.

"From the particulars given of the work done by the hand power machines, it does not appear that these are equal in efficiency to the hand hammer in drilling vertical holes. The first machine with two men drilled a 1¼ inch hole 12 37 inches deep, having a capacity of 16·69 cubic inches, in 17 minutes; whilst three men by hand, two striking and one holding the chisel, drilled a somewhat larger hole 22 inches deep, having a capacity of 27·64 cubic inches, in 18½ minutes. In this comparison no allowance is made for the labour of moving and fixing the machine."

An Electric Pumping and Hauling Plant.

An important electric plant on a large scale has been put in the Hyde Lane Pit, owned by the Dukinfield Coal and Cannel Company, England. The power is conveyed a distance of 700 yards, and the main object for which the plant has been erected is to pump water out of the dip workings to the bottom of the shaft at the rate of 10,000 gallons per hour, and the vertical height to which the water is raised is 160 yards along an incline 400 yards long, dipping 1 in 2½, and for which purpose the following machinery has been erected: On the surface in a special engine-house is fixed a pair of horizontal high-pressure steam engines, 14¼ in. cylinders, 2 ft. stroke, running ninety-six revolutions per minute, with 80 lb. of steam pressure on the boilers; these engines drive direct, by means of a 12 in. link belt, the dynamo or generator, which is one of Stanley and Davies' patent "Excelsior" type capable of giving an output of 220 volts, and 200 ampères, or 60 horse power, at its normal speed of 500 revolutions per minute. From the generator to the motor, which is fixed down the pit 700 yards distant, the current is conveyed through specially insulated stranded copper cables, having a carrying capacity of twice the maximum load. The cable is carried on porcelain insulators. The motor, which is of the same type of machine as the generator, will give out 40 effective horse power, running at 700 revolutions per minute. This machine drives direct on to the pulley or pump shaft, by a 10 in. link belt, driving same through one pair of spur wheels; the pumps make 40 strokes per minute. Special care has been taken in the design of the pumps to make all working parts easily accessible, and to avoid all internal packings; all glands are packed from the outside, and any of the valves can be examined with very little trouble. The pumps are of the horizontal type, having four single-acting rams 8 in. diameter, 8 in. stroke; two sets of pumps are mounted on each bed, and the rams are bridled together in pairs, the cranks and connecting rods working within the bridles, and the cranks are set at such an angle to each other that the working load or strain is equal in any part of the stroke—a most desirable feature where electricity is applied. The two beds are bound together by cross-girders, making the whole a strong, compact and self-contained piece of machinery. The pump house, which has been cut out of the solid rock, is brick arched, about 50 ft. long, by 15 ft. by 10 ft. high, and is lighted by four electric lamps of 16-candle power each. The water is conveyed up to the shaft through 400 yards of 6 in. wrought iron piping. The generating dynamo on the surface supplies current also for the general lighting of the colliery, both on the surface and down the pit. The offices, engine houses, workshops, screens, pit bank, and down the shaft are all lighted by incandescent lamps, varying from 16 to 50-candle power, and are fitted with the usual special colliery fittings, according to positions, and near the dynamo are found the measuring instruments and distributing board, bringing the whole conveniently under the control of the man in charge. This plant has been working very satisfactorily for about three months, but the hauling arrangements which form part of the scheme are not yet complete. These will consist of two similar motors of 20-horse power each, fixed at the top of two main hauling roads, coupled direct by gearing to the hauling apparatus.

The Penberthy Automatic Injector.—This injector, although known in Canada but a few years, has gained a reputation unequalled by any injector that we have ever heard of, for the short time it has been on the market. The manufacturers, the Penberthy Injector Co., established a factory at Windsor in the spring of 1887, and by making a simple and reliable injector, and one that in price was much less than others before used, have placed about 8,000 in the Canadian market, and in the same length of time over 40,000 in the United States, an output unprecedented in the history of injectors. They report the spring trade thus far more than double that of 1890, and they are at present supplying some of the largest manufacturers of portable and traction engines in the Dominion, as will be seen by reference to their advertisement in this issue. Their factory which they supposed would accommodate their trade, is now found to be totally inadequate for the output, and they are about to enlarge the same to double its present size. The office of this company is at Detroit, Mich., where all communications should be addressed.

Explosions from Unknown Causes.*

By J. C. Bayles, East Orange, N. J.

The most unsatisfactory occurrences in the experience of a manufacturer are those from which he suffers damage and learns nothing useful. That there are such incidents, and that they occur with annoying frequency, is unfortunately true. An accident which can be understood and explained always carries some consolation with it. However bad the consequences, one finds comfort in reflecting that they might have been worse, and that the knowledge of how to avert a more disastrous calamity from the same cause is worth what it cost. But when an accident occurs, which remains unexplained after anxious days of investigation and sleepless nights of reflection, and which is as liable to occur twice or twenty times, as once, very little satisfaction of any kind can be extracted from it by the most philosophical victim. Three such incidents have come under my notice in one establishment. Fortunately none of them were attended with very serious consequences, as no one was hurt, and the damage to property was slight; but in each instance, loss of life and great destruction were escaped by so narrow a margin as to make them extremely disquieting. I have recorded them in the hope, that from the experience of others may be gained what my own careful investigations have failed to reach—satisfactory explanations.

The first of these curious occurrences was the bursting of a 16-inch pipe carrying air under a compression of about 1 pound. The pipe was made of light galvanized iron with soldered seams. Into it a rotary fan-blower delivered air, and from it smaller pipes were carried to the furnaces. The blower was run continuously. Neither the main pipe nor its branches had any connection with the gas conduits. Both air and gas pipes delivered into the furnaces; but although the gas was under much higher compression than the air, there appeared to be no good reason why, having free escape in case of leakage, it should ever make its way back into the air pipe. One warm afternoon in June the main air pipe exploded with great violence. Every window in the mill was blown out, a considerable section of the roof was raised an inch or two, and in several places it was broken through. The pipe was torn into a thousand pieces, and a waggon load of fragments not larger than my hand were scattered all over the mill. Several of these fragments were driven edgewise into the roof timbers. The disk closing the end of the pipe was projected against a brick wall with such violence that it remained fastened in place, and is there yet, a mural tablet commemorating the event.

I promptly investigated the accident and learned the following facts: The pipe in which the explosion occurred extended the whole length of the mill. The machines then in use were placed together near the end connected with the blower, leaving some 80 feet of what may be called dead end. It was in this dead end that the explosion occurred. The portion of the pipe from which outlets were taken was substantially uninjured, but 75 feet of the 80 feet beyond the farthest outlet were utterly destroyed. The fact that, with very little mending, the part of the pipe which the explosion had not reached continued for some months to supply the machines with air, shows how local the explosion was; and the damage to the mill building gave sufficient evidence of its violence.

The natural explanation of this explosion is that gas found its way into the air pipe and was packed away in the dead end, and that when mixed with air in explosive proportions, it reached a furnace and exploded. I can only say that the most rigid investigation failed to explain how the gas got into the air pipe against the pressure it carried, and why an explosion beginning at a furnace should have restricted its effects to the dead end of the air pipe. It was undoubtedly a gas or vapor explosion, but I can find no other explanation of the presence of gas or vapor than that it was formed by the volatilization of the oil consumed in lubricating the trunnions of the blower. It is conceivable that the large amount of oil consumed by the blower is volatilized, and that it becomes a hydrocarbon gas which would behave like any other gas of similar composition. This gas, being lighter than air, would occupy the upper part of the pipe, and remain undisturbed, while air was drawn from outlets taken from its underside. This light gas may have worked along and accumulated in the dead end of the air pipe until it reached, in admixture with air, the explosive condition. But whence the spark? And why, if fired by a furnace, was the destructive force of the explosion exerted so far from the point of ignition? This hypothesis assumes that the volatilized or gasified oil of many days' running would remain undiffused for as many nights, until its accumulated volume was great enough to explain the phenomena of the subsequent explosion. The best that can be said of it is that, perhaps, it is better than no theory at all.

Nothing similar has occurred since. We replaced the galvanized iron pipe with a 16-inch steel tube, 400 feet long, to meet the increased requirements of the establishment. All the other conditions remain the same, except that a small opening was left in the end of the pipe which cannot be wholly closed. Whether this is necessary we do not know. The accident taught us nothing whatever, and, so far as we are aware, the same causes are now at work, and may at any time produce like results. The fact that no great damage was done is due to the frail character of the tube in which the explosion occurred. If the 16-inch steel tube should ever be destroyed with equal thoroughness by such an explosion as I have described, I hope I shall be in another State.

The second of the curious actions I shall mention was the explosion of a No. 6 Sturtevant blower. I was a witness of this amusing, though somewhat alarming, occurrence, and can speak of it from personal knowledge. The blower was inside the mill, and was driven by two belts from pulleys on the main line of shafting. It was used to furnish blast for the gas-generators. Some trouble with the main driving-belt necessitated a stoppage of the mill engine, and the blower stopped. In a few minutes the engine started again, and with it the blower. It had been long in other use, but as this was its first day of service in that position I was naturally curious to see how it worked. So I stood watching it. Suddenly it disappeared. One side passed close to me and lodged against a post. Fragments weighing twenty to fifty pounds were distributed in all directions. The explosion was accompanied by a violent report and succeeded by a dense cloud of yellow-brown, offensive-smelling smoke, which rose to the roof, rolled right and left, and finally escaped at the monitor.

Again I investigated, until there remained no questions to ask. That it was not a centrifugal rupture I know without being told. The conclusion was that during the stoppage of the engine some air-gas from the producers had worked back through the pipe into the blower. When the blast was resumed these products of imperfect combustion were carried with the air-current into the producers, and being mingled in explosive proportions had been fired by contact with the incandescent fuel and exploded. This explanation was never quite satisfactory to me. An explosion which began in the producer could only reach the blower through two branches of a tee, six feet of vertical pipe, an elbow, twenty-five feet of horizontal pipe under ground, another elbow, six or eight feet of vertical pipe, another elbow, and four feet, more or less, of pipe conected with the outlet of the blower. Some of these pipes were light and some heavy, and the section underground was much larger then the section at either end of the run. If an explosion violent enough to wreck the blower completely had occurred through the whole length of this very circuitous pipe, I should have expected to find some evidence of it in the pipe itself. It was intact. Not a joint was started. Furthermore, as the blower had been running at least four minutes immediately before the explosion, what could have remained in it to explode? The fact was, however, that the blower was shattered, while the pipe was undisturbed, even the delivery-nozzle of the blower remaining coupled to the length of pipe on the mill-floor, which was not thrown out of line. As in the first instance, this explosion taught us nothing.

The third of the series of unexplained accidents consisted of two explosions following one another so closely and under conditions so nearly identical that they may be considered as one episode. In the purification of gas we use purifying boxes of the usual pattern. We have four boxes so connected by the centre-seal that we can throw any one of the four out of use when it is necessary to clean it. The gas always passes through three boxes before reaching the gasometer, and one is always kept ready to be filled with fresh iron and brought into use when needed. When the gas shows the presence of impurities or diluents it is time for a change. To make the procedure clear, let us suppose the boxes to be numbered 1, 2, 3 and 4, and the gas to be passing through 1, 2 and 3 in the order stated. No. 1 would, of course, become foul first, as it first receives the gas. If a test of gas which has passed No. 3 shows that it is not completely purified, No. 1 is cut out and No. 4 brought into use. The gas would then go through Nos. 2, 3 and 4 in the order stated, and No. 1 would be emptied and refilled in readiness to become the third of the series when the fouling of No. 2 made it necessary to pass the gas through Nos. 3, 4 and 1. In reality, the box to be brought into use is not refilled until it is needed, but otherwise the procedure is as I have described.

One day the superintendent and the manager had occasion to go into the purifier-house together and while there the superintendent tried the gas. Getting a reaction indicating the presence of impurities, and finding the fourth, or idle box, ready, he turned the centre-seal, cutting out the box which had been the first to receive the gas, and making the clean box the last of the series. The cap of the outlet was left off for the escape of the air, and not screwed on until there was a strong smell of gas, indicating that the air had been expelled. The same thing had been done in the same way hundreds of times. In two or three minutes the third box exploded with great violence. The cover was wrenched loose from the four clamps holding it down; carried up through timbers and roof and dropped again, badly wrecked. The centre-seal was canted to one side, allowing a copious escape of gas. The building took fire, and a second explosion in the basement blew out about half the foundations. The second explosion was easily understood. Fortunately, fire-extinguishers and hydraulic jacks saved the building, and except the need of repairing the broken box, the damage was slight. I at once began an investigation, which has lasted ever since. The explosion was undoubtedly due to the ignition of a mixture of gas and air in the box; but how was it ignited? The gas, before reaching the box in which the explosion occurred, had passed through the hydraulic main, two scrubbers, more than 500 feet of unjacketed pipe, and two purifying boxes, each containing three layers of wet sesqui-oxide of iron. It requires a violent stetch of the imagination to believe that a spark could travel so far under conditions so adverse. The pipe which delivers gas to the boxes is rarely quite cold, but I have never found it more than warm. The tops of the boxes are always cold and the gas enters the gasometer at atmospheric temperature. While we were speculating as to the cause of this accident, and congratulating ourselves that it was never likely to happen again, another box, the third of the series in use, exploded under exactly similar conditions. A detailed account of one explosion describes the other perfectly.

Matters were getting serious. No one had been hurt; but it was not impossible that the thing would happen under conditions which could not fail to kill somebody. I must find out what was wrong and correct it. So I called in all the experts I could reach. Some were honest enough, after looking the plant over, to confess that they had no explanation to offer. Others gave reasons which would have been satisfactory had they not been at variance with the facts. For the information of those who may be disposed to speculate as to why these boxes exploded, I may say:

1. The hydraulic main is modelled after the best gas works practice.
2. The scrubbers are adequately supplied with water.
3. The iron in the boxes which exploded was found, on analysis, to contain less than nine per cent. of free sulphur, and is still in use
4. The iron was adequately revived before being replaced, and did not heat in the boxes. After the explosion it was found to be cold.
5. The iron was sufficiently wet.
6. There was no fire in the purifier-house and "no smoking."

Since these two explosions, which occurred in April last, we have had no trouble. There has been no change in the arrangement of the gas plant, for we can discover no way to improve it.

It would have been a great satisfaction to have been able, in these instances, to follow the sage advice of Hotspur, and out of the nettle danger pluck the flower of safety. But our nettle crop does not seem to be of the flowering variety. If I had investigated less closely I might have reached satisfactory conclusions—perhaps of no more value, however, than the honest doubts I am now willing to confess.

* Transactions of the American Institute of Mining Engineers: New York Meeting, September, 1890.

The Progress of British Coal Mining.—In a paper on "Coal Mining in 1850 and 1890: A few Contrasts," read recently by Mr. James Tonge, F.G.S., before the Manchester Geological Society, some interesting comparisons were made: In 1851, rather over 50,000,000 tons of coal and other minerals were raised; in 1889, 185,187,266 tons. In 1851 there were 216,217 persons employed above and below ground; in 1889 there were 563,735 persons employed. In 1851 there were 984 deaths caused by accidents in and about mines, being at the rate of 4.56 persons per 1,000 employed; in 1889 there were 1,069 deaths caused by accidents, being at the rate of 1.88 persons per 1,000 employed. The winding arrangements in 1850 were often of the crudest. Then it was not uncommon to see single engines used to wind the coal, and to raise and lower the workmen, and the cases were not at all infrequent where the engine was only just equal to its work under ordinary circumstances, and if there should be an unexpected weight at the end of the rope, the engineer had great difficulty in starting his engine, not being able to lift the load from the bottom, and at the same time put motion into the fly-wheel, and cases were quite common where the engineer, after vainly attempting to get "over the centre," came to the engine-house door and called to the banksman to come and assist him, this they did by lifting at the fly-wheel, some by hand and some by crowbars or other levers. Now, in most cases, the engines are sufficiently powerful and coupled, so that the difficulty of centreing is never experienced, the engines starting off with the greatest ease. In 1850 the winding ropes were in many cases made of hemp, sometimes 5 in. broad, and where the engine-house and pit were at a considerable distance from each other, it frequently happened that the wind had much effect upon the rope. In 1850 the underground apparatus for hauling, viz.: tubs, trolleys, rails, &c., were of the most meagre description. The rails were simply pieces of angle iron, with holes at the end. adapted for what were called "pancake wheels." Yet, even these were such an improvement upon the barrow and other previous makeshifts, that a grateful miner poured forth his thanks in verse.

"But heavy puttin' 's now forgotten
Sic as we had i' former days;
Ower holey thill an' dylls a-splittin',
Trams now a-run on metal ways.

"God bless the man in peace and plenty
That first invented metal plates;
Draw out his years to five times twenty,
Then slide him through the heavenly gates."

"For if the human frame to spare
Frae toil an' pain ayont conceivin',
Hae aught to dae wi' gettin' there,
I'm sure he maun gan' strite to heaven."

IRON, STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, April 22, 1891.—No changes of any consequence have marked the course of the pig iron market during the past month. In the earlier part Scotch pig iron warrants fell to the lowest point they have touched for some time past, and were sold in the neighborhood of 42*s.*, but since then there has been a reaction, and the price to-day stands at about 2*s.* per ton over the lowest point touched. It is difficult to give in advance any indication of the course of this market, but the quantity of warrant iron now in stock is comparatively small and easily handled, and could thus be manipulated by some speculative movement to a much greater degree than was the case a year or two ago when stocks amounted to over 1,000,000 tons. Against the possibility of any great advance, however, is to be put the fact that the demand is very small at present, and business in the iron trade generally extremely quiet, both in Great Britain and on the Continent. While prices may therefore advance somewhat from their lowest point, it is hardly possible we will see very high figures ruling this year. On this side of the Atlantic we find the same state of affairs among American producers of pig iron, and prices have touched their lowest figures. It is a question to-day whether the great bulk of American furnacemen are getting cost for their pig iron, and it appears certain that the southern brands, which have the advantage of being made where fuel and ore lie almost side by side, will have the advantage in this respect over their northern competitors. American iron is still being pushed in Canada, but at prices which would not be accepted from consumers in the United States, and it is evident that makers are doing their best to get rid of their surplus product on this side of the line. A fair business has been done in Scotch iron, and "Summerlee" has been placed for spring delivery on the basis of about $21.50 in Montreal, with such brands as "Carnbrae" and "Govan," at about $1.50 to $2.00 less. Stocks in yard are being considerably reduced, and very little will be carried over the present month. For stock lots prices still keep at $23.00 for "Summerlee," but the quantity available is extremely small. Spring business has, however, opened very quiet, and there is no appearance of any great demand for the next two or three months. This is owing to causes indicated in our last report, but the increase in the price of grain and the consequent clearing out of stocks held by the farmers, have made the situation rather brighter. In finished iron the market still remains the same, and it is questionable whether the present price of bar iron in England is remunerative to the producers, on account of the abnormally high price of coals. Canadian bars are still being sold at $2.10 in Montreal with English brands at $2.25. The tin plate market is in a very peculiar position owing to the fact that while present figures are about $4.50 to $4.75 for cokes, orders are being booked for delivery after the month of July, at about 75c. to $1.00 per box less. It is questionable, however, if prices will reach the low point many people anticipate, as it is rumored that some of the works which have had more business than they could handle during the past year, will close down for a season after the American demand has been supplied. It is likely also that they will now give their attention to the manufacture of Canada plates, which will be wanted as usual for the fall trade on this side. Copper has been sold at very low figures in the United States lately, and the same weakness has marked the market on this side. In zinc and spelter prices have been somewhat weaker and reports from the other side point to lower figures.

London, April 13, 1891.—There are rumors of a further attempt towards the creation of a "corner" in Scotch warrants, and certain transactions which have been concluded during the week give color to the reports. The movements of the Glasgow operators have been duly reflected in London, and at times the effect has been to mak- baying in London, even at top prices, so difficult that rates have been somewhat in advance of those ruling in Scotland. The scarcity of cash iron has attracted some amount of attention, but operations have been confined to a limited range. On the London Exchange on Friday of last week the reported business was limited to some seven or eight warrants, most of which were done in the afternoon. Scotch cash realized 42*s.* 7*d.* in the first 'Change, but declined 1*d.* in the afternoon. For a month business was neglected, but for the end of May 42*s.* 9½*d.* was paid. Monday was a blank, both morning and afternoon, with quotations at 42*s.* cash and 2*d.* more a month, Scotch, 37*s.* 9*d.* Middlesborough cash, and 46*s.* 11*d.* hematite cash. Tuesday morning was another blank, with Scotch nominally declared at 42*s.* 3*d.* cash, and 1*d.* more a month. In the afternoon two or three Scotch warrants were turned over on the basis of 42*s.* 4½*d.* for a few days short of a month. Both Middlesborough and hematite were neglected, the former at 37*s.* 8*d.* and the latter at 46*s.* 11*d.* cash. Wednesday morning's market was inactive, only one warrant having been done for a month at 42*s.* 8½*d.* In the afternoon four or five warrants changed hands for prompts falling due the last week of the present month at 42*s.* 7½*d.* to 42*s.* 8*d.* Middlesborough iron advanced 1*d.* and hematite 2*d.* on the respective quotations of the previous day. Thursday morning cash was in demand, and sellers obtained 42*s.* 8½*d.* to 42*s.* 9*d.* cash, and 42*s.* 10*d.* a month. In the afternoon there was an easier market, with cash at 42*s.* 6*d.*, and a month 42*s.* 8*d.*

Scotch Pig Iron Warrant Market.—Appended is our usual table of quotations and statistics:—

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, Apl. 7	42/5	49/6	44 9	39/-	41/4
Furnaces in blast in Scotland, April 7	41	89	82	87	77
Quantity of iron in public stores	524400	319951	1031727	969467	859770
Shipments of Scotch pig iron for week ending April 4	4191	12275	6213	6412	6955
Do. since beginning of year	54443	111905	106011	92519	105072
Middlesboro' iron imported at Grangemouth, week ending April 4	7110	3425	9987	7795	7030
Do. since beginning of year	93647	35685	106279	98469	97603
Cleveland.					
Price of Middlesbro' No. 3, warrants on April 7	37/10	52/-	39/-	31/11	34/-3
Furnaces in blast in Middlesbro' district	94	105	101	96	91
Quantity of iron in public stores*	122839	147722	249205	323712	336819
Shipments of pig iron from Middlesbro' for week ending April 4	14920	24657	29890	19586	14380
Do. since beginning of year	195126	168533	250230	227141	190898
West Cumberland and North Lancashire.					
Price of hematite M/Nos. warrants†	47/-	58/7½	49/-	42/-	43/6
Furnaces in blast in W. Cumberland and N. Lancashire	40	52	44	50	51
Quantity of iron in public stores†	177943	363067	424122	439610	313057
Shipment of hematite iron for week ending April 4	12155	10000	10356	11570	12602
Do. since beginning of year	132514	154207	144120	122864	142038

* Connal's & N. E. Rly. Co's.
† Workington, Maryport, and Barrow.

New York, April 20, 1891.—The iron market has been generally dull and featureless with little change since our last, the only exception being steel rails, for which quite a number of orders have been placed by various railroad companies. Rolling mills are holding prices firmly at $30 at the mills. In other branches of the trade business has been entirely of a routine character. Buyers have been in the market only to fill immediate wants, evidently feeling confident of being able to secure all the iron they require at any time in the immediate future, and possibly at still lower prices. There is no pressing for sales on the part of sellers, however, although supplies are ample, and prices are firm with no concessions. There does not appear to be much probability of any change from this state of affairs for a few weeks yet. Any improvement in the general business situation of the country with the consequent increased demand for iron, which is the only thing that can help the market, must of necessity be gradual. On the other hand the production of pig iron has been reduced to such an extent that it is not likely that it exceeds consumption greatly at the present time, and if no more furnaces blow in, prices should remain about where they are now. The number of furnaces in blast is not likely to increase, as the profits at present prices are virtually *nil*. In pig iron trade has been dull and of a hand-to-mouth character. We quote: Northern, No. 1 X, $17.50@$18; No. 2 X, $16.50@$17. Sales of warrant iron have been reported in the South at very low figures, $9.60 being the best bid for grey forge, Birmingham delivery. There has been very little doing in either spiegeleisen or ferro-manganese. Spiegeleisen, 20%, is quoted nominally at $27.50@$28.50; 80% ferro-manganese, $63@.$64.

Cleveland, O., April 20, 1891.—The pig iron business is depressed, and the only apparent cause is a lack of confidence on the part of consumers in the stability of present conditions, although it would be hard to imagine a much better opportunity for placing large orders. The reports of the Western Pig Iron Association up to date show a reduction, during the past thirty days, of some eighty thousand tons of pig iron, leaving on hand total stocks of about 250,000 tons. Of this reduction, some twenty-eight thousand tons are credited to the Shenango Valley and the Pittsburg district, and only four hundred tons to the Mahoning Valley. It follows without saying that there must have been a large falling off in consumption somewhere. And that is the case right here, at home. There has been no practical change in the coke situation. A little coke is being made, mostly for the Pittsburg market, and a small percentage of this supply finds its way to Cleveland, for the use of the furnaces above referred to. The threatened coal strike is apt still further to complicate the situation, in that it may lead to the shutting down of the mills within a week or two after its commencement, and so add to the lack of production even of manufactured material. Some of the foundries report business very brisk, while others, apparently on the same footing, report no business at all; but even those now engaged in turning out work have no employment beyond a week or two, while a year ago they were loaded up with orders for three or four months ahead. Bar iron is generally held at $1.60, but lower quotations obtain, here and there, for small lots, and for immediate consumption. Looking at the situation in the light of all that has been said, the outlook is anything but cheerful for all the lines entering into, or intimately connected with the ore and pig iron business. The only satisfaction that may be expressed is that arising from the fact that no worse can befall the market than what has already happened, so that the possibly worse horoscope is discounted in advance.

Copper.—There has not been a great deal of change in the situation of copper since our last, if anything it is a little weaker both in the American and European markets. In the former it is now easily obtainable at 13¾c. from first hands, but no concessions have been made below this. There is very little second-hand copper about, and the large companies are receiving orders for fair amounts. It is anticipated that before long a number of manufacturers and consumers will come into the market pretty freely. Rail and water shipments from the Lakes will soon be resumed, which will bring the cost of copper down about ½c. per lb. The Anaconda mine still remains closed, and it is as yet unknown when it will be re-opened. The European market has been slightly depressed and prices have weakened off a little. Chili bars are somewhat lower, closing at £51 5*s* @ £51 7*s.* 6*d.* spot, and for three months prompt, at £51 10*s.* @ £51 12*s.* 6*d.* The visible supply for the first half of the month has increased 1,200 tons. It is estimated that 500 tons monthly will be shipped from Chili, which means a diminution of about 2,000 tons monthly, which, with the closing down of the Anaconda, should have some effect on statistics before long. We quote: Tough copper, £53 15*s.* @ £54; best selected, £55 15*s.* @ £56; strong sheets, £60 @ £61; India sheets, £58 @ £58 10*s.*; yellow metal sheets, 5¾*d.*

Lead.—The lead market has been depressed in the United States; recent sales have been made at 4.20c. and as low as 4.15c. in New York. A new decision has been rendered by the Custom House appraisers on the valuation of lead in silver ores, which hitherto has been taken at 1c. below the price of pig lead ruling in New York. Satisfactory proof having been given the board that the above was unjust and did not allow for freight and smelting charges, a price of about 1¾c. below the price ruling in New York has now been adopted. This will allow larger quantities of Mexican silver ores to come into that market. Consumption so far has not been very good, and in some quarters production seems to have somewhat increased, though not to any great extent. In St. Louis lead has been weak and lower, common having sold as low as 3.95c. prompt delivery. In London Spanish lead is quoted at £12 12*s.* 6*d.*, and English at £12 15*s.*

Nickel.—There is very little doing at present in nickel; the metal is scarce and quotations are steady at 67½c. @ 70c.

The Composition of the Ore Used and of the Pig Iron Produced at the Radnor Forges.

By J. T. Donald, M.A.

The St. Maurice and the Radnor forges, situated in the vicinity of Three Rivers, are of interest to those interested in the development of the iron industry in Canada, as well as to the student of the history of the early colonists of the Province of Quebec. These forges are at present the property of the Canada Iron Furnace Company, Limited, and the managing director of this company, Mr. Geo. E. Drummond, has kindly furnished the following historical note: "The value of the Three Rivers ores has been known since a very early period in the history of Canada. Official examinations were made by order of the Government of France as far back as 1668; tests of the ore were made before the year 1700, and finally in 1737 a company was formed to erect a furnace and commence the manufacture of pig iron. The Government of France seems later on to have gained control of the work, for in 1752 the St. Maurice furnace (erected and operated by the Government) was blown in, and the old stone stack bearing date 1752 and the Government insignia, the Fleur-de-Lis, still remains to dispute with that of Principio in Maryland, the right to be considered the oldest in America.

At that early period upwards of 300 men were employed under directors who had obtained their skill in Sweden. According to the reports of Colonial Secretary Tranquet, works were carried on with much success. In addition to pig iron, wrought iron of high quality was manufactured from the product of the bog ore; shot and shell were cast, and pigs and bars were even exported to France, After the conquest the works were leased to private parties, and since then have passed through many hands.

"Many samples of the articles—notably stoves—manufactured from the pig iron made in those early days, still remain to attest the high quality of the iron."

The furnace at Radnor, though similar in construction to that at St. Maurice, from which it is only four miles distant, was erected at a much later date, and in some respects it may be considered the successor of the old St. Maurice furnace. At present the latter is idle, but that at Radnor is in blast. Recently, the ore used and the pig iron produced in this furnace have been analysed. The ore is a mixture of equal parts of the bog ore of the neighborhood and of the curious "lake ore" from Lac la Tortue. An average sample of each was submitted to analysis, and the results are given below:—No. 1 is the bog ore, No. 2 the lake ore, No. 3 is a lake ore from the same locality, analysed by Mr. W. A. Carlyle, B. A. Sc., some three years ago:—

COMPOSITION OF IRON ORE.

	I.	II.	III.
Ferric oxide	60·74	70.04	69·64
Ferrous oxide	.....	.....	0·72
Manganic oxide	1·18	1·78	2·99
Alumina	2·59	2·20	2·43
Lime	3·47	0·32	.....
Magnesia	0·93	0·27	0·60
Phosphoric anhydride	0·69	0·76	0·47
Sulphuric anhydride	0·19	0·23	0·09
Silica	13·94	7·84	8·17
Loss on ignition	16·49	16·84	15·00
	100·22	100·28	100·11
Metallic iron	42·52	49·03	49·31
Phosphorus	0·302	0·331	0·205
Sulphur	0·078	0·093	0 036

The close correspondence between Mr. Carlyle's analysis and that of the writer would seem to indicate that this Lac la Tortue ore is of fairly uniform composition over a considerable area.

The Radnor furnace charge consists of 840 lbs. of the mixed ore, 84 lbs. of limestone and 32 bushels of charcoal; the blast used has a pressure of three-fourths of a pound, and ranges in temperature from 300° F. to 450° F. The yield of iron is on an average 42-43 per cent. of the weight of ore used. The iron sent for analysis consisted of sections of two pigs of different degrees of hardness, and produced at different times. Nos. 1 and 2 are the Radnor irons, No. 3 is Dr. T. Sterry Hunt's analysis of a specimen of gray pig made at St. Maurice in 1868:—†

COMPOSITION OF PIG IRON.

	I.	II.	III.
Iron	94·375	96·302	Undet'd
Carbon	·378	·336	1·100
Graphite	1·904	1·796	2·820
Silicon	1·379	·485	·860
Sulphur	·062	·049	·025
Phosphorus	·464	·430	·450
Manganese	1·145	·895	1·240
	90·707	100·293	

Toughness of Cast Iron.—Some interesting tests of cast iron produced at one of the great stove manufactories in Albany, N.Y., have been made. The pieces were 1 inch in width, ⅛ inch thick, and between 15 and 18 inches long. Of these strips, some were twisted so as to form spirals, and others were wrapped upon coils. That cast iron can be made very tough, and even a certain amount of elasticity be imparted to it, is, of course, well known, but it is unusual, if not unprecedented, for any metal employed in stove foundries to bear such tests as those thus indicated. The twisting and bending in this case were done hot, there being nothing in the specimens but a judicious mixture of good irons and the absence of old scrap—the fact being also stated that the irons in question represent the daily meltings of the foundry from which they came, all the stoves produced there having their plates of the same metal which exhibits this peculiar toughness. It is not asserted that, because the metal will bear a torsional strain of the kind described, it is, therefore unbreakable, there being, of course, a limit to its remarkable elasticity.

A Big Business.—The Lidgerwood Manufacturing Company of New York, Chicago and Boston, the well known makers of hoisting engines, sold during the year 1890. 1,105 engines and 588 boilers. This shows an average output of nearly 4 engines and 2 boilers per day. They are preparing a new catalogue which will contain illustrations of many new hoisting engines, and in which considerable space will be devoted to suspension cableways—a new feature of their business.

Cast Iron Car-Wheels.—There has been a great deal said about the mileage of wheels which were made by the various car-wheel foundries, and the merit of certain mixtures or specific methods of producing wheels has been largely proclaimed. On the other hand, there has been a very severe duty-test assigned to wheels by the users of them, a test none too hard, in view of the fact that so many lives and so much property is put in jeopardy by every imperfect car-wheel; but there has, no doubt, been some hardship in the interpretation of responsibility which called out, at the meeting of the Manufacturers of Chilled Car-Wheels at New York last Fall, a protest, on account of the wheel-makers having no control over the condition of railroad service, which took the form of the following resolution:—

"*Resolved*, 1. That in all mileage on time guarantees, the wheel-maker ought to be held responsible only for wheels which fail through faults of material or workmanship.

"2. That, where wheels are taken out of service on account of sharp flanges, flat spots, comby or shelled out treads, or for cracked brackets or plates, and it is found on breaking up the wheels that the depth and character of the chill, and the strength and character of the metal in the plates are up to the standard specifications adopted by the Joint Conference Committee of the Railway Master-Mechanics', the Master Car-Builders' and the Wheel-Makers' Associations, it shall be considered that the failure is due to the service and not to the quality of the wheels, and that the wheel-maker ought not to be called upon in such cases to pay for or replace any such wheels."

In the matter of tests of wheels a statement is presented, issued by Messrs. A. Whitney & Sons, of Philadelphia, giving the results of inspections and tests of 10,000 wheels from their foundry, made between March, 1889, and March, 1890, by the R. W. Hunt & Co. Bureau, of Chicago, and we give the record of this inspection to show the perfection to which the casting of car wheels is now being carried.

Each wheel was measured around the tread by a brass tape, the record showing that 4,325 were all of exactly the same circumference; 4,365 were all of exactly the same circumference, but one-eighth inch less than the 4,325; 881 were all of exactly the same circumference, but one-eighth inch more than the 4,325; 429 varied one-eighth of an inch either way from the above.

Out of the 10,000, the extreme variation in 8,690 was only ⅛ of an inch in circumference, or $\frac{1}{32}$ of an inch in diameter, and in 881 more it was only ¼ of an inch in circumference, or $\frac{1}{16}$ of an inch in diameter.

Tested by a true ring resting on the cone of the wheel, not one was found with a variation of more than $\frac{1}{32}$ of an inch from the ring at any point.

To test the strength, the specifications required that one wheel out of every 100 ready for shipment, should be broken by a drop of 140 pounds weight falling twelve feet, and that it should stand five blows without breaking into two or more pieces. For the 10,000 wheels shipped, 105 were broken, with the following results:—

* Canadian Record of Science, Vol. III., No. 1, p. 43.

† Report Geol. Survey, 1873-74.

To start the first crack, the average number of blows was 13 7/8.

To start the first crack, the weakest required 5 blows, and the strongest 58.

To break the wheel in two, the average number of blows was 49 5/8.

To break the wheel in two, the weakest required 9 blows and the strongest 118.

(Two wheels broke at 9 blows, fifteen between 10 and 20, four between 20 and 30, thirty-four between 30 and 50, and fifty between 50 and 118 each.)

The Messrs. Whitney say, that the average depth of chill at the root of the flange in the 105 wheels broken, was 1/8 of an inch, and the depth did not vary, in any case, more than 1/8 of an inch around the wheel.

In reference to the contracting-chill, we take this opportunity of quoting from a communication to the *National Car and Locomotive Builder*, in which Mr. John R. Whitney discussed the behaviour of iron in solidifying.

"For the 'whole' casting, the process of solidification is a gradual one, and with some irons it is much more gradual than with others. But it does not follow from this that a casting 'will, from the moment the mould is filled or poured till it has reached, as a casting, its lowest point of temperature, be all the time constantly shrinking and contracting so as to occupy less space.' If it did, in every casting, and especially in every one of any considerable size, the centre ought to be the most intensely compressed part, as it is the last to reach the 'lowest point of temperature,' and therefore should show the finest and closest grain. But we do not find it so. The centre always shows the largest and most open grain. If, however, as each successive portion becomes solid, its contraction is resisted and prevented by expansion of each successive portion in becoming solid, the open-grained centre is easily and satisfactorily explained.

"On a recent occasion, the following experiment was made with a carefully prepared apparatus. A pattern, 4 feet long, 3 7/8 inches deep and 2 3/4 inches wide was moulded in the open sand, one end of the mould being closed by fire-brick and the other end by a piece of gas-carbon, which was suitably connected with a small battery and galvanometer. The fire-brick rested at one end against a block of iron weighing about half a ton. The gas-carbon block was carefully secured in the sand, so that the weight of iron in the mold should not be sufficient to move it, and the stand, bearing an arm on which a pointer was delicately pivoted, was then adjusted, so that the needle should press against the gas-carbon, and the pointer stand at zero on the scale. The long arm of the pointer was 24 inches and the short one 6 inches long, or, as 1 to 4. The scale was graduated to 1/10 of an inch.

"The mould was filled with very fluid hot iron in seventeen seconds, and then the following results were carefully noted:—

For more than						
	1′	after the mould was filled, pointer stood at zero.				
At	1′ 30″	"	"	"	moved 1/16	inch.
"	1′ 50″	"	"	"	" 1/8	"
"	3′ 10″	"	"	"	" 1/4	"
"	5′ 20″	"	"	"	" 3/8	"
"	8′ 5″	"	"	"	" 7/16	"
"	11′ 30″	"	"	"	" 15/32	"
"	12′ 5″	"	"	"	" 1/2	"

"At twelve minutes from that time, the pointer stood perfectly still at 1/2 inch until twenty-five minutes and fifteen seconds after mould was filled, when the galvanometer showed that contact with the gas-carbon was broken and shrinkage had begun.

"Long before these experiments were instituted, the fact that iron follows essentially the same law as water in solidifying, was well known and published. I need cite only two authorities. Professor Edward Turner, in his *Elements of Chemistry*, published in Philadelphia in 1835, says, p. 20: 'Water is not the only liquid which expands under reduction of temperature, as the same effect has been observed in a few others which assume a highly crystalline structure in becoming solid; fused iron, antimony, zinc and bismuth are examples of it.' Professor Thomas Graham, also, in his *Elements of Chemistry*, published in Philadelphia in 1843, says, p. 385: 'Iron expands in becoming solid and, therefore, takes the impression of a mould with exactness.'"—*Journal of the Charcoal Iron Workers.*

NOTICE---A Chemist and Mineralogist of standing will make a professional visit to British Columbia and the Pacific Coast in May or June. Any parties having mining claims they wish to have examined or reported on can communicate with him by addressing "Expert" Canadian Mining and Mechanical Review Offices, Ottawa, Ont.

NORTH-WEST MOUNTED POLICE

RECRUITS.

APPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is five feet eight inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—

Staff-Sergeants.....$1.00 to $1.50 per day.
Other Non-Com. Officers.. 85c. to 1.00 do

	Service pay.	Good conduct pay.	Total.	
1st year's service..	50c.	——	50c.	per day.
2nd do ..	50c.	5c.	55c.	do
3rd do ..	50c.	10c.	60c.	do
4th do ..	50c.	15c.	65c.	do
5th do ..	50c.	20c.	70c.	do

Extra pay is allowed to a limited number of Blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force Regina N. W. T.

Money Orders.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

On Money Orders payable within Canada, the commission is as follows:

If not exceeding $4				2c.
Over $4,	not exceeding	$10		5c.
" 10,	"	"	20	10c.
" 20,	"	"	40	20c.
" 40,	"	"	60	30c.
" 60,	"	"	80	40c.
" 80,	"	"	100	50c.

On Money Orders payable abroad the commission is:

If not exceeding $10				10c.
Over $10	not exceeding	$20		20c.
" 20	"	"	30	30c.
" 30	"	"	40	40c.
" 40	"	"	50	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November 1889.

TENDERS.

SEALED TENDERS, addressed to the undersigned, and endorsed "Tender for Indian Supplies," will be received at this office up to noon of SATURDAY, 9th May, 1891, for the delivery of Indian Supplies, during the fiscal year ending 30th June, 1892, consisting of Flour, Beef, Bacon, Groceries, Ammunition, Twine, Agricultural Implements, Tools, &c., duty paid, at various points in Manitoba and the North-West Territories.

Forms of tender, containing full particulars relative to the Supplies required, dates of delivery, &c., may be had by applying to the undersigned, or to the Indian Office, Winnipeg.

Parties may tender for each description of goods (or for any portion of each description of goods), separately or for all the goods called for in the Schedules, and the Department reserves to itself the right to reject the whole or any part of a tender.

Each tender must be accompanied by an accepted Cheque in favor of the Superintendent General of Indian Affairs, on a Canadian Bank, for at least five per cent. of the amount of the tender, which will be forfeited if the party tendering declines to enter into a contract based on such tender when called upon to do so, or if he fails to complete the work contracted for. If the tender be not accepted, the cheque will be returned, and if a contract be entered into for a part only of the supplies tendered for an accepted cheque for five per cent. of the amount of the contract may be substituted for that which accompanied the tender; the contract security cheque will be retained by the Department until the end of the fiscal year.

Each tender must, in addition to the signature of the tenderer, be signed by two sureties acceptable to the Department for the proper perfofmance of the contract based on his tender.

This advertisement is not to be inserted by any newspaper without the authority of the Queen's Printer, and no claim for payment by any newspaper not having had such authority will be admitted.

L. VANKOUGHNET,
Deputy of the Superintendent-General of Indian Affairs.

Department of Indian Affairs,
Ottawa, March, 1891.

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. 7, Revised Statutes of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six 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. Up to ten areas the cost is 50 cts. per area, for every area in addition in same application 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 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 in smelted gold valued at $18.00 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 twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile 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 free of charge, 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, 7½ 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.

MINING REGULATIONS
TO GOVERN THE DISPOSAL OF DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

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 ft. in length and 500 ft. 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 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, 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 fraudulently, 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 THE INTERIOR.

A. M. BURGESS,
Deputy Minister of the Interior.

Further Improvements in Mining Machinery will Appear on this Page in Following Issues.

SERGEANT'S "LITTLE CANUCK" DRILL.

For Light Mining and Quarry Work.

MOUNTED ON TRIPOD, WEIGHS ONLY 150 LBS. MOUNTED ON SERGEANT'S ADJUSTABLE "LIGHT WEIGHT" DRIFTING COLUMN, WEIGHS 250 LBS.

Designed to dispense with hand drilling in irregular and difficult stopes and benches, and for trimming and block holeing.

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